

Voice Controlled Pick and Place Robot using Arduino and Bluetooth Technology

Prof. Suraj S. Shinde¹, Mr. Prashant K.Chormale², Mr. Sushant K.Chormale³

¹ Assistant Professor, Electrical Engineering Sahakar Maharshi Shankarrao Mohite Patil Institute of Technology and Research Shankar Nagar Akluj (MS)

^{2,3,4} B Tech Students, Electrical Engineering Sahakar Maharshi Shankarrao Mohite Patil Institute of Technology and Research Shankar Nagar Akluj (MS)

Abstract— Voice-controlled robotic systems are becoming increasingly important in automation and industrial applications. This paper presents a review and design methodology of a Voice Controlled Pick and Place Robot using Arduino Uno, Bluetooth module, DC motors, motor driver shield, robotic arm, and battery supply. The robot is controlled using voice commands transmitted through an Android mobile application via Bluetooth communication. The Arduino Uno processes the received commands and controls the movement of the robot and robotic arm for pick-and-place operations. The proposed system reduces human effort, improves operational accuracy, and provides an economical solution for industrial and domestic automation applications. This paper discusses the system architecture, literature review, methodology, applications, advantages, comparison with existing systems, and future scope of the proposed robotic system.

Index Terms— Voice Controlled Robot, Arduino Uno, Bluetooth Module, Pick and Place Robot, DC Motor, Robotic Arm, Automation.

I. INTRODUCTION

Automation and robotics technologies are rapidly transforming industrial and domestic applications. Pick and place robots are commonly used in industries for material handling and repetitive operations. Traditional robotic systems require manual operation or complex programming methods, whereas voice-controlled robotic systems provide a simple and intelligent human-machine interaction.

A Voice Controlled Pick and Place Robot uses speech recognition technology for controlling robot movements and robotic arm operations. In this system, voice commands are given through an Android mobile

application and transmitted to the Arduino Uno controller using Bluetooth communication. The Arduino processes the commands and controls the motor driver and robotic arm accordingly.

The proposed system mainly consists of:

- Arduino Uno Board
- Bluetooth Module (HC-05/HC-06)
- DC Motors
- Motor Driver Shield
- Battery
- Robot Chassis and Wheels
- Connection Wires
- Robotic Arm

The system architecture includes Bluetooth communication between the mobile device and Arduino Uno, which controls the motor driver and robotic arm for performing pick-and-place operations.

II. LITERATURE REVIEW

Several researchers have developed robotic systems based on voice control and wireless communication technologies.

Manjunatha et al. developed a Bluetooth-controlled pick-and-place robot using Arduino for industrial automation applications. The system improved operational efficiency and reduced manual effort [1].

Mostaque and Karmakar proposed a low-cost Arduino-based robotic arm controlled through voice commands and Bluetooth communication. Their system was capable of handling lightweight objects effectively [2].

Anil Kumar et al. designed an Android voice-controlled pick-and-place robot using Bluetooth communication between the smartphone and Arduino Uno. The system demonstrated reliable wireless control [3].

Sampath Kumar et al. implemented a voice-controlled robotic vehicle using Arduino and Bluetooth technology for smart robotic applications [4].

Shravan Kumar et al. integrated camera vision with a voice-controlled robotic arm for intelligent object manipulation and monitoring applications [5].

From the literature survey, it is observed that voice-controlled robotic systems are widely used in industrial automation, healthcare, rescue operations, and smart robotic applications.

III. SYSTEM ARCHITECTURE

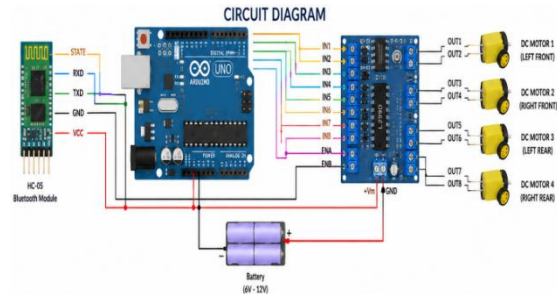
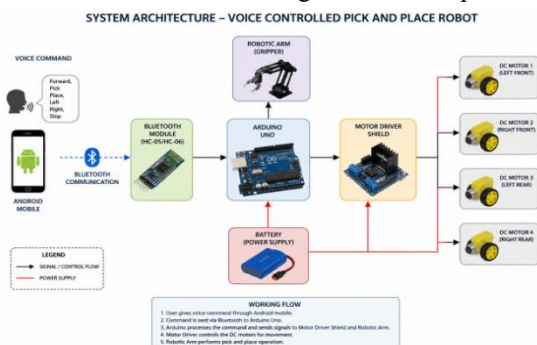
The proposed system architecture consists of the following major components:

1. Bluetooth Module connected to Arduino Uno
2. Arduino Uno connected to Motor Driver Shield
3. Motor Driver connected to DC Motors
4. Battery supplying power to the entire system
5. Robotic arm controlled through Arduino outputs

The working principle of the system is as follows:

1. User gives voice command through Android mobile application.
2. Bluetooth module receives the command.
3. Arduino Uno processes the command.
4. Motor driver controls the DC motors.
5. Robotic arm performs pick-and-place operations.

Robotic arm controlled through Arduino outputs



Working of Circuit Diagram

The circuit diagram represents the hardware connection of the Voice Controlled Pick and Place Robot using Arduino Uno, HC-05 Bluetooth module, motor driver shield, DC motors, and battery supply.

Step-by-Step Working

1. Voice Command Input

- The user gives voice commands through an Android mobile application.
- Commands such as Forward, Backward, Left, Right, Pick, and Place are converted into text signals by the mobile app.

2. Bluetooth Communication

- The HC-05 Bluetooth module receives the wireless commands from the mobile phone.
- The module transfers the received data serially to the Arduino Uno through:
 - TXD → RX pin of Arduino
 - RXD → TX pin of Arduino

3. Arduino Uno Processing

- Arduino Uno acts as the main controller of the system.
- It reads the received Bluetooth commands and processes them according to the programmed instructions.
- Based on the command, Arduino sends control signals to the motor driver shield.

4. Motor Driver Shield Operation

- The motor driver shield (L293D/L298N type) is connected to Arduino digital output pins.
- Since Arduino cannot provide sufficient current directly to motors, the motor driver amplifies the current and controls:
 - Motor direction
 - Motor speed
 - Forward and reverse rotation

5. DC Motor Movement

- Four DC motors are connected to the output terminals of the motor driver:

- Motor 1 → Left Front
- Motor 2 → Right Front
- Motor 3 → Left Rear
- Motor 4 → Right Rear
- Depending on the command received:
 - All motors rotate forward for forward movement.
 - Motors rotate in opposite directions for turning operations.

6. Battery Power Supply

- A 6V–12V battery supplies power to:
 - Arduino Uno
 - Motor driver shield
 - DC motors
 - Bluetooth module
- The motor driver receives motor power directly from the battery.

7. Robotic Arm Operation

- The robotic arm or gripper is controlled through Arduino output pins.
- When the “Pick” command is received:
 - Arm closes to grip the object.
- When the “Place” command is received:
 - Arm opens to release the object.

IV. METHODOLOGY

A. Hardware Components

1) Arduino Uno: Arduino Uno acts as the central controller of the robotic system. It processes the voice commands received through Bluetooth communication and controls the motors.

2) Bluetooth Module: HC-05 Bluetooth module is used for wireless communication between the smartphone and Arduino Uno.

3) DC Motors: DC motors provide movement to the robot chassis and robotic arm mechanisms.

4) Motor Driver Shield: Motor driver shield controls motor direction and speed because Arduino cannot directly drive high-current motors.

5) Battery: Battery provides power supply to the Arduino board, motor driver, Bluetooth module, and motors.

6) Robot Chassis and Wheels: The chassis provides mechanical support and mobility to the robotic system.

7) Connection Wires: Connection wires establish electrical connections among all hardware components.

B. Software Methodology

- Arduino IDE is used for programming the Arduino Uno.
- Android mobile application converts speech into text commands.
- Commands such as Forward, Backward, Left, Right, Pick, and Place are transmitted through Bluetooth communication.
- Arduino processes the commands and controls the motors and robotic arm.

V. APPLICATIONS

The Voice Controlled Pick and Place Robot can be used in:

- Industrial automation
- Material handling systems
- Medical assistance robots
- Military and defense applications
- Hazardous environment operations
- Warehouse automation
- Educational robotics projects
- Home automation systems

VI. ADVANTAGES

The proposed system offers several advantages:

- Easy wireless operation
- Reduced human effort
- Low-cost implementation
- Improved accuracy and efficiency
- User-friendly voice control
- Portable and flexible design
- Suitable for hazardous environments
- Real-time control and monitoring

VII. COMPARISON WITH EXISTING SYSTEM

Parameter	Existing Manual System	Voice Controlled Pick and Place Robot
Control Method	Manual Operation	Voice Commands
Human Effort	High	Low
Automation Level	Low	High
Response Time	Slow	Fast
Accuracy	Moderate	High
Wireless Communication	Not Available	Bluetooth Based
Safety	Low	High

The proposed voice-controlled system provides better automation, flexibility, and efficiency compared to conventional manual systems.

VIII. FUTURE SCOPE

The future scope of the proposed robotic system includes:

- Artificial Intelligence integration
- Computer vision and image processing
- IoT-based remote monitoring
- Autonomous navigation systems
- Gesture and voice hybrid control
- Advanced wireless communication technologies
- Solar-powered robotic systems
- Medical and rescue robotic applications

These advancements can improve the intelligence, accuracy, and industrial usability of the robotic system.

IX. CONCLUSION

The developed Voice Controlled Pick and Place Robot successfully performs wireless robotic operations using voice commands through Bluetooth communication. The integration of Arduino Uno, Bluetooth module, motor driver shield, DC motors, and robotic arm provides efficient movement and object handling operations.

The experimental results show that the robot responds accurately to voice commands such as forward, backward, left, right, pick, and place with minimum delay. The Bluetooth communication system ensures reliable wireless control within the operating range. The motor driver effectively controls the DC motors,

enabling smooth movement of the robot and robotic arm.

The proposed system reduces human effort, improves operational efficiency, and provides a low-cost automation solution for industrial and domestic applications. The robot demonstrates good accuracy, flexibility, and user-friendly operation, making it suitable for material handling, warehouse automation, and hazardous environment applications.

Overall, the project successfully achieved its objective of developing an economical and efficient voice-controlled robotic pick-and-place system. Future enhancements such as Artificial Intelligence, IoT integration, and computer vision can further improve the intelligence and automation capabilities of the system.

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