STM JOURNALS

Current Trends in Signal Processing

GESTURE AND VOICE DRIVEN REMOTE CONTROL SYSTEM

ISSN- 2277–6176
Vol-14
Issue-1
Year-2024
Research Article

Date of Receiving- 23rd April 2024
Date of Acceptance- 31st May 2024
Date of Publication- 7th May 2024

GESTURE AND VOICE DRIVEN REMOTE CONTROL SYSTEM

Tanmay Lonare*[1], Devyani Mahajan[2], Anish Kulkarni[3], Prof. S.V. Tathe[4]

Abstract

The Gesture and Voice Driven Remote Control System represents an innovative technology that empowers users to interact with and control electronic devices through hand movements, voice commands, and sensor integration while also enabling remote access and operation. This system provides an alternative and more accessible means of interaction, ultimately redefining the way we engage with our devices. By interpreting gestures and voice commands through advanced recognition algorithms and speech recognition, it eliminates the need for physical remotes, significantly enhancing accessibility and convenience and user experience in device interaction. This integration of hand movement and vocal instructions transforms the landscape of human- computer interaction, offering a futuristic and user- friendly interface with a wide range of applications. This abstract provides a glimpse into the potential of this groundbreaking system, revolutionizing the way we control and access electronic devices. Gesture and Voice-Driven Remote-Control System is a groundbreaking technology that allows users to interact with and control electronic devices using hand movements, voice commands and sensor integration, all while enabling remote operation. This system provides an accessible and user-friendly alternative for device interaction. By combining hand gestures, voice commands, vocal instructions, it revolutionizes human-computer interaction, offering a futuristic interface for various applications.

Keywords: Automatic device, Raspberry pi, Node MCU, HC-05, Gesture control, Face Recognition.

***Author for Correspondence**
Tanmay Lonare
E-mail: tanmaylonare.soe.entc@gmail.com

[1]Student, Department of Electronics and Telecommunication,Sinhgad College of Engineering, Savitribai Phule Pune University, Pune, India
[2]Student, Department of Electronics and Telecommunication,Sinhgad College of Engineering, Savitribai Phule Pune University, Pune, India
[3]Student, Department of Electronics and Telecommunication,Sinhgad College of Engineering, Savitribai Phule Pune University, Pune, India
[4]Professor, Department of Electronics and Telecommunication,Sinhgad College of Engineering, Savitribai Phule Pune University, Pune, India

Citation: Tanmay Lonare, Devyani Mahajan, Anish Kulkarni,Prof.S.V. Tathe

INTRODUCTION:

Gesture and Voice-Driven Remote-Control Systems are redefining the way we interact with our digital environments. By merging the simplicity of hand gestures and the ease of voice commands, these systems provide an intuitive, user-friendly interface for controlling a variety of electronic devices remotely. At the core of this technology is the innovative use of computer vision, and voice recognitionalgorithms that enable the system to understand and execute commands based on physical motions orspoken words. Users can simply gesture in the air or speak naturally to operate everything from lightsand TVs to HVAC systems, without the need to physically touch as Switch or remote control. This system not only makes everyday interactions with technology more convenient but also significantly enhances accessibility. It is a boon for those with mobility challenges or

disabilities, allowing for a more inclusive design in smart homes and office space. By eliminating the need for direct contact orbutton-presses provides a comfortable, efficient experience for users Moreover, this fusion of gestureand voice recognition promotes a hands-free approach that aligns with modern desires for swift and effortless control. Whether adjusting volume on a speaker system with a wave of the hand or setting an alarm with a simple voice command, the control is as natural as the way we communicate. Beyondconvenience, these systems can be engineered to learn from interactions, becoming more responsive and personalized over time. They also represent a step forward in creating more intelligent and adaptiveliving spaces that respond to our presence and needs, providing a glimpse into the future of home automation.

In summary, Gesture and Voice-Driven Remote-Control Systems are not just another technological innovation; they are a move towards more harmonious and human- centered interaction with the devices that surround us, offering a glimpse into a future where technology adapts to us, not the otherway around. The proposed system is shown in Fig1.

Voice- and gesture-driven remote control

systems combine voice commands and gesture recognition to provide intuitive control, redefining human-computer interaction. They promote inclusivity in smart environments by improving accessibility for users with disabilities. These technologies, which provide convenient control over electronic gadgets, are in line with contemporary convenience demands. They gradually adjust to user needs and personalize experiences by gathering insights from encounters. This development is a step toward intelligent living environments, where technology is incorporated into everyday life in a seamless manner. In the end, these systems provide a vision of harmonious interaction in which technology enhances accessibility and ease while meeting human needs.

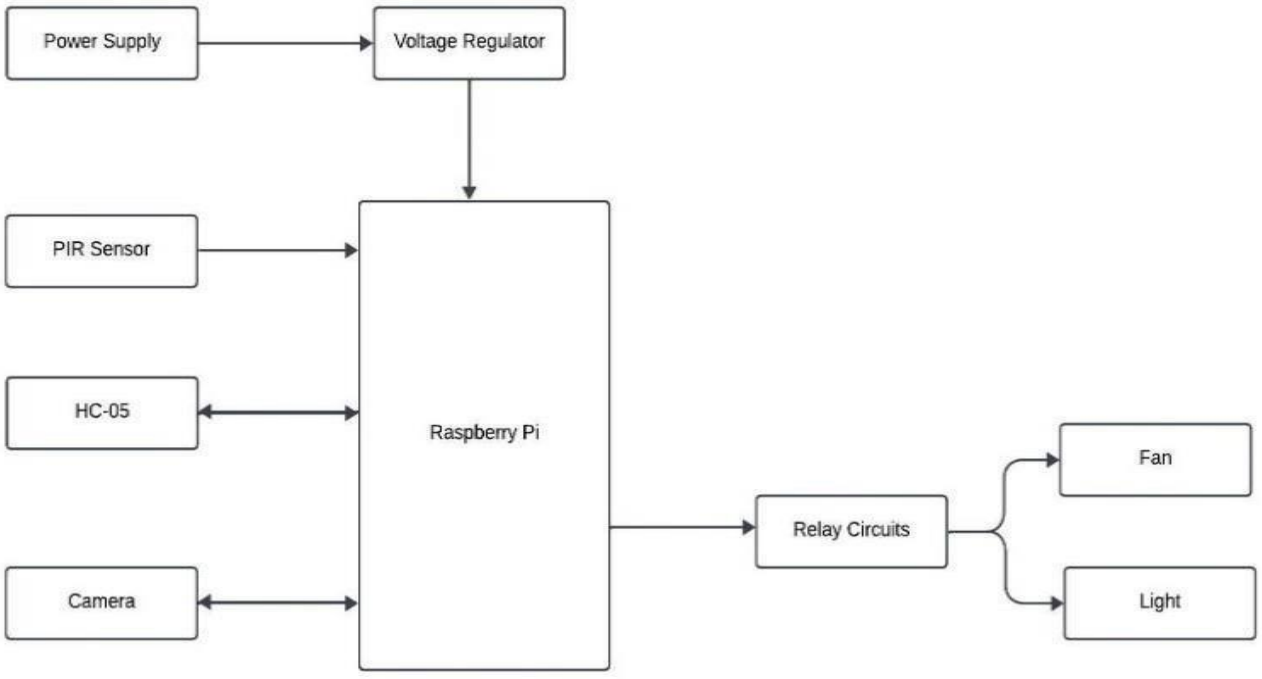

Fig 1: Proposed system

Literature Survey

Gesture and voice-driven remote-control systems stand at the forefront of technological innovation, offering

users a novel and more accessible means of interacting with their electronic devices.[1] presents the design and implementation of a smart home automation system that can be controlled remotely through voice commands. This system aims to provide convenience, especially for the elderly and disabled, by allowing them to control home appliances using voice commands. Additionally, it incorporates a home security feature using an ultrasonic sensor to detect movement and send notifications to the homeowner's mobile device.
The results indicated that the voice recognition application was not able to recognize all types of pronunciationwith 100% accuracy. This implies that the system's effectiveness may decrease with increased environmental noise and varying voice frequencies. The text also suggests there are specific areas of improvement that can be addressed in future iterations of the system. [2] electrical switchboards make it difficult for the members in the home, especially the elderly and physically handicapped to operate them. Speech based home automationgives us access control device in our home by giving speech commands by using a phone remotely. Here the home appliances are controlled through commands given from remote controller or a touch screen. The system also operates automatically by detecting the presence of human beings in the room and accordingly theloads are switched off in the absence of humans. The novelty of our research lies in its focus on user-centricdesign principles and its commitment to providing an accessible and intuitive interaction experience for users of all backgrounds and abilities. By integrating customizable user interfaces into gesture and voice-driven remote-control systems, we aim to address existing limitations and pave the way for more inclusive and personalized interaction experiences.
The Hand Gesture Control System (HGCS) uses a three- tier architecture that includes a gestural interface, a gestural processing and identification tier, and a set of home devices.
The system architecture allows for direct execution of commands on home devices through wireless communication such as Wi-Fi, Bluetooth, or IR.
The control gestures are designed to be comfortable and of low complexity, allowing for intuitive user interaction with home devices. The authors plan to increase the gesture library to customize the system according to user profiles. There is an interest in expanding applications to industrial control where gestural interfaces need to be more precise [7].

In the Bluetooth Home Automation, the focuses on leveraging Bluetooth technology to create a cost-effective, secure, and flexible home automation system that is particularly accessible for the elderly and physically disabled, enabling control over home appliances through voice commands using smartphones. In the Speech-based Home Automation they discuss the development of a home automation system that allows control of home appliances through speech recognition. This system aims to provide convenience and accessibility, particularly benefiting users with physical disabilities or those seeking hands-free operation. In Voice Control and Home Security for Smart Home Automation the Introduces a system integrating voice control with home security features, using GSM, Bluetooth, and ultrasonic sensors. It offers high accuracy invoice recognition and movement detection for security, emphasizing the system's utility for the elderly, disabled, and for enhancing home security. In Bluetooth Home Automation, they may face l limitations in range due to Bluetooth technology, potential interference with other devices, and could be less scalable for larger home automation setups due to bandwidth constraints. In the Speech-based Home Automation the Challenges may include the system's reliance on clear speech, which can be affected by background noise or accents, leading to potential inaccuracies in command interpretation. In the Voice Control and Home Security for Smart Home Automation the This system, while comprehensive, could become complex for users to set up and manage. Additionally, voice recognition accuracy in diverse environments and security concerns regarding false triggers or unauthorized access may pose challenges [3-6].

The works under discussion showcase several smart home automation systems that respond to the needs of the elderly and disabled population. These systems enable household appliances to be operated by voice or gesture. The initial system has an ultrasonic sensor for movement detection and a security feature that allows users to provide voice instructions. A speech recognition-based home automation system that can automatically control appliances based on human presence is described. Finally, a system that integrates voice control with GSM, Bluetooth, Arduino, and home security features is demonstrated. Its maingoals are improving home safety and accuracy. These systems do, however, have drawbacks, including restricted range and Bluetooth interference, problems with noise or accents affecting voice recognition accuracy, potential complexity in setup and management, and security flaws [8].

METHODOLOGY

HC-05 is connected to the Raspberry Pi for voice recognition. The trigger and Echo pins are connected to GPIO pins on Raspberry Pi for sending and receiving signals. The camera module I interfaced with CSI (Camera Serial Interface) port on the Raspberry Pi. A Node MCU is connected to Raspberry Pi to get the input signal fromany distant place. These inputs given to the Raspberry Pi can be worked from anywhere. Fig 2 shows the interfacing diagram of the system [9].

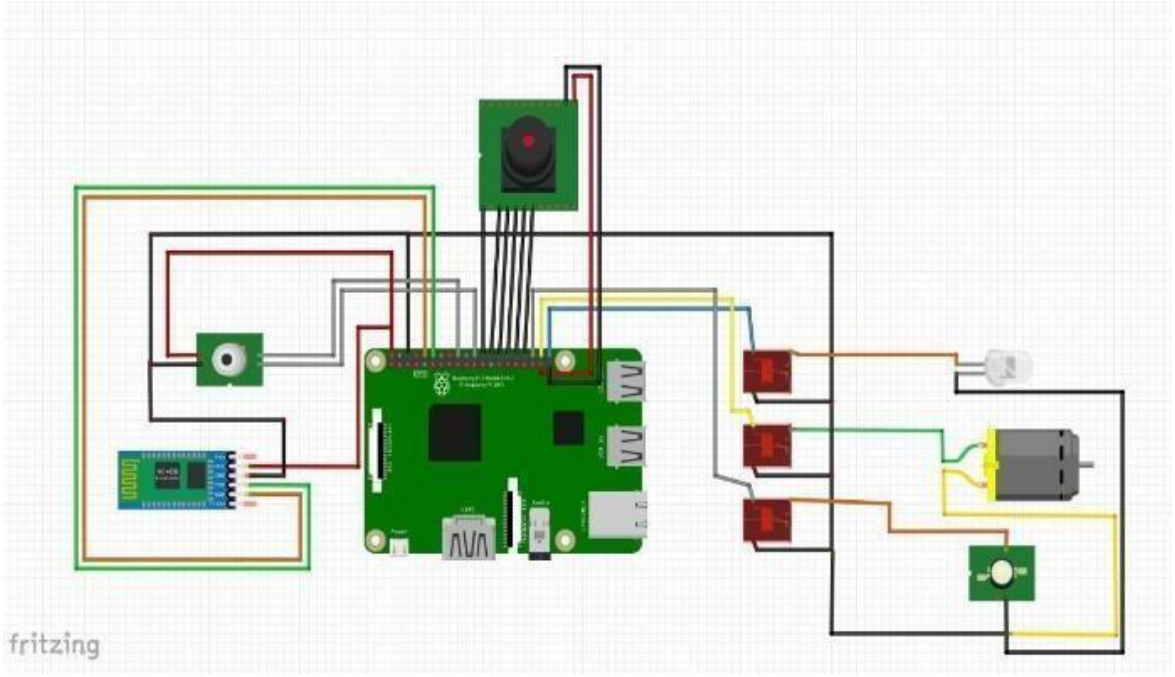

Fig 2: Interfacing diagram of system

Raspberry Pi has memory options of 2GB, 48GB, and 8GB, allowing you greater flexibility across several applications. Enhanced connectivity choices include Wi-Fi, Ethernet, and Bluetooth 5.0, resulting in speedier data transfer and better communication possibilities. The board's larger heat sink and enhanced airflow lowerthe risk of overheating during intense operation. The USB-C power connector enhances power transmission and compatibility with modern pour sources. It supports multimedia tasks such as video playback. RaspberryPi 4 B provides improved software compatibility because it is supported by a variety of operating systems.

Because of Raspberry pi's strong hardware and software support, this board is utilized for a variety of applications, such as media, Internet of Things, and home automation. Even for beginners and intermediate users, the Raspberry Pi4B is simple to use and highly accessible. This is made possible by its simple setup procedure and approachable programming environment. In addition, our board is frequently utilized in educational settings, such as by students working on projects. It is a great option for both educators and students as it teaches electronics and programming basics. The Raspberry Pi 4B is an excellent choice in situations where power consumption is a concern because it is extremely energy efficient and uses less power than standard desktop computers. With this board, remote access and control are feasible. This board is utilized in projects where remote accessibility is a key component. The Raspberry Pi 4B is a good choice forapplications that require remote access because it is simple to operate and manage from a distance. With a Raspberry Pi 4B, installing cameras and external sources like LEDs is not a laborious task. It provides extremely high performance and feature levels. The connection setup of the proposed system is shown in figure 3.

Fig 3: Connection set up of proposed system.

RESULT

After completing the connection set-up, using the mobile app 'Blynk' application, a person could simply say (voice command) switch ON or OFF the appliance (bulb is used here) through the app. After getting the instruction through the Bluetooth module. It can also be controlled by gestures. As the camera turns on the gesture recognition starts, if there is any movement of hand it recognizes the signal and performs the task specifically. The system can also be accessed remotely with the help of Node MCU. The Workflow of the proposed system is shown below in figure 4.

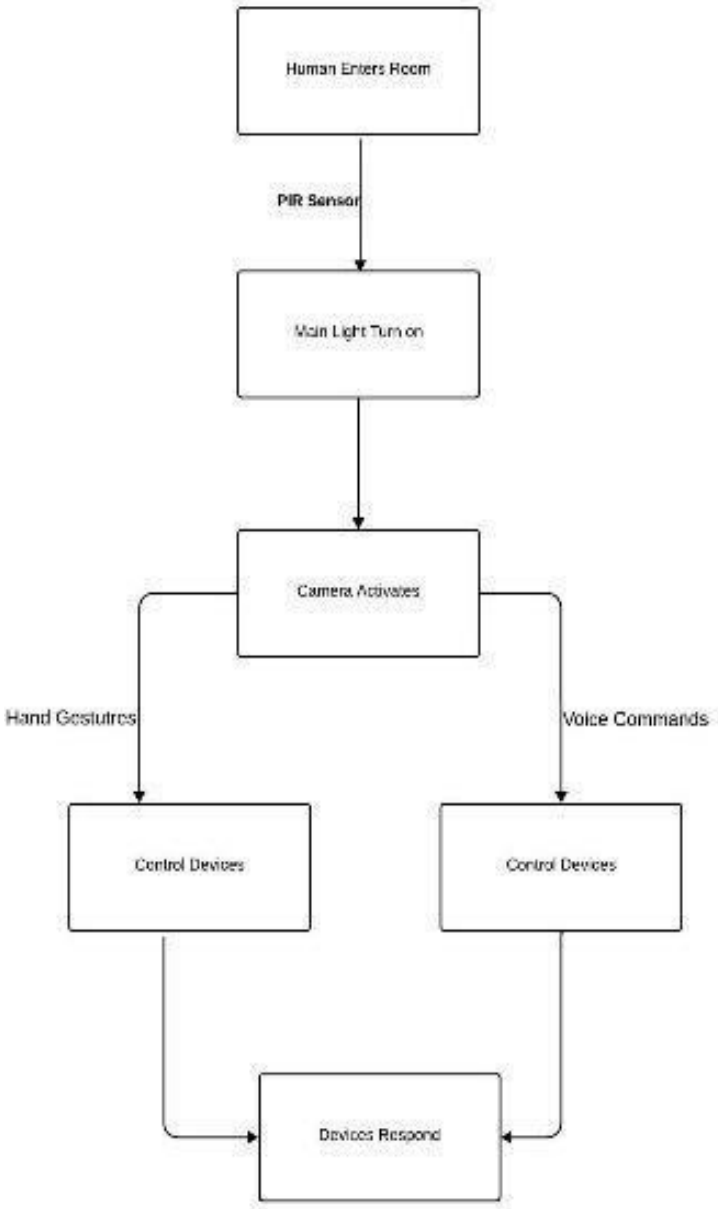

Fig 4: Workflow of proposed system

Specific commands are given for specific tasks. For voice modulation it has command as ‘Turn ON Light’, ’Turn OFF Light’, ‘Turn ON Fan’, ‘’Turn OFF Fan’. More commands can be added as per our requirements. For gesture recognition the landmarks are traded on the palm. Here specific commands are also given. when light will turn ON results shown in finger 5. More such gestures can be givenfor the specific tasks.

Fig 5: Working of proposed system

Conclusions

In conclusion our research has introduced a novel approach interface customization within gesture and voice-driven remote-control system aimed at enhancing usability, accessibility, and user satisfaction. By developing a customizable user interface framework that empowers users to personalize their interaction experience according to their unique preferences and accessibility needs, we have addressed a key limitation in existing systems.

Our findings demonstrate the effectiveness of the customizable user interface framework in improving the usability and accessibility of gesture and voice-driven remote-control systems. Through user evaluations and usability testing, we have shown that the ability to customize gesture preferences, voice command settings, and visual feedback options leads to higher levels of user satisfaction and engagement across diverse user populations.

The novelty of our research lies in its focus on user-centric design principles and its commitment to providing an inclusive and intuitive interaction experience for users of all backgrounds and abilities. By integrating customizable user interfaces into gesture and voice-driven remote-control systems, we have paved the way for more personalized and adaptive interaction experiences that meet the diverse needs of users in various contexts.

The Gesture and Voice Driven Remote Control System offers a revolutionary means of interacting with electronic devices. Through hand gestures and voice commands, it eliminates the need for physical remotes, significantly enhancing accessibility and convenience. This transformative technology redefines human-computer interaction, promising a user-friendly and futuristic interface for diverse applications**.**

The customizable user interface framework introduced in this research has the potential to revolutionize the way we interact with technology, enabling more inclusive and user-friendly experiences across diverse domains, including smart homes, healthcare, education, and entertainment.

REFERENCES

[1] M. Mahith, D. S. B. Kumar, K. C. Prajwal and M. Dakshayini, "Bluetooth Home Automation," Second International Conference on Green Computing and Internet of Things (ICGCIoT), Bangalore, India, 2018, pp. 603-607.

[2] P. -J. Gonzalo and A. Holgado-Terriza Juan, "Control of home devices based on hand gestures," IEEE 5th International Conference on Consumer Electronics - Berlin (ICCE- Berlin), Berlin, Germany, 2015, pp. 510-514.

[3] M. Asadullah and K. Ullah, "Smart home automation system using Bluetooth technology," International Conference on Innovations in Electrical Engineering and Computational Technologies (ICIEECT), Karachi, Pakistan, 2017, pp. 1-6.

[4] M. Ebrahim Abidi et al., "Development of Voice Control and Home Security for Smart Home Automation," 7th International Conference on Computer and Communication Engineering (ICCCE), Kuala Lumpur, Malaysia, 2018, pp. 1-6.

[5] R. Huang and G. Shi, "Design of the control system for hybrid driving two-arm robot based on voice recognition," IEEE 10th International Conference on Industrial Informatics, Beijing, China, 2012, pp. 602-605.

[6] S. K. Barnwal and P. Gupta, "Evaluation of AI System’s Voice Recognition Performance in Social Conversation," 2022 5th International Conference on Contemporary Computing and Informatics (IC3I), Uttar Pradesh, India, 2022, pp. 804-808.

[7] G. Tatar and S. Bayar, "FPGA Based Bluetooth Controlled Land Vehicle," 2018 International Symposium on Advanced Electrical and Communication Technologies (ISAECT), Rabat, Morocco, 2018, pp. 1-6.

[8] R. N. Gore, H. Kour, M. Gandhi, D. Tandur and A. Varghese, "Bluetooth based Sensor Monitoring in Industrial IoT Plants," 2019 International Conference on Data Science and Communication (IconDSC), Bangalore, India, 2019, pp. 1-6.

[9] K. L. Raju, V. Chandrani, S. S. Begum and M. P. Devi, "Home Automation and Security System with Node MCU using Internet of Things," 2019 International Conference on Vision Towards Emerging Trends in Communication and Networking (ViTECoN), Vellore, India, 2019, pp. 1-5.