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Voice Controlled Humanoid Robot

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Abstract—The rapid growth of robotics and embedded system technologies has increased the need for intelligent and user-friendly robotic systems. Conventional robot control methods such as remote controls, keyboards, and programmed instructions often make human-robot interaction difficult and less efficient. To overcome these limitations, this project proposes the design and development of a Voice Controlled Humanoid Robot that can understand human voice commands and perform corresponding actions. The proposed system uses speech recognition technology to convert voice commands into digital signals. These commands are transmitted through Bluetooth communication to a microcontroller such as Arduino or ESP32, which processes the commands and controls servo motors through a motor driver circuit. Based on the received instructions, the humanoid robot performs movements such as walking, turning, hand movements, and other predefined actions. The main objective of this project is to create a simple, low-cost, and efficient robotic system that improves natural communication between humans and robots. The system provides hands-free robot control, making it suitable for educational purposes, assistive technologies, automation systems, and future smart robotic applications. The project demonstrates the practical implementation of embedded systems, wireless communication, and voice recognition technologies in humanoid robotics.

I. INTRODUCTION

Robotics has become one of the most important fields in modern engineering due to its applications in industries, healthcare, education, defense, automation, and smart assistance systems. Among different types of robots, humanoid robots are gaining significant attention because they imitate human movements and provide better interaction with users. Traditional robotic systems are generally controlled using remote controls, switches, keyboards, or pre-programmed instructions. These methods require manual effort and reduce the flexibility and natural interaction between humans and robots. Voice recognition technology offers a modern solution for improving human-robot communication. By using speech as an input method, robots can understand user instructions and perform actions accordingly. Voice-controlled robotic systems provide hands-free operation, ease of accessibility, and efficient communication. Such systems are especially useful for elderly people, physically challenged individuals, and applications where manual control is difficult. The proposed project, Voice Controlled Humanoid Robot, focuses on designing a humanoid robotic system capable of responding to human voice commands. The system mainly consists of a speech recognition module or mobile application, Bluetooth communication module, microcontroller unit, motor driver circuit, and servo motors. The user provides commands through voice input, which are recognized and converted into digital signals. These signals are transmitted wirelessly to the microcontroller, which processes the commands and controls the servo motors to generate humanoid movements.

The project aims to develop a low-cost and efficient robotic system that enhances natural interaction between humans and machines. The humanoid robot can perform basic actions such as moving forward, backward, turning left or right, and hand gestures based on user commands. The integration of embedded systems and wireless communication technologies improves the flexibility and usability of the robot. This project also demonstrates the importance of speech recognition and automation in modern robotics. The proposed system can be further enhanced by integrating artificial intelligence, obstacle detection sensors, camera modules, and Internet of Things (IoT) technologies for advanced robotic applications. Therefore, the Voice Controlled Humanoid Robot provides a strong foundation for future intelligent robotic systems used in smart homes, healthcare assistance, industrial automation, surveillance, and educational research.

II. LITERATURE SURVEY

[1] S. Kumar, R. Verma, Guptha P Sharma et al. (2019), "VoiceControlledRoboticSystemUsingArduino".

This paper presents the design and implementation of a robotics system that can be controlled using voice commands through a smartphone application. In this system, the user gives voice commands such as forward, backward and right using a mobile application. The application converts the speech into text commands and sends them to the robot using Bluetooth communication. An Arduino micro controller is used as the main controller of the robot. The Arduino receives the commands via a Bluetooth module and processes them to control the motor driver circuit, which in turn controls the robot's DC motors.

Based on the received command, the robot performs the corresponding movement. The proposed system demonstrates that voice recognition can significantly simplify human-robot interaction, allowing users to control robots without manual devices like keyboards or remote controllers.

[2] A. Sharma, K. Singh, R. Mehta et al. (2020), "Speech Recognition Based Robot Control System".

This research focuses on developing a speech recognition based robot control system that enables robots to respond to human voice commands. The system uses a speech recognition module that converts spoken commands into digital signals. When the user speaks a command, the speech recognition module analyzes the voice signal and identifies the command using speech processing algorithms. The recognized command is then transmitted to the robot's microcontroller. The microcontroller interprets the command and sends control signals to the robot's motor driver and motors, enabling the robot to perform movements such as moving forward, backward, turning left, or turning right. This system improves the efficiency of human-robot communication and provides a hands-free method of controlling robotic systems.

[3] R. Gupta, S. Agarwal, M. Tiwari, et al. (2021), "Voice Controlled Humanoid Robot Using Embedded Systems".

This paper proposes the development of a humanoid robot capable of understanding voice commands and performing predefined actions. The system integrates embedded system technology with voice recognition algorithms. The robot consists of several servomotors that control different parts of the robot such as arms, legs, and head to simulate human-like movements. The voice commands given by the user are processed using speech recognition software. After the command is recognized, the embedded microcontroller processes the command and sends appropriate signals to the servomotors to execute the desired action. The research highlights the importance of natural communication between humans and robots, especially in areas like service robots, education, and assistive robotics.

[4] M. Patel, H. Shah, D. Tridevi N. Desai, Mark R Brinton, et al. (2018), "Speech Recognition Based Intelligent Robot for Human Machine Communication".

This research introduces an intelligent robot system that can be controlled using speech recognition technology. The system uses speech recognition software to capture and interpret voice commands given by the user. The spoken commands are first converted into digital signals using speech recognition algorithms. These signals are then transmitted to a robotic controller, which processes the command and performs the corresponding action. The robot can carry out basic tasks such as movement control or object handling depending on the commands received. The study emphasizes the potential of speech recognition systems in creating more interactive and intelligent robotic systems. The paper also highlights how voice recognition can improve accessibility for people who may have difficulty using traditional control devices.

[5] P. Singh, R. Kumar, A. Mishra S. Yadav, et al. (2020), "Bluetooth Based Voice Controlled Robot".

This paper presents a Bluetooth based voice controlled robot system where voice commands are provided through a smartphone application. The smartphone uses built-in speech recognition features to convert spoken words into command signals. These commands are transmitted to the robot using a Bluetooth communication module. The Bluetooth module sends the commands to a microcontroller, which processes them and generates control signals for the motor driver. The motor driver then controls the robot's motors to perform actions such as moving forward, backward, left, or right. The system demonstrates that smartphone-based voice recognition combined with wireless communication can create an efficient and user-friendly robotic control system.

[6] L. Wang, Y. Zhang, H. Chen Q. Liu, et al. (2022), "Voice Recognition Controlled Humanoid Robot".

This study presents a voice recognition based humanoid robotic system that can recognize human speech and perform various actions. The system integrates advanced speech recognition algorithms with microcontroller based robotic control. The voice recognition module processes spoken commands and converts them into digital instructions. These instructions are then sent to the robot's microcontroller, which controls multiple servomotors responsible for humanoid movements. The robot can perform tasks such as walking, turning, or gesturing, depending on the commands received. The research demonstrates how voice recognition technology can make humanoid robots more interactive and capable of responding naturally to human instructions.

III. CONCLUSION

The Voice Controlled Humanoid Robot project was successfully designed and implemented using Arduino, Bluetooth communication, and voice recognition technology. The robot is capable of responding to voice commands received from an Android application through the HC-05 Bluetooth module and performing movements such as forward, backward, left, right, and stop operations.

This project demonstrates the practical application of embedded systems, wireless communication, motor control, and automation in robotics. The use of voice commands makes the system user-friendly, efficient, and interactive.



The project also helped in understanding the working of Arduino programming, Bluetooth interfacing, motor drivers, and real-time control systems.

The developed system can further be improved by adding artificial intelligence, obstacle detection, camera modules, gesture control, and IoT features for advanced robotic applications. Overall, the project provides a cost-effective and innovative solution for voice-based robotic control and serves as a strong foundation for future smart robotics systems.

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