

Voice Control AI Robot

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Abstract:

This paper presents the design and implementation of an AI voice controlled robot using an Arduino microcontroller and Bluetooth communication. The main objective of the project is to control a robot through human voice commands using a smartphone. The system uses a Bluetooth module to receive commands from a mobile application. The Arduino controller processes these commands and sends signals to the motor driver. The motor driver then controls the movement of DC motors attached to the robot. The robot can perform actions such as moving forward, backward, left, right, and stop based on voice input. This technology helps in improving human-robot interaction and automation. It can also be useful for disabled people and industrial applications. The system is simple, cost-effective, and easy to implement. The results show that the robot responds accurately to voice commands. This project demonstrates the potential of voice recognition technology in robotics and smart automation systems.

I. INTRODUCTION

Robotics and artificial intelligence are rapidly advancing technologies that are widely used in various fields such as automation, industry, healthcare, and smart systems. A voice-controlled robot is an intelligent robotic system that can perform actions based on human voice system. These signals are transmitted to a microcontroller such as Arduino or PIC, which acts as the central processing unit of the robot. The microcontroller interprets the commands and controls the robot accordingly. Wireless communication technologies such as Bluetooth, RF modules, and GSM are used to establish communication between the user and the robot, eliminating the need for complex wiring and enabling remote operation.

commands, electrical faults can result in severe equipment making human-machine interaction easier and more efficient. The main objective of this project is to design and develop a robot that can be controlled through voice instructions using a smartphone application.

The system also includes motor drivers and actuators, which are responsible for the movement of the robot. Based on the received commands, the robot can perform actions such as moving forward, backward, turning left, or turning right. Additionally, various sensors such as gas sensors, temperature sensors, and obstacle detection sensors can be integrated into the system to enhance safety and automation features. These sensors allow the robot to monitor environmental

conditions and respond to hazardous situations in real time.

Power supply is an essential component of the system, typically provided by rechargeable batteries. The overall design of the voice control AI robot focuses on low power consumption, high efficiency, and reliability. Such systems are widely used in industrial automation, smart home applications, and assistive technologies for physically challenged individuals. The integration of real-time sensing, intelligent control, and wireless communication makes voice-controlled robots highly effective in modern technological environments.

using wireless communication technologies such as Bluetooth or RF modules.

The microcontroller processes the received data and generates appropriate control signals. The proposed system works by capturing the user's voice through a microphone or mobile application. The voice input is processed using speech recognition software, which converts the spoken words into digital commands. These commands are transmitted to the microcontroller. These signals are then sent to the motor driver circuit, which controls the movement of motors and actuators. Depending on the command, the robot performs actions such as forward movement, backward movement, left turn, or right turn.

II. LITERATURE REVIEW

1. Shiny P K (2020)

Shiny P K and team developed a voice-controlled guiding robot that responds to spoken commands to assist users in navigation and movement. Their research demonstrated that voice recognition technology can effectively control robot movement and improve human-robot interaction.

2. Linda Mary John (2021)

Linda Mary John proposed a voice-controlled assistance robot designed to help humans perform tasks using speech commands. The system uses speech recognition and a microcontroller to control the robot's movements and operations.

3. Shih-An Li (2023)

Shih-An Li and colleagues designed a voice interaction robot system using deep neural network-based automatic speech recognition. The system allows robots to understand spoken commands and perform tasks in real-world environments.

3. Shubham Thakare (2018)

Shubham Thakare proposed an intelligent voice-controlled robot using speech recognition techniques such as Hidden Markov Models (HMM). The robot converts voice input into commands to control motor movement.

5. Prakash Patil (2024)

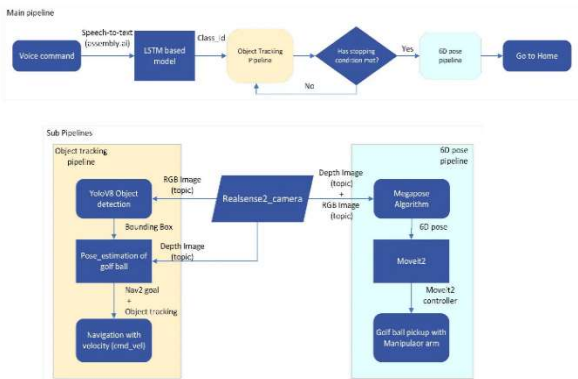
Prakash Patil and team developed a voice-controlled AI robot using Arduino and motor drivers. The robot receives voice commands through Bluetooth communication and performs movement actions accordingly.

III. PROPOSED SYSTEM ARCHITECTURE

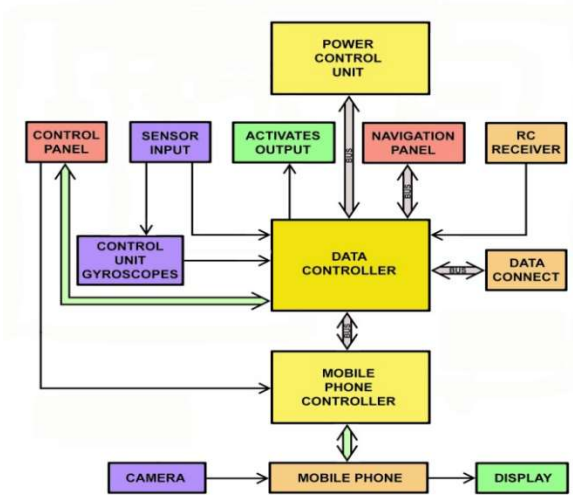
The proposed system works by capturing the user's voice through a microphone or mobile application. The voice input is processed using speech recognition software, which converts the spoken words into digital commands. These commands are transmitted to the microcontroller using wireless communication technologies such as Bluetooth or RF modules.

The microcontroller processes the received data and generates appropriate control signals. These signals are then sent to the motor driver circuit, which controls the movement of motors and actuators. Depending on the command, the robot performs actions such as forward movement, backward movement, left turn, or right turn.

A. Overall System Design



IV. METHODOLOGY



The output section of the system includes a motor driver circuit and actuators. The motor driver receives signals from the microcontroller and controls the movement of motors accordingly. This allows the robot to perform various actions such as moving forward, backward, and turning in different directions.

In addition to these components, the system integrates various sensors such as obstacle sensors, gas sensors, and temperature sensors. These sensors continuously monitor the surrounding environment and provide feedback to the microcontroller. Based on this feedback, the system can take automatic actions to ensure safety and improve performance.

A power supply unit, typically consisting of rechargeable batteries, provides the necessary energy to all components of the system. The overall architecture is designed to be efficient, flexible, and scalable, making it suitable for applications in industrial automation, smart home.

The proposed voice-controlled A.I. robot system is developed using a combination of speech recognition technology, wireless communication, and embedded systems. The methodology is divided into several stages as follows:

1. System Design and Architecture

The overall system is designed to accept voice commands as input, process them using a microcontroller, and generate appropriate control signals to drive the robot. The system consists of three main sections: input unit, processing unit, and output unit.

2. Voice Command Acquisition

Voice commands are captured using a smartphone application or microphone. The user provides predefined commands such as forward, backward, left, right, and stop.

3. Speech Recognition Process

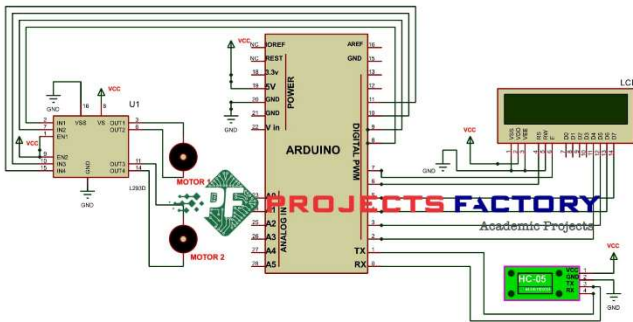
The captured voice signals are converted into text commands using speech recognition technology. This process ensures accurate interpretation of user instructions.

4. Wireless Communication

The recognized commands are transmitted to the robot via a Bluetooth communication module (HC-05). This enables real-time and wireless control of the robot.

V. CIRCUIT DIAGRAM

ARDUINO VOICE CONTROL ROBOT



The circuit diagram of the proposed voice-controlled A.I. robot integrates a microcontroller, Bluetooth communication module, motor driver, DC motors, and a regulated power supply to achieve efficient and real-time control of the robotic system.

The central component of the system is the Arduino Uno microcontroller, which acts as the processing unit. It receives digital command signals from the Bluetooth module and executes predefined instructions to control the robot's movement. The Bluetooth module (HC-05) is interfaced with the Arduino through serial communication, where the transmitter (TX) and receiver (RX) pins are cross-connected to enable data exchange.

The HC-05 Bluetooth module is responsible for establishing wireless communication between the user's smartphone and the robot. It receives the processed voice commands (converted into text via a mobile application) and transmits them to the microcontroller for further processing.

The motor driver module (L298N) is used as an interface between the microcontroller and the DC motors. Since the Arduino cannot supply sufficient current to drive the motors directly, the L298N driver amplifies the current and controls motor operations. The input pins (IN1–IN4) of the motor driver are connected to the digital output pins of the Arduino, while the output pins (OUT1–OUT4) are connected to the DC motors. This configuration allows bidirectional control of motor

rotation, enabling forward, backward, left, and right movements.

VI. IMPLEMENTATION



Fig.4 Voice control A.I Robot

The implementation of the AI voice controlled robot involves assembling the hardware components and programming the system to respond to voice commands. First, all the required components such as the Arduino UNO, Bluetooth module (HC-05), motor driver (L298N), DC geared motors, robot chassis, wheels, jumper wires, and a 12V battery are arranged and connected according to the circuit diagram. The DC motors are mounted on the robot chassis and connected to the motor driver module. The motor driver is then connected to the Arduino microcontroller to control the direction and speed of the motors..

VII. ACKNOWLEDGMENT

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support created a good learning environment for carrying out this work

controlled the motor driver to operate the motors accordingly.

VIII. RESULTS

The AI voice controlled robot was successfully designed and implemented using an Arduino microcontroller, Bluetooth module, motor driver, and DC motors. The system was tested with different voice commands through a smartphone application. During testing, the robot was able to receive commands such as forward, backward, left, right, and stop through the Bluetooth module. The Arduino processed these commands correctly and controlled the motor driver to move the robot in the required direction.

IX. CONCLUSION

In this project, an AI voice controlled robot was successfully designed and implemented using an Arduino microcontroller, Bluetooth module, motor driver, and DC motors. The main objective of the system was to control the movement of a robot using voice commands through a smartphone application. The system was able to recognize voice commands and transmit them wirelessly through Bluetooth communication. The Arduino processed the received commands and

X. REFERENCES

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