iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** IV **Month of publication:** April 2026

DOI: https://doi.org/10.22214/ijraset.2026.80065

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue IV Apr 2026- Available at www.ijraset.com

Voice Assistant Controlled AI Robot with Automation & Stored Response System

Mr. J. Ranjith Kumar[1], Keerthika A[2], Lakshmi Priya S[3]
[1]*Project Guide, Department of Electronics and Communication Engineering, Jeppiaar Engineering College, Chennai*
[2, 3, 4]*Student, Department of Electronics and Communication Engineering, Jeppiaar Engineering College, Chennai*

Abstract: ***This paper presents the design and development of a voice assistant-controlled AI Robot with an automation and Stored Response System. The system integrates artificial intelligence, speech recognition, and embedded systems to create an interactive robotic platform. The robot operates in two modes: manual voice control and automatic obstacle avoidance. Voice commands are processed using AI/ML-based chatbot logic, enabling intelligent interaction and movement control. The ultrasonic sensor ensures safe navigation by detecting obstacles. A stored-response system using an SD card module provides audio feedback, thereby improving human–robot interaction. The proposed system offers an efficient, user-friendly, and autonomous solution suitable for educational and assistive applications. Additionally, the system is designed to be cost-effective and easily scalable for future enhancements. It supports real-time processing, ensuring quick response to user commands and environmental changes. The modular architecture allows integration of advanced features such as IoT connectivity and remote monitoring. Overall, the system demonstrates improved reliability and adaptability in dynamic environments.***
Keywords: AI Robot, Voice Recognition, Arduino UNO, Chatbot, Obstacle Avoidance, Embedded Systems

I INTRODUCTION

In recent years, robotics and artificial intelligence have significantly advanced, enabling intelligent systems capable of interacting with humans. Voice-controlled robots are widely used in automation, assistive technologies, and smart environments. However, traditional robotic systems often lack natural communication and intelligent interaction capabilities. This project aims to develop a voice assistant-controlled robot that can understand commands, perform actions, and provide meaningful feedback. By integrating AI, speech processing, and embedded systems, the proposed system enhances human–robot interaction and improves overall automation efficiency. Furthermore, the system is designed to operate in both manual and autonomous modes, increasing its flexibility in real-world applications. The inclusion of a stored response mechanism allows the robot to communicate effectively with users, making interactions more engaging and informative. This approach also reduces dependency on continuous internet connectivity by enabling offline responses. Overall, the proposed system contributes to the development of smarter, more adaptive robotic solutions suitable for modern technological environments.

II SYSTEM ARCHITECTURE

The proposed Voice Assistant Controlled AI Robot is designed with an integrated architecture that combines sensing, voice processing, control, and actuation modules. The Arduino UNO acts as the central controller, managing all system operations and ensuring real-time performance.

A Voice Input Layer

The voice input layer captures user commands through a microphone or mobile interface. The speech input is converted into text using speech recognition techniques and processed using AI/ML-based chatbot logic to understand user intent. Based on the interpreted command, appropriate control signals are generated for further processing. This enables hands-free and user-friendly interaction with the robot.

B Sensing Layer

The sensing layer uses an ultrasonic sensor to detect obstacles and measure the distance between the robot and surrounding objects. It continuously monitors the environment and sends real-time data to the controller. When an obstacle is detected within a certain range, the system responds immediately to prevent collisions, ensuring safe navigation.

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C Processing and Control Unit

The Arduino UNO serves as the processing and control unit of the system. It receives inputs from both the voice input layer and sensing layer, processes the data, and makes decisions accordingly. It controls the movement of the robot and coordinates all system components, ensuring smooth and efficient operation.

D Actuation Layer

The actuation layer consists of the L298N motor driver and DC motors, which are responsible for the movement of the robot. Based on the control signals from the Arduino, the motor driver regulates the speed and direction of the motors, enabling the robot to move forward, backward, left, and right with stability.

E Audio Output Layer

The audio output layer includes an SD card module, amplifier, and speaker. The SD card stores pre-recorded audio responses, which are played based on system actions or user commands. The amplifier strengthens the audio signal, and the speaker delivers clear voice feedback, improving interaction between the user and the robot.

F Power Supply Unit

The power supply unit provides the necessary voltage to all system components. A regulated supply ensures stable operation, with appropriate voltage levels for the Arduino, sensors, and motors. This helps maintain system reliability and prevents damage due to voltage fluctuations.

III. WORKING PRINCIPLE

The proposed Voice Assistant Controlled AI Robot operates by integrating voice recognition, sensor input, and embedded control for real-time operation. Initially, the system is powered, and the Arduino UNO initializes all connected modules. The user provides voice commands through a microphone or mobile interface, which are processed using speech recognition and AI-based chatbot logic. The interpreted command is sent to the Arduino, which controls the robot's movement through the motor driver and DC motors. At the same time, the ultrasonic sensor continuously detects obstacles in the robot's path. If an obstacle is detected, the system automatically stops or redirects the robot to prevent a collision. The SD card module stores pre-recorded audio responses, which are played through a speaker to provide feedback to the user. The system operates in both manual voice control mode and automatic obstacle avoidance mode, ensuring efficient and safe performance.

IV. HARDWARE COMPONENT

The primary hardware components used in the system include:

• Arduino UNO Acts as the main control unit for processing and decision-making. • Ultrasonic Sensor Detects obstacles, and measures distance • L298N Motor Driver Controls the speed and direction of motors • DC Motors enable the movement of the robot • Microphone / Mobile Interface Captures voice commands from the user •SD Card Module Stores pre-recorded audio responses • Amplifier, and Speaker Provides audio output for feedback • The Power Supply Unit supplies the required voltage to all components

Each Component is selected based on efficiency, cost, and availability to ensure practical implementation

V. ADVANTAGES OF THE PROPOSED SYSTEM

The developed system offers several benefits

• It is cost-effective and suitable for an academic project • Hands-free operation using voice commands• Improved human–robot interaction through AI-based responses • Real-time obstacle detection and avoidance for safe navigation• Dual mode operation (manual voice control and automatic mode) • User-friendly and easy-to-operate system• Cost-effective design using easily available components• Quick response time with efficient processing • Expandable system for future enhancements like IoT and camera integration

VI. APPLICATIONS

• Educational purposes for learning robotics and AI concepts • Assistive robotics for helping elderly or physically challenged individuals • Home automation systems for voice-controlled device operation • Smart surveillance and monitoring applications • Industrial automation for basic robotic assistance • Research and development in AI and embedded systems • Personal assistant robots for daily tasks

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VII. RESULTS AND DISCUSSION

The proposed Voice Assistant Controlled AI Robot was successfully implemented and tested under various operating conditions. The system demonstrated accurate recognition of voice commands and responded effectively to user inputs with minimal delay. The robot was able to move smoothly in different directions based on commands, while the ultrasonic sensor ensured reliable obstacle detection and avoidance. The stored response system provided clear and timely audio feedback, enhancing user interaction. The integration of manual voice control and automatic navigation improved overall system efficiency and flexibility. Experimental results indicate that the system is reliable, user-friendly, and capable of real-time operation, making it suitable for practical applications in automation and assistive technologies.

VIII. CONCLUSION

The proposed Voice Assistant Controlled AI Robot with Automation and Stored Response System was successfully designed and implemented. The system effectively integrates voice recognition, sensor-based obstacle detection, and embedded control to achieve intelligent and real-time operation. It demonstrates reliable performance in both manual voice control and automatic navigation modes. The inclusion of a stored response system enhances human–robot interaction by providing clear audio feedback. Overall, the system is cost-effective, user-friendly, and adaptable for various applications in automation and assistive technologies.

IX. FUTURE SCOPE

The system can be further improved by incorporating advanced Natural Language Processing (NLP) techniques to enhance voice understanding and interaction accuracy. Integration with IoT and cloud platforms can enable remote monitoring and control, making the system more scalable and efficient. Additionally, implementing camera-based object detection will allow the robot to recognize and respond to its surroundings more intelligently. Developing a mobile control application can improve user accessibility and convenience. Furthermore, adding multi-language support will make the system more versatile and user-friendly for a wider range of users.

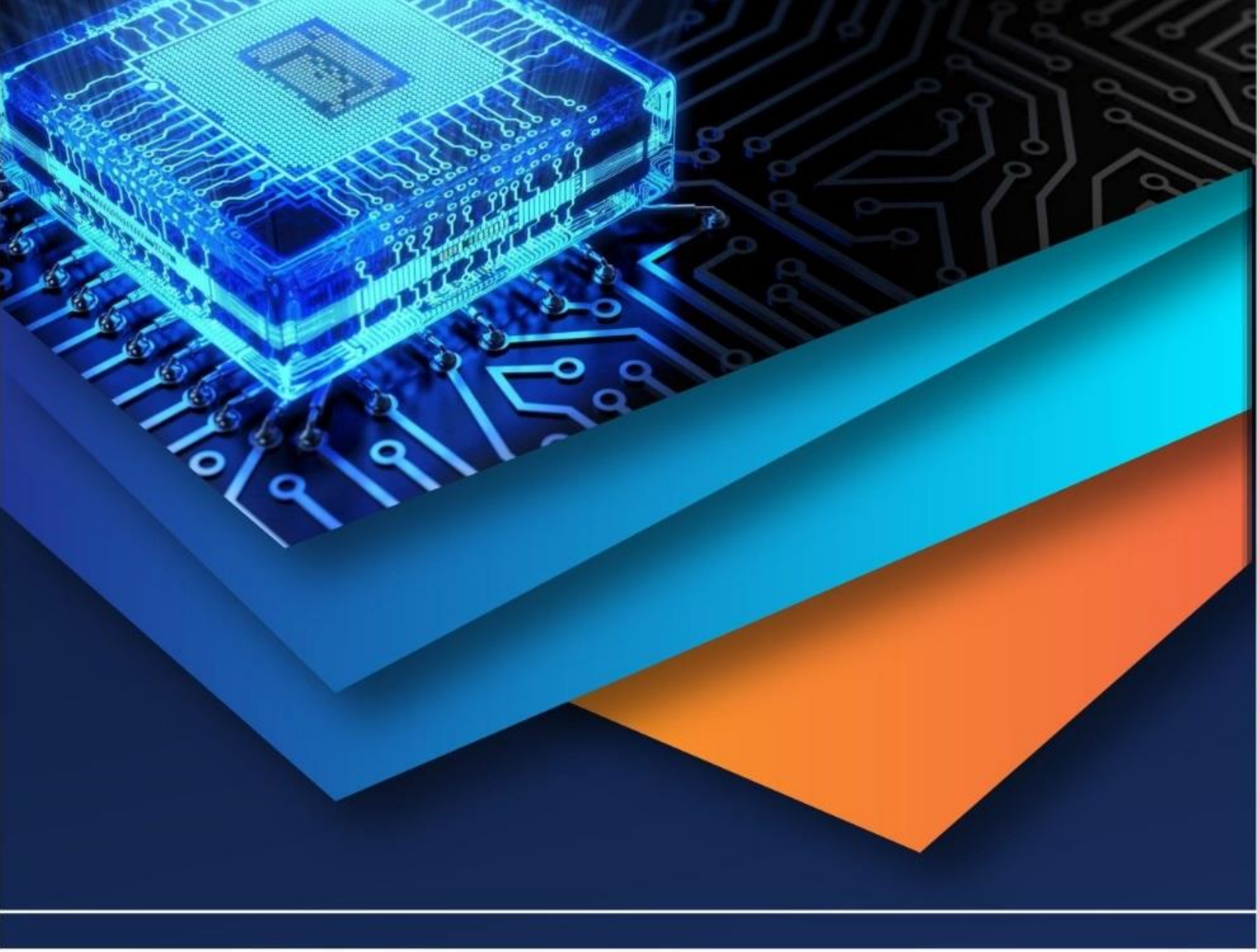
X. ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to the faculty members of the Department of Electronics and Communication Engineering, Jeppiaar Engineering College, for their continuous support and guidance throughout the development of this project. Finally, we acknowledge all the resources and references that contributed to the successful completion of this work.

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