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RESEARCH ARTICLE OPEN ACCESS

DESIGNING A SMART HOME MODEL USING EASYVR AND ARDUINO FOR VOICE CONTROL OF DEVICES

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ABSTRACT

This paper presents the design and implementation of a smart home model using easyVR and Arduino to voice control home appliances, without relying on traditional sensors. The system leverages easyVR, a voice recognition module, to process spoken commands, which are then interpreted by Arduino to control various smart devices, such as lights, TVs, and air conditioners. The proposed system aims to provide an affordable and efficient solution for home automation, offering a user-friendly, hands-free interface for users. The paper identifies the hardware and software components of the system, including the integration of easyVR with Arduino, and addresses the challenges of implementing accurate voice recognition in a real-world environment. A prototype is developed to demonstrate the functionality and effectiveness of the voice control system. The results show that the system responds reliably to voice commands, providing a seamless smart home experience. This paper demonstrates the potential of easyVR and Arduino in creating scalable and cost-effective voice-controlled smart homes.

I. INTRODUCTION

Smart homes have rapidly become one of the most influential technological innovations, providing users with enhanced comfort, energy efficiency, and increased automation in their living spaces. With the rise of the Internet of Things (IoT) and the integration of artificial intelligence, the concept of smart homes has evolved, enabling seamless control of household devices such as lights, security systems, and thermostats.

In this context, voice control has become essential in the development of smart home systems, offering a more intuitive and user-friendly method for interaction. Technologies like easyVR and Arduino have significantly contributed to this evolution, providing low-cost, customizable solutions for voice-controlled smart home applications [1] [2].

The integration of voice recognition systems like easyVR with microcontroller platforms such as Arduino allows users to control a wide range of smart devices simply by issuing voice commands. This approach not only enhances the user experience but also makes smart homes more accessible and affordable. Recent advancements in voice recognition technology have improved the accuracy and efficiency of recognizing spoken commands, which is vital for the effective operation of smart home systems [3] [4]. Additionally, platforms like Arduino offer great flexibility, allowing users to design and implement custom solutions tailored to their specific needs and preferences [5] [6].

Voice-controlled automation systems have been increasingly integrated into everyday life, providing a more hands-free and efficient way to manage home environments. Using speech as an interface to control devices, such as lights, fans, and home security systems, enhances both the convenience and functionality of smart homes, and opens up possibilities for even greater automation and interactivity [7] [8].

By removing the need for manual inputs or mobile apps, voice commands offer a direct, natural, and intuitive way for users to interact with their environment, contributing to the growing appeal of smart homes among consumers [9] [10].

Moreover, the affordability of Arduino and easyVR systems has lowered the cost barrier, enabling the development of smart home models that are not only advanced but also economically viable for a broader range of users. This cost-effectiveness, combined with the flexibility for customization,

positions these platforms as ideal tools for prototyping and experimenting with voice-controlled smart home systems [11] [12]. As demand for smart home technology continues to grow, integrating voice recognition capabilities within Arduino-based solutions could provide users with a more accessible, user-friendly, and cost-effective approach to home automation [13] [14].

In this paper, we explore how combining easyVR and Arduino can be used to design a functional and efficient smart home model, entirely controlled by voice commands. The objective is to demonstrate how these technologies can simplify the management of home environments while maintaining affordability and accessibility for users [15] [16]. With the ongoing development of voice recognition systems and affordable hardware solutions, this approach could represent a significant step toward more advanced, interactive, and user-friendly smart homes [17] [18].

II. GENERAL MODEL OF THE SYSTEM USED

In this paper, the same smart home model that was presented in a previous article was used, which was based on control via sensors, but in this study the ability to control voice using easyVR and Arduino was added, which enhances the interaction with the smart home in a new way.

The diagram in (Fig.1) shows the general model that was used in this paper. As a basic point, we created a system that allows each element to be controlled by voice control.

To understand the diagram, you should know the following:

A 10V battery is used to power the lights, TV and air conditioner.

As for the use of a relay, it is very necessary because the Arduino voltage at the outputs is 5V, which closes the relay to allow a higher voltage of 10V to pass to the element that needs to be powered.

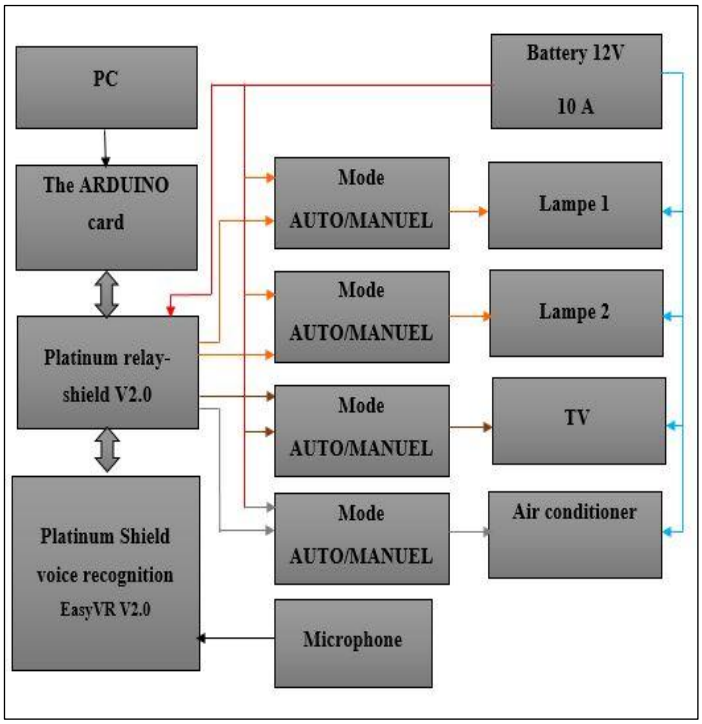

Figure 1: General model of the system used
Source: Authors (2025)

III. CONNECTING EASYVRA TO RDUINO

EasyVR is a voice recognition module that enables Arduino to recognize and process voice commands. The module works by capturing sound input through a microphone, then processing the speech signals to identify predefined voice commands. These commands are stored in the EasyVR module, which is programmed using a computer and a special software called EasyVR Commander.

When a voice command is spoken into the microphone, the EasyVR module processes the sound and matches it with the stored command. It then sends the corresponding signal to the Arduino. The Arduino board, based on the received signal, executes specific tasks, such as turning on or off a device like a light or fan, controlling a motor, or activating a relay.

This combination of EasyVR and Arduino allows for hands-free control of various devices, making it a powerful solution for building smart systems.

To integrate the ARDUINO module with an EasyVR voice control microcontroller, proper connections and setup are essential. The easyVR module is designed to recognize and process voice commands, allowing users to control various devices in a smart home system through speech (Fig.2). To connect easyVR to Arduino, the module is typically connected via a serial communication interface.

The TX (transmit) pin of easyVR is connected to the RX (receive) pin of Arduino, and the RX (receive) pin of easyVR is connected to the TX (transmit) pin of Arduino. Additionally, the GND pin of easyVR is connected to the Arduino ground, and the VCC pin is connected to the Arduino's 5V pin, providing the necessary power to the module. After ensuring the proper physical connections, the next step is to upload the appropriate code to the Arduino to establish communication with easyVR and enable voice recognition. The easyVR module stores pre-configured voice commands that can trigger specific actions on connected devices, such as turning lights on or off. This seamless integration enables the creation of a voice-controlled smart home system, enhancing user experience and automation.

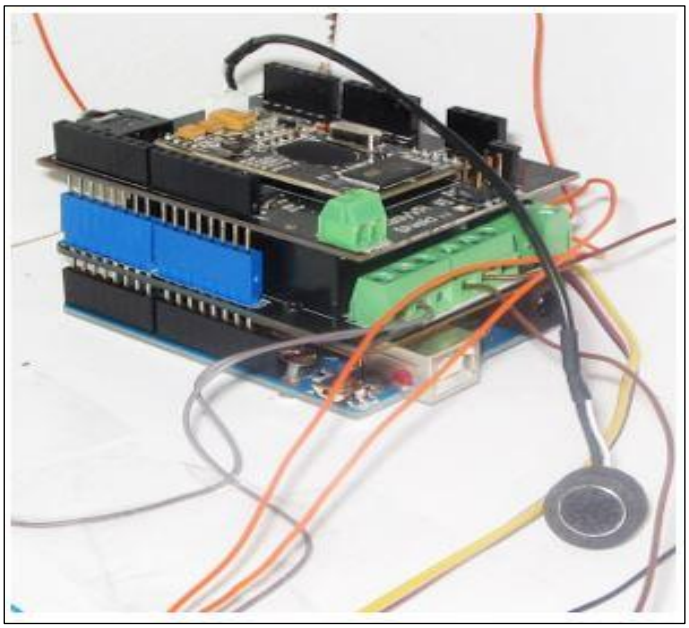

Figure 2: Connection of (ARDUINO and EasyVR)
Source: Authors (2025)

IV. ARDUINO AUTO MODE WIRING

In this system, a set of devices, such as indoor lights, television, and air conditioner, are connected to be controlled by voice commands using the EasyVR module. In AUTO mode, voice commands are used to turn on or off any of the home appliances included in the program. These devices are connected to the analog or digital inputs on the Arduino board, while control components, such as relays, are connected to the digital outputs, enabling the necessary voltage to be supplied to operate these appliances.

The connections are organized in (Fig.3). The microphone captures the voice command, which is processed by the EasyVR module. The processed information is then sent to the Arduino, where the corresponding command is executed based on the pre-programmed instructions. This setup allows for automatic and efficient control of the electrical devices, providing comfort and energy efficiency through voice interaction with the smart system.

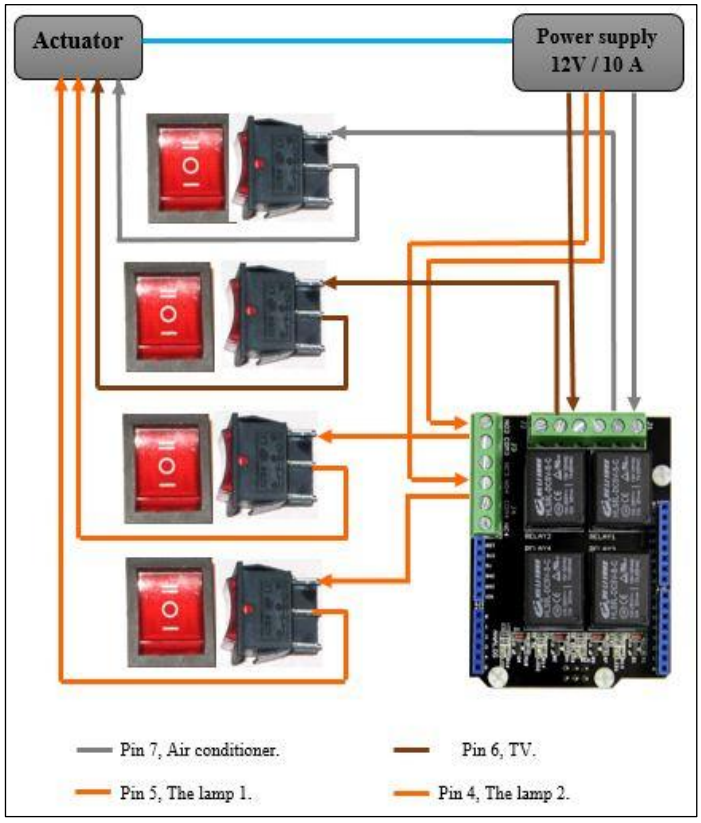

Figure 3 : ARDUINO system AUTO Mode wiring.
Source : Authors (2025)

V. ARDUINO-EASYVR VOICE CONTROL SYSTEM DIAGRAM

The diagram below (Fig.4) demonstrates the voice control system using Arduino and EasyVR. In this setup, the EasyVR module is responsible for processing voice commands received through the microphone. When specific commands are spoken, the system triggers the corresponding actions via Arduino.

"TIVI" command turns on the television.
"OFTIVI" command turns off the television.
"CLIM" command turns on the air conditioner.
"OFCLIM" command turns off the air conditioner.
"ONE" command turns on light 1, while "TOW" turns it off.
"THREE" command turns on light 2, while "FOUR" turns it off.

The Arduino processes these commands and controls the connected devices, such as relays for the television, air conditioner, and lights, to automate actions based on voice instructions.

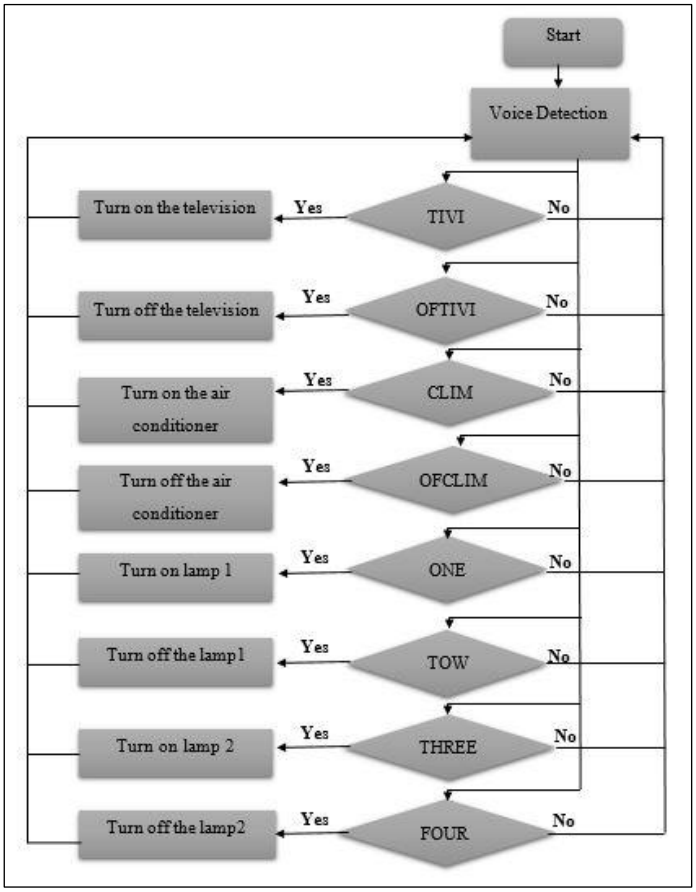

Figure 4: Voice Control system diagram using Arduino and EasyVR
Source: Authors(2025)

VI. ADVICE

It is important to be cautious when placing the shield onto the Arduino board. Ensure that the USB connector on the board is properly insulated. The connection pins on the shield are quite short, and pressing down on them could lead to a real risk of a short circuit at the shield level. Always handle the components with care to avoid damaging the board or causing electrical issues.

To connect the ARDUINO to the computer, you must put the EasyVR shield in PC mode (Fig.5).

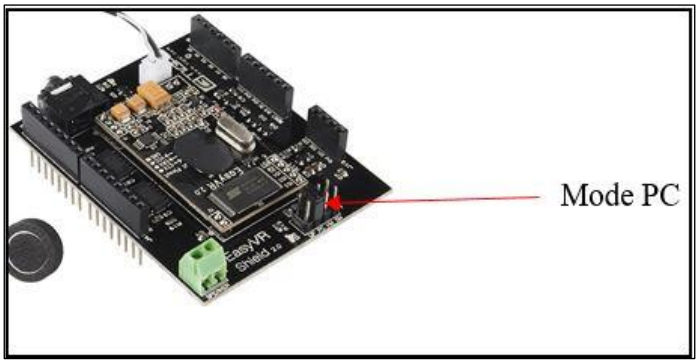

Figure 5: Mode PC « easyVR shield ».
Source: Authors (2025).

To run the program we change the EasyVR shield mode to “SW” mode (Fig.6).

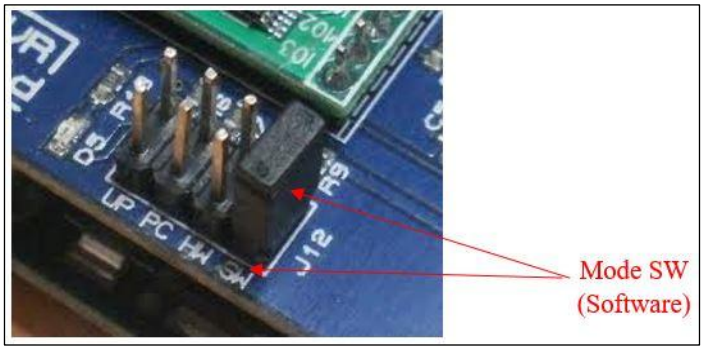

Figure 6: The SW mode does shield EasyVR.
Source: Authors(2025).

We put the TV, Air Conditioner, Lamp 1 and Lamp 2 actuators in AUTO modes (Figure.7).

Figure 7: AUTO mode “TV, Air conditioner, Lamp1 and Lamp2”.
Source : Authors(2025)

VII. RESULTS AND DISCUTIONS

The results obtained from the smart home project (Fig.8) demonstrate the successful implementation and operation of the voice control system for managing lights, television, and air conditioning. Each component performed as expected, validating the effectiveness of the proposed approach. The EasyVR module accurately recognized voice commands, enabling smooth and reliable control of the connected devices.

The television responded promptly to the voice command "TIVI" to turn on and "OFTIVI" to turn off, demonstrating the system's precision in controlling entertainment devices. Similarly, the air conditioner was efficiently controlled by the "CLIM" and "OFCLIM" commands, providing seamless adjustment of the room's temperature without any delays.

The lighting system also performed well with the voice commands "ONE" and "TOW" to control light 1, and "THREE" and "FOUR" to manage light 2. The lights turned on and off as expected, ensuring easy and convenient control of the home environment.

These results highlight the effectiveness of combining voice recognition with Arduino, confirming the system's reliability and suitability for real-world home automation applications. The successful integration of EasyVR for voice commands provides a robust platform for smart home systems, enhancing user convenience and energy efficiency. This success also lays a strong foundation for future improvements and additional features in home automation systems.

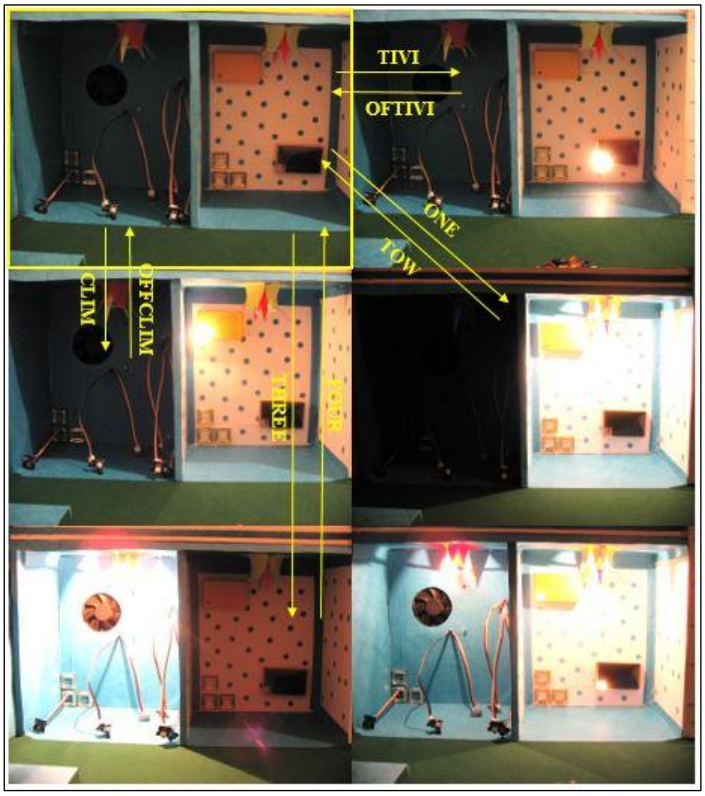

Figure 8 : System results.
Sourace : Authors (2025).

VIII. CONCLUSIONS

In conclusion, the successful implementation of the voice-controlled smart home system using Arduino and EasyVR demonstrates the potential of voice recognition technology in enhancing home automation. The system effectively managed devices such as lights, television, and air conditioning, providing an intuitive and efficient way to control household appliances. The results validated the feasibility of integrating voice commands with microcontroller platforms like Arduino, highlighting their suitability for real-world applications.

This project not only showcases the effectiveness of combining hardware and software solutions for smart homes but also emphasizes the importance of user-friendly interfaces for everyday technology. The success of this prototype lays the groundwork for further advancements in smart home systems, with possibilities for integrating more devices and improving energy efficiency. As voice control continues to evolve, this approach has the potential to transform the way we interact with our homes, offering greater convenience, accessibility, and automation.

IX. AUTHOR’S CONTRIBUTION

Conceptualization: Soufiane Hachani.
Methodology: Soufiane Hachani.
Investigation: Soufiane Hachani.

Discussion of results: Soufiane Hachani.
Writing – Original Draft: Soufiane Hachani.
Writing – Review and Editing: Soufiane Hachani..
Resources: Soufiane Hachani.
Supervision: Soufiane Hachani.
Approval of the final text: Soufiane Hachani.

X. DISCLAIMER

The authors declare that they received no financial support or grants from any public, commercial, or non-profit entities for this research. All the views expressed in this work are solely those of the authors.

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