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Arduino based Voice-Controlled Robot Car with Obstacle Detection

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Abstract: ***This project introduces an Arduino-based Bluetooth Voice-Controlled Robot Car with Obstacle Detection, which is intended to assist physically challenged people by providing a hands-free control mechanism. The robot may be controlled using voice instructions over a Bluetooth connection, allowing people to control its movement (forward, backward, left, right, stop) without exerting physical effort. Furthermore, an ultrasonic sensor allows the robot to identify obstructions in its path, ensuring safe navigation by immediately pausing or redirecting the robot as needed. This combination of voice control and obstacle detection makes the system suitable for improving accessibility, independence, and safety for people with mobility issues, as well as for use in other domains such as personal assistance, security, and automation.***

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I. INTRODUCTION

In recent years, advances in robotics and automation have greatly enhanced accessibility and assistance technologies for those with mobility disabilities. Traditional mobility aids frequently need manual operation, which may be inappropriate for people with severe physical limitations. To address this issue, voice-controlled robotic devices have evolved as a novel alternative, providing hands-free navigation and control.

This project showcases an Arduino-based Bluetooth Voice-Controlled Robot Car with Obstacle Detection, which is intended to improve accessibility and independence for those with mobility issues. By combining voice recognition technology and obstacle detection, the system enables users to control the robot automobile with basic spoken commands like "forward," "backward," "left," "right," and "stop."

Voice commands are sent over Bluetooth to an Arduino microcontroller, which controls the robot accordingly.

To ensure safe and efficient movement, the robot has an ultrasonic sensor that identifies impediments in its path. When an obstacle is detected, the system takes remedial action, either pausing or altering the robot's route to prevent collisions. This function not only improves safety, but also allows for autonomous navigation in dynamic conditions.

Aside from supporting people with disabilities, this technology has potential uses in a variety of industries, including personal assistance, security patrols, home automation, and industrial automation. The combination of voice control and obstacle recognition makes it a versatile and user-friendly robotic system, laying the groundwork for future advances in smart assistive technology.

II. EXISTING SYSTEM

Traditional remote-controlled gadgets with physical controls, such as buttons or joysticks, might be difficult or impracticable for physically challenged people to use. These devices necessitate fine motor skills and physical exertion, which may be impractical for users with mobility problems.

Furthermore, the majority of these systems do not include autonomous obstacle recognition, increasing the likelihood of crashes in congested or unfamiliar areas. As a result, present solutions frequently fail to provide a truly accessible and safe manner for impaired people to explore or control equipment independently, reducing their autonomy and increasing their reliance on others for help.

III. PROPOSED SYSTEM

The suggested solution makes use of an Arduino-based Bluetooth robot to provide both voice control and obstacle detection. It improves accessibility for impaired people by allowing hands-free control and assuring safety through real-time obstacle avoidance. This integration enhances navigation in congested or dynamic situations, making it appropriate for a variety of applications, including personal assistance and hazardous environments.

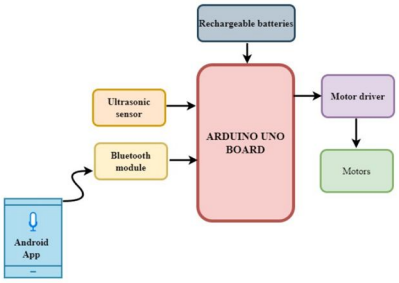

Fig.1. Architecture

IV. COMPONENTS USED AND DESCRIPTION

A. *Arduino UNO*

Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board. Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package. Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board.

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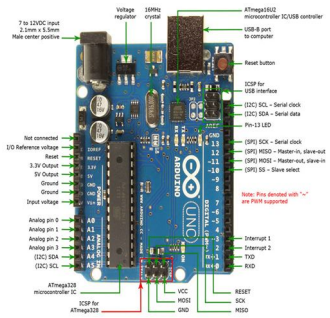

Fig.2. Arduino UNO Pin Description

B. *Gear Motor*

A gear motor combines an electric motor and a gearbox. This makes it a simple, cost-effective solution for high-torque, low-speed applications since it combines a motor with a gear reducer system.

Fig.3. Gear Motor

C. *L298N Motor Driver*

L298N motor driver IC is very simple is to drive the two DC motors simultaneously. This IC works on the principle of Half H-Bridge. It controls the speed of the motor microcontroller sends the pulse signals to it accordingly. An L298N has four input pins, four output pins, 2 enable pins, Vss, Vcc and GND.

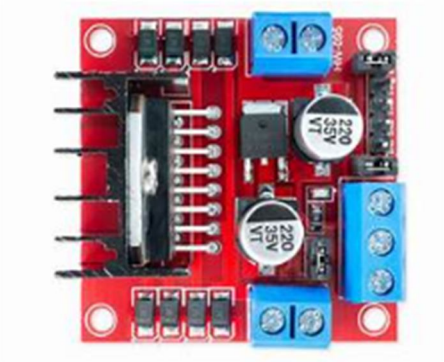

Fig.3. L298N motor driver

D. Bluetooth Module HC – 05

Fig.4. Bluetooth module HC-05

HC-05 Bluetooth Module is a smooth to use Bluetooth SPP (Serial Port Protocol) module, designed for obvious wireless serial connection setup. Its communication is through serial communication which makes an easy manner to interface with controller or PC. HC-05 Bluetooth module gives switching mode among master and slave mode which means it capable of use neither receiving nor transmitting records.

E. Ultrasonic Sensor

The four pins on the HC-SR04 Ultrasonic (US) sensor are labeled Vcc, Trigger, Echo, and Ground, respectively. This sensor is widespread and is utilized in many applications where sensing objects or measuring distance is necessary. The ultrasonic transmitter and receiver are formed by two projects resembling eyes on the module's front

Fig: 5 HCSR04 ULTRASONIC SENSOR

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V. RESULTS

The "Voice Controlled Bot" could be used in both the wheelchair and the serving bot. Because of its low cost and ability to respond to essential commands, including a Bot inside a wheelchair could improve mobility for those with disabilities. If we could apply our bot at hotels, it would boost the number of work opportunities for persons with disabilities.

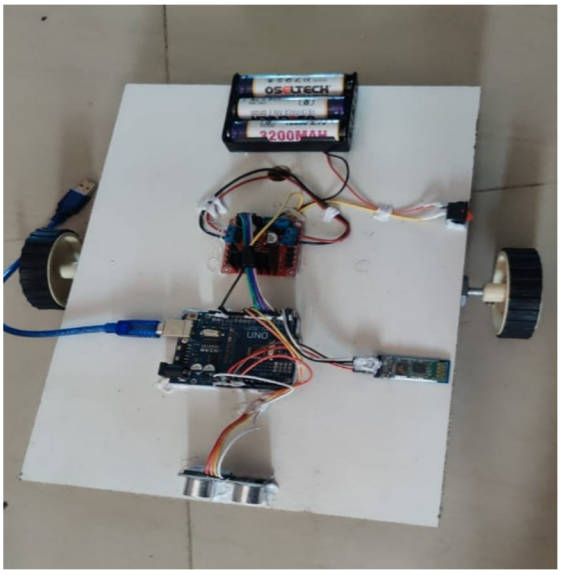

Fig 8: Working

When the voice-controlled bot is connected to the power supply, the bot gets initialized. At the initial stage we have connect the Bluetooth module with mobile application. Once it connected, we will start the commanding the bot by voice. We have four basic commands which send to microcontroller through Bluetooth which uses mobile application. Mobile application will process the input data converted into commanding signal. This signal is processed by Arduino UNO then signals the motor driver. Gear motors will start rotates according to signal received from motor driver..

VI. CONCLUSION

A microphone within the Android intelligent smartphone is used to identify human voices. The android software analyses and transforms this voice into English phrases. Speech reputation is a multidisciplinary topic of computational linguistics that studies approaches and tools for computer-assisted recognition and translation of spoken language into text. It is also known as computerised speech popularity (ASR) or speech-to-text content (STT). It includes knowledge and study from languages, computer technology, and electrical engineering domains. Speech recognition has a long history, with several waves of main innovations. Most recently, the field has profited from improvements in deep learning and huge statistics. The gains are proven not only by the surge of instructional papers issued in the domain, but also by the global enterprise adoption of a variety of deep learning methodologies in creating and deploying voice recognition systems.

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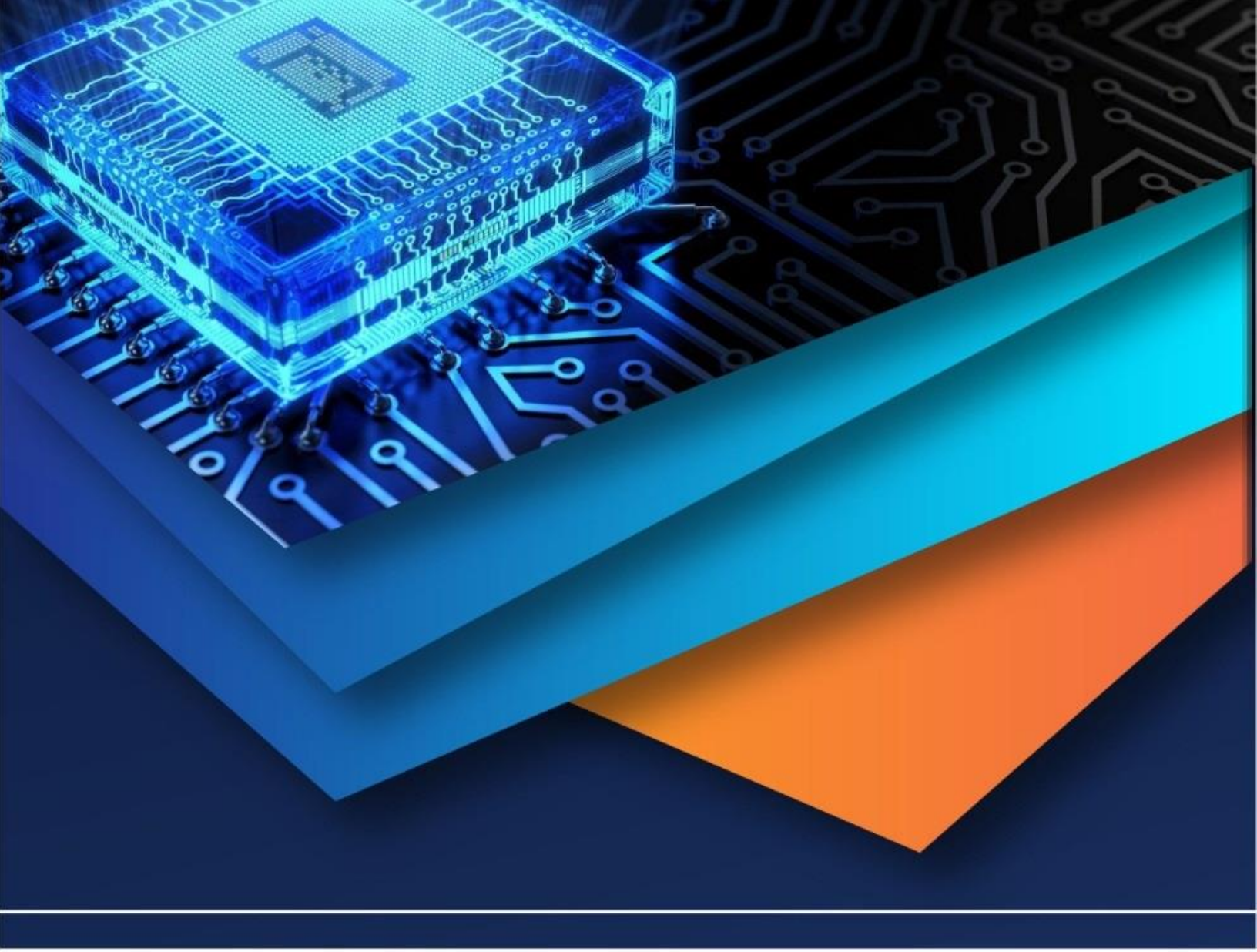

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