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Voice Controlled Robotic Car

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Abstract: *The proposed project presents the design and implementation of a voice-controlled robot that integrates intelligent sensing, communication, and actuation mechanisms to enhance human–machine interaction. The system is developed using an Arduino microcontroller as the central processing unit, interfaced with a Bluetooth module to receive real-time voice commands from a Voice Bot mobile application. Upon processing these commands, the Arduino controls the robot's motion via an H-Bridge motor driver circuit, enabling forward, backward, left, and right stop movements of the DC motors.*

To ensure environmental awareness and safety, the robot incorporates an ultrasonic sensor for obstacle detection, preventing collisions by halting or rerouting the robot's motion when an object is detected within a predefined distance. For visual indication and user feedback, the system integrates a 16x2 LCD display that shows status messages such as movement direction or obstacle detection.

An additional feature of the robot is its automatic lighting system for operation in low-light conditions. Using an LDR (Light Dependent Resistor), the system monitors ambient light levels; when darkness is detected, the Arduino activates a relay-driven LED headlight to illuminate the path. Furthermore, left and right indicator LEDs are triggered synchronously with corresponding motion commands, providing clear directional signaling similar to real-world vehicles.

This multifunctional design combines voice-based control, autonomous sensing, and user feedback mechanisms, making it an efficient and user-friendly robotic platform. Its applications range from assistive robotics for physically challenged individuals, smart home automation, and surveillance, to educational demonstrations in embedded systems and robotics. By integrating low-cost sensors and widely available components, the system ensures affordability, scalability, and adaptability for future enhancements, including IoT-based remote monitoring and machine learning-driven decision-making..

Keywords: *Light Dependent Resistor*.

I. INTRODUCTION

This project introduces a voice-controlled mobile robot designed to respond to real-time voice commands transmitted via a Bluetooth connection from a smartphone-based Voice Bot application. The heart of the system is an Arduino microcontroller, which processes user commands and coordinates the robot's motion through an H-Bridge motor driver connected to DC motors. This enables smooth navigation in forward, backward, left, and right directions.

To enhance safety and environmental adaptability, the robot is equipped with an ultrasonic sensor that continuously monitors the surroundings for obstacles. When an object is detected within a predefined range, the robot either halts or adjusts its motion to avoid collision. An LCD display is integrated into the system to provide real-time feedback to the user, such as motion status, obstacle detection alerts, and light activation information.

The system also incorporates an automatic illumination feature using an LDR (Light Dependent Resistor) to detect ambient light intensity. In low-light or dark environments, a relay-controlled LED light is activated to illuminate the path, ensuring reliable operation at night or in poorly lit areas. Additionally, directional indicators (left and right LEDs) are triggered whenever corresponding

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II. LITERATURE SURVEY

Research in robotics has consistently explored human-robot interaction, with many focusing on control technologies using diverse methodologies. Prior works highlight the use of Android smartphones for robot control via Bluetooth communication using microcontrollers like ATMEGA328. Other research explored controlling vehicles using a Wi-Fi module through an Android application.While existing literature demonstrates various wireless control methods, including speed control and basic obstacle sensing in some designs, a comprehensive, multifunctional platform integrating hands-free voice control with autonomous environmental sensing (LDR and Ultrasonic), real-time LCD feedback, and directional signaling in a single, affordable, and modular design remains a focus for advancement. The identified gap confirms the need for a system that provides both intuitive control and robust environmental adaptability.

III. OBJECTIVES

1. Develop a voice-controlled robotic platform
Implement a system that receives and processes real-time voice commands from a Voice Bot mobile app via Bluetooth.

2. Enable efficient robot navigation
Control the movement of the robot (forward, backward, left, right, and stop) using an Arduino microcontroller and H-Bridge motor driver with DC motors.

3. Integrate obstacle detection for safe operation
Use an ultrasonic sensor to detect objects within a predefined range and prevent collisions by halting or redirecting the robot.

4. Provide real-time status feedback
Display robot actions (movement, obstacle alerts, lighting status) on an LCD screen for user awareness.

5. Implement environmental adaptability
Use an LDR sensor to monitor ambient light conditions and automatically switch on a relay-controlled LED headlight in darkness.

6. Incorporate signaling features
Activate left and right indicator LEDs in synchronization with directional movement commands to enhance clarity and visibility.

7. Ensure affordability and scalability
Design the system using low-cost, widely available components while maintaining modularity for future upgrades (IoT integration, GPS, AI-based control).

IV. HARDWARE AND SOFTWARE REQUIREMENS

The Hardware and Software requirements of our Project are Listed below in the Tables below

Component	Description
Microcontroller	Arduino Uno (ATmega328P)
Power	Power Supply/Battery
Communication	Bluetooth Module (HC-05/HC-06)
Motion	DC Motor
Motor Driver	H-Bridge (L293D/L298N)
Sensing	LDR Sensor

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Output/Display	LCD Display (16x2)
Output/Indicator	Relay , LED's (Headlight/Indicator)
Programming	Arduino IDE
Language	Embedded C

V. METHODOLOGY

The proposed Voice Controlled Robot integrates multiple hardware and software components into a unified flow. The system is designed to provide hands-free control and environmental awareness.

Voice Command Input: The user provides directional commands ("forward," "backward," "left," "right," or "stop") via a Voice Bot mobile application. The voice is converted to text and transmitted via the Bluetooth module.

Command Reception and Processing: The Arduino microcontroller decodes the received Bluetooth data and triggers the corresponding action.

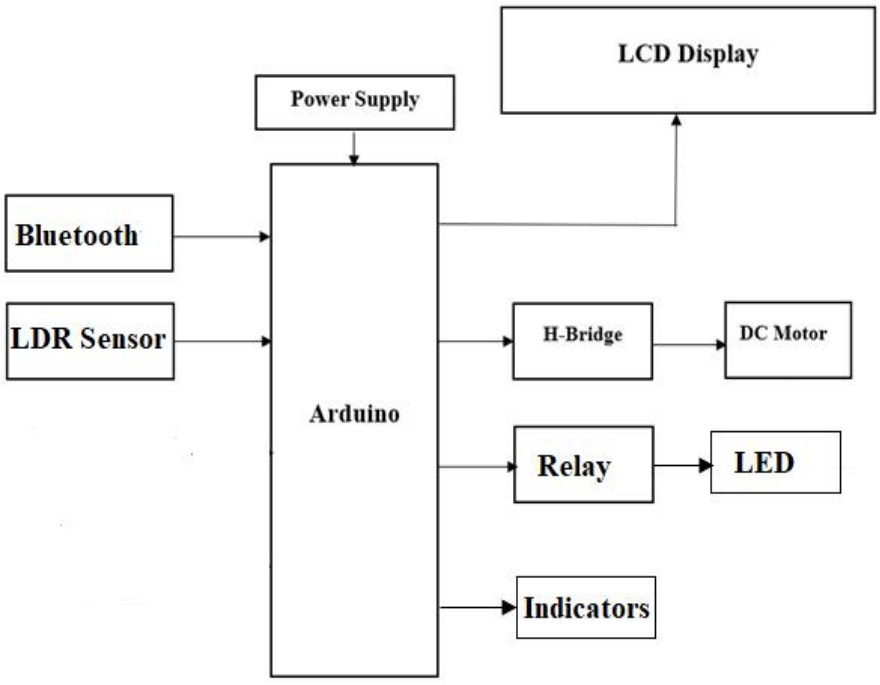
Motor Control: An H-Bridge motor driver receives signals from the Arduino to control the DC motors, executing the desired motion.

Obstacle Detection: An ultrasonic sensor continuously scans the path. If an obstacle is detected within a predefined threshold, the Arduino overrides the motion, halts the robot, and displays an alert on the LCD.

Automatic Lighting: An LDR sensor monitors ambient light; if darkness is detected, the Arduino activates a relay-controlled LED headlight.

Directional Indicators: Corresponding indicator LEDs are switched on when a "left" or "right" command is received, providing a visual cue of the robot's intent.

Feedback and Interaction: A 16x2 LCD display provides real-time status updates, including movement direction, obstacle alerts, and lighting conditions.



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VI. RESULTS AND DISCUSSION

The prototype successfully demonstrated the integration of all functional requirements under varying conditions.

Voice Command Responsiveness: The system successfully received and processed commands from the Voice Bot app via Bluetooth, with a performance goal of responding within a short delay (<2 seconds).

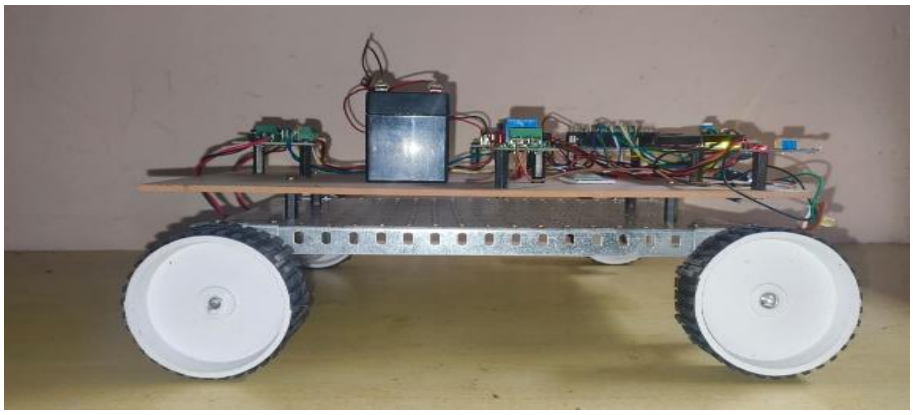
Safe Navigation: The ultrasonic sensor achieved accurate obstacle detection, reliably halting the robot when objects were within the predefined range, thereby ensuring safe operation.

Environmental Adaptability: The LDR-based automatic lighting system successfully monitored ambient light and activated the relay-controlled LED headlight in darkness, enhancing operational reliability in low-light environments.

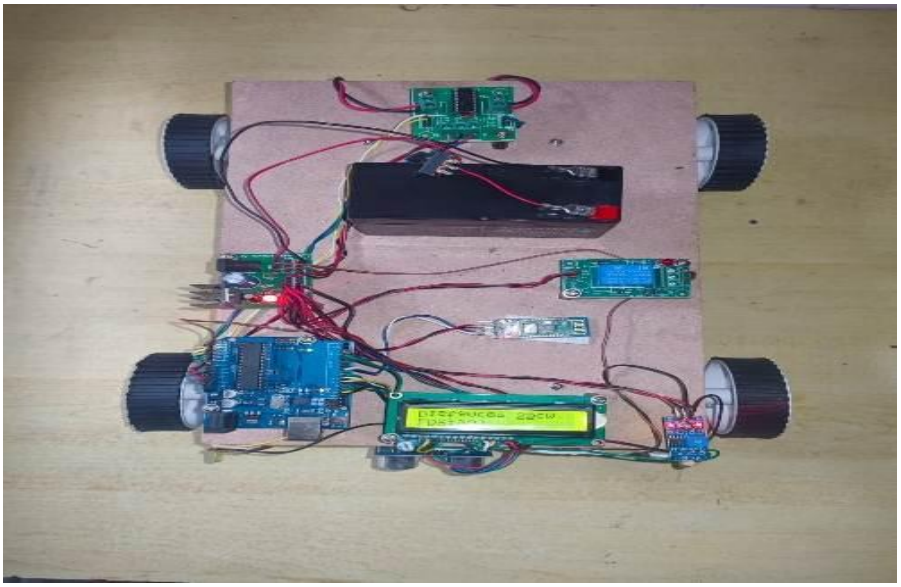
User-Friendly Signaling: The synchronization of left and right indicator LEDs with directional movement commands provided clear signaling, enhancing usability similar to real-world vehicles.

Real-Time Feedback: The LCD display was fully operational, providing immediate, clear status feedback on movement, lighting, and obstacle alerts, meeting the usability requirement.

Modularity and Affordability: The system was built using low-cost, modular components (Arduino, HC-05, L293D), validating its scalability and affordability goals.



a) Hardware



b) Working

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VIII. CONCLUSION

The proposed Voice Controlled Robot successfully demonstrates the integration of voice recognition, wireless communication, environmental sensing, and intelligent control into a single, low-cost robotic system. By using an Arduino microcontroller as the core controller, the system effectively processes real-time commands from a Voice Bot app via Bluetooth, enabling smooth navigation through an H-Bridge-driven DC motor setup.

The inclusion of an ultrasonic sensor enhances safety by preventing collisions through proactive obstacle detection, while the LDR-based automatic lighting system ensures reliable operation in low-light conditions. The addition of relay-controlled headlights and directional indicator LEDs makes the robot more user-friendly and realistic in its movement representation. Furthermore, the LCD display provides real-time feedback, improving interaction and usability.

This multifunctional design not only meets the requirements of hands-free robot control but also addresses practical challenges such as navigation safety, lighting in darkness, and user feedback. Its affordability and modularity make it suitable for diverse applications, including assistive robotics for differently-abled individuals, smart home automation, surveillance, and educational purposes.

The project highlights how simple embedded systems and low-cost sensors can be combined to build an intelligent robotic platform. With future enhancements such as IoT integration, GPS navigation, or AI-based decision-making, this system can evolve into a more advanced autonomous robotic solution, contributing to the growing field of human–robot interaction and smart automation.

REFERENCES

[1] D. Floreano and J. Urzelai, "Evolutionary Robots with Online Self-Organization and Behavioral Fitness," June 2000.M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.

[2] Zhizeng L, Jingbing Z, "Speech recognition and its application in voice-based robot control system," In 2004 International Conference on Intelligent Mechatronics and Automation, 2004. Proceedings.

[3] Ryther CA, Madsen OB, "Obstacle Detection and Avoidance for Mobile Robots," Technical University of Denmark, 2009.

[4] Dhanya KR, JeyanthiR, "Automatic braking system with fusion concept," Int. J. Emerg. Trends Eng. Dev., April 2012.

[5] Ahasan MA, Hossain SA, Siddiquee AU, Rahman MM (2012). Obstacles Invariant Navigation of an Autonomous Robot Based on GPS. Khulna University.

[6] Ass. Prof. Emad S. Othman, Senior Member IEEE -Region 8, 2017, Voice Controlled Personal [7] Harshada Rajput, Karuna Sawant, Dipika Shetty, Punit Shukla, Prof. Amit Chougule, 2018, Engineering and Technology (IRJET), pp1154-1156.

[8] T. Thivagar, A. Sriram,2020, Hand Gesture ,2020, Voice Controlled Smart Vehicle, International

[9] Design of a Bluetooth Enabled Android Application for a Microcontroller Driven Robot By Vito M. Guardi,(May 2014).

[10] Android Controlled Mobile Robot By Jorge Kazacos Winter,(July2013).