IJARETY

International Journal of Advanced Research in Education and TechnologY (IJARETY)

Volume 11, Issue 3, May-June 2024

Impact Factor: 7.394

www.ijarety.in editor.ijarety@gmail.com

International Journal of Advanced Research in Education and TechnologY(IJARETY)

| ISSN: 2394-2975 | www.ijarety.in| | Impact Factor: 7.394| A Bi-Monthly, Double-Blind Peer Reviewed & Referred Journal |

|| Volume 11, Issue 3, May-June 2024 ||

DOI:10.15680/IJARETY.2024.1103051

Development of Arduino based Voice Controlled Car with Obstacle Detection

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ABSTRACT: This paper proposes a design variant of obstacle avoidance and voice control for the automobile's car unit. The future advancement in this technology will help us in for the handicapped ones who cannot drive the vehicle on their own, transportation purposes, hazardous environment places where human interaction might be impossible and so on. Also, the use of sensors will provide greater safety from sudden hits. A Bluetooth module is used to create a communication link between the car and human voice commands via Android Application. The RF transmitter of the module can take human voice commands through the application which will then be converted into encoded digital data up to an adequate range of 100 meters from the robot. The receiver of the module decodes the input data before feeding it to the microcontroller to drive DC motors via motor driver L298D for necessary movements. An Arduino UNO which is the brain of our system is programmed to read voice commands and respond accordingly. Obstacle detection can be done by ultrasonic sensors interfaced with the Arduino UNO. Considering this feature, in the future it might prove a milestone in vehicle automation. Further the project can be developed using the Internet of Things, Artificial Intelligence technology where a user can control the car from any corner of the world.

KEYWORDS: Obstacle detection, Voice command, Ultrasonic Sensors, Bluetooth module, Motor Driver, Infrared sensor, Arduino UNO

I. INTRODUCTION

The combination of major fields such as mechanical, electrical and electronics provides automation systems which are known as Robots. The growths in these industries are a major reason for the efficiencies in every sector by reducing the human effort and interaction [1]. By doing such, this promises us a safer environment in dangerous and insightful grounds. Due to its precision and absolute accuracy it has made a major presence in all the essential fields whether it is education, bio-medicals, engineering and so on.

A. Obstacle avoidance

To achieve the obstacle avoidance in the system we are using an Ultrasonic distance sensor which is connected to the L298D motor shield followed by Arduino UNO. This sensor is used to detect any object at some certain distance using sonar. This noncontact ultrasound sonar is used to measure the distance between the object and the sensor. It consists of two transmitters, a control circuit and a receiver for emitting and receiving pulse data respectively. A high ultrasonic sound is emitted by transmitters which will get reflected by any nearby object and the sensor will see toward to get any return echo. The distance for object detection can be subsequently changed by our own means in the coding algorithm. The distance will get calculated of the transmitted signal and receive echo in the control system.

B. Speech recognition

The ability of the machine to receive and interpret the human voice or to understand and carry out spoken commands can be concluded as speech recognition. It works on the basis of algorithms codes that match the sound of the detected speech or voice with word sequences and interpret it as a command in Arduino IDE which is a coding platform for Arduino UNO. With the help of these we can command around our system as per the desired needs.

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II. LITERATURE REVIEW

Yasir Ali menon et al. (2016) present a system for driving a robotic vehicle with connected speech input.
The basis for the speech recognizer will be an Android smartphone that communicates with the robot through Bluetooth. This approach permits efficient data recognition and transfer. In addition, the robot will be capable of detecting barriers and alerting the operator to issue a different command. Our proposed method will be useful for applications such as robots that assist individuals with disabilities and industrial applications such as robots that perform manual tasks [1].

Subankar Roy et al. (2016) suggest the design of a new inverted ROBOT that can be controlled through an Android application.
The interface Arduino UNO and Android using Bluetooth communication. UART can be used to interface Arduino with Bluetooth modules. The robot's movements can be controlled based on commands received from android. A robotic system's output consistency, quality, and repeatability are unparalleled. This robots are programmable and interchangeable, allowing for different uses [2].

Abdul Naim Khan et al. (2018) concentrated on the technique of speech recognition through speech-to-text conversion.
Using this technology, it was previously impossible to control our machines with voice commands. Therefore, this study provides an analysis and implementation to aid disabled individuals who are unable to drive their own vehicle. In the future, people will drive their own vehicle with enhanced protection against hit-and-run incidents due to the automatic braking or slowing down feature. An Arduino interfaced with a Bluetooth module will serve as the communication channel with the device via which voice commands will be issued. Arduino-programmed electronics will provide control over the motors used to propel the robotic vehicle. Ultrasonic sensors interfaced with Arduino aid in the automatic slowing or stopping of a vehicle upon detection of a sudden barrier, and after a pause, aid in the vehicle's avoidance of the obstacle [3].

Brahmandaberi Saketh et al. (2022) offer a robotic vehicle designed to receive the user's voice command and carry out the specified user task without the presence of a human operator in a certain area.
Voice commands can be used to control the robot, which requires an Android app to communicate through Bluetooth HC-05 module. Consequently, the robotic vehicle is equipped with an Ultrasonic sensor module to detect objects. The robotic vehicle's motors will be controlled by a customized Arduino as part of its hardware. Ultrasonic sensors connect with Arduino to assist in the autonomous braking of a vehicle upon recognition of an unexpected obstruction. Currently, obstacle avoidance robots are utilized in hazardous environments where humans cannot enter. It can recognize the voice with ease[4].

Pawal.k.l et al. (2022) created a robot that responds to voice commands. For essential duties, an Android application with a microcontroller is utilized.
Bluetooth technology is used to facilitate the connection between the Android app and the automobile. The robot is operated via the application's buttons or by the user's voice. Two dc servo motors linked to the microcontroller on the robot's receiver side help its movement. The Bluetooth RF transmitter converts the application's orders into digital signals for transmission to the robot over a suitable distance (about 100 meters). At the receiving end, the data is decoded by the receiver and sent to the microcontroller, which then drives the DC motors to do the required tasks. The objective of the Voice-Controlled Robotic Vehicle is to do the required task by listening to the user's orders. A prior session of preparation is required for the user to operate the robot efficiently. For this purpose, a code is utilized to direct the controller [9].

III. METHODOLOGY

As show in the diagram, two rechargeable batteries as the power supply is used that is connected to motor driver and Arduino respectively. When the circuit is energized, first we will have to pair the android phone with the Bluetooth module through the mobile's Bluetooth setting the default password of the Bluetooth module will be '1234'. Once the phone gets paired open the application 'CAR BLUETOOTH RC' which we can download from Google play store. After opening the application there will be set of control displayed on the screen. If the device has not been connected the control will be locked meaning the control

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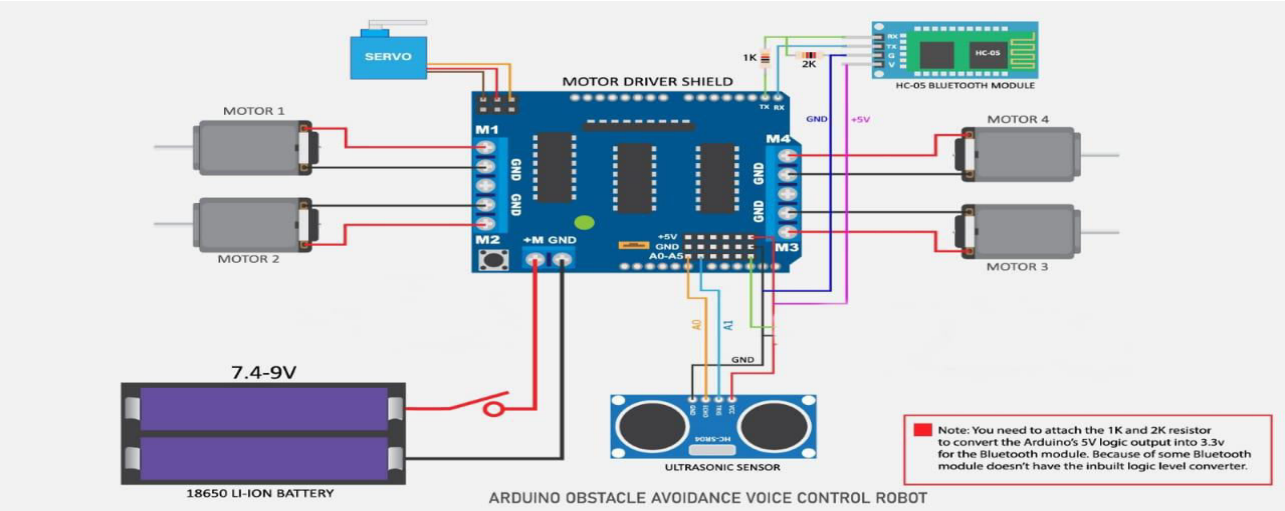

buttons cannot be pressed. When the car is at its initial position the application automatically sends the command S meaning stop. The stop command is put in a loop that keeps on repeating throughout the execution of the program. As the user presses any control buttons the stop command will be interrupted by the move forward, backward, right, left, depending on the user and the car moves like wise. The program is designed in such a manner that we can also give multiple commands at the same time i.e. move front and turn right or left and same with the backward motion. The Arduino also stores the program in its memory so it does not require reuploading of Program. The IN1, IN2, IN3 and IN4 are the inputs for the motor driver that receives command from the Arduino for the two motors respectively. The motor driver should be grounded with the Arduino ground pin (GND). The motor driver will require minimum of 6v and above to run, any voltage below 6v the motor remains off. The RXD pin of the Bluetooth module is for receiving commands from the Android devices and sends to Arduino through this pin and the TXD is for transmitting or sending dates or information. It is supplied with a 5v dc source from the Arduino 5v pin. The main part of the above circuit diagram is Arduino UNO. The power supply section is very important. It should provide constant voltage to the devices for successful working of the project.

IV. RESULTS AND DISCUSSION

When the car gets power from 9v lithium-ion battery supply, the Arduino Uno gets booted up, and the car starts, after this driver gives command to the car via Arduino Bluetooth App. The commands of the driver are, “Move Forward”, “Move backwards”, “turn left” and “turn right.” After that, the car senses the obstacle in front/back via sensors (ultrasonic sensor, IR sensor) it stops. Then the car waits for the next given by the driver depending upon the command Car will move accordingly.

ALGORITHM

A. Voice Control Robot Car Detection

Start

Step 1: Attach the robotic car's Bluetooth module (HC-05) to the Android application.

Step 2: Once the robotic car and mobile device are paired, send voice and text commands through the Android application.

Step 3: Voice commands are turned into text by the phone's processor, and the application uses Google's speech recognition software to turn speech into text.

Step 4 HC-05 will automatically transmit it serially to the Arduino UNO.

Step 5: The Arduino Uno will perform actions on the DC motors. Step 6: When the text matches a certain pattern, Arduino directs the robotic car to move forward, backward, right, or left. Stop

B. Obstacle Detection

Start

Step1: Attach the robotic car, HC-05 to the Android Application.

Step 2: Once the robotic car and mobile device are paired, send text commands through the mobile phone.

Step 3: Data characters read from the Android application.

Step 4: HC-05 transmit text message to the Arduino UNO using UART serial communication protocol.

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Step 5: The Arduino UNO will perform actions on the DC motors.
Step 6: Robotic Car detect the obstacles using ultrasonic Sensor. Stop

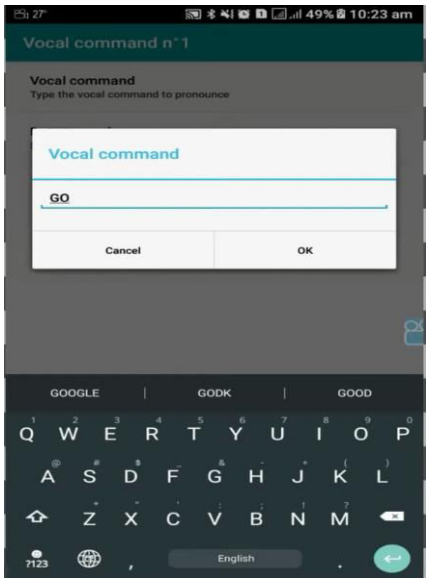
SOFTWARE APPLICATION

The application in which users provide commands from an android phone via a voice application. A Google Voice Search programme includes a library of English words that provides command to a set of characters to send to the recipient and monitors details and detects distant objects when it receives the command. The Android app allows users to connect to HC-05 through Bluetooth and send Arduino signals to successfully execute required function.

RESULT

Therefore, our voice-controlled obstacle-avoiding car prevents the car from collisions and is aware of its surroundings. It also finds obstacles and makes movements according to the user voice command. Our car is accurate because the Bluetooth module is us ed for communication and works best between short ranges as the robot can travel in two seconds when input is provided. We have used an ultrasonic sensor and an IR sensor for its advantage. The ultrasonic sensor does not react to light, smoke, dust, mist, etc., so we have used it on the front side of the robot whereas we have used an IR sensor on the rear side of the robot. IR sensor helps to detect the obstacle on the rear side hence, helping the car to avoid collision. Voice command is used for detection advanced communication with the car using the android app. Therefore, a good performance is available for this project.

OUTPUT



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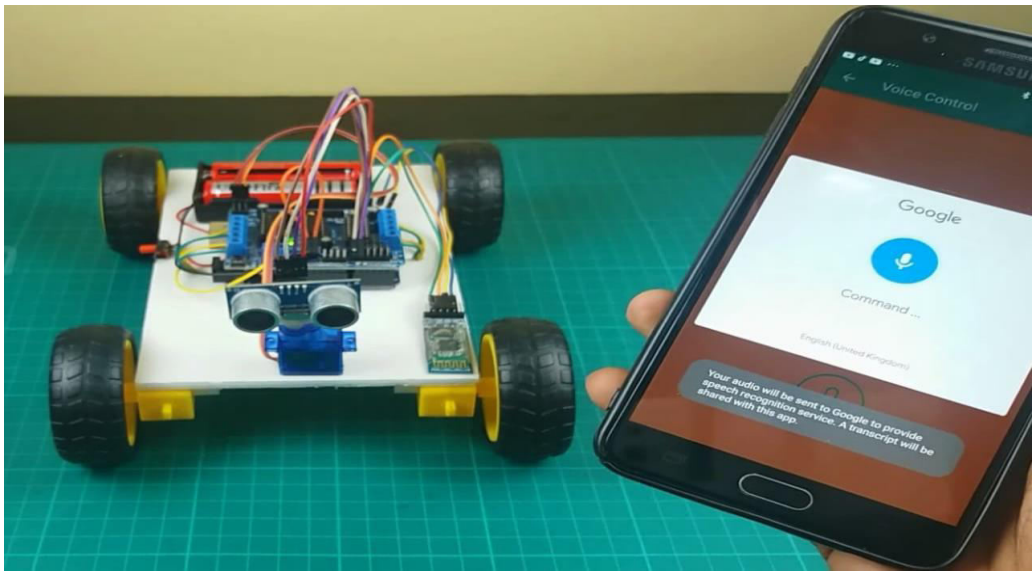

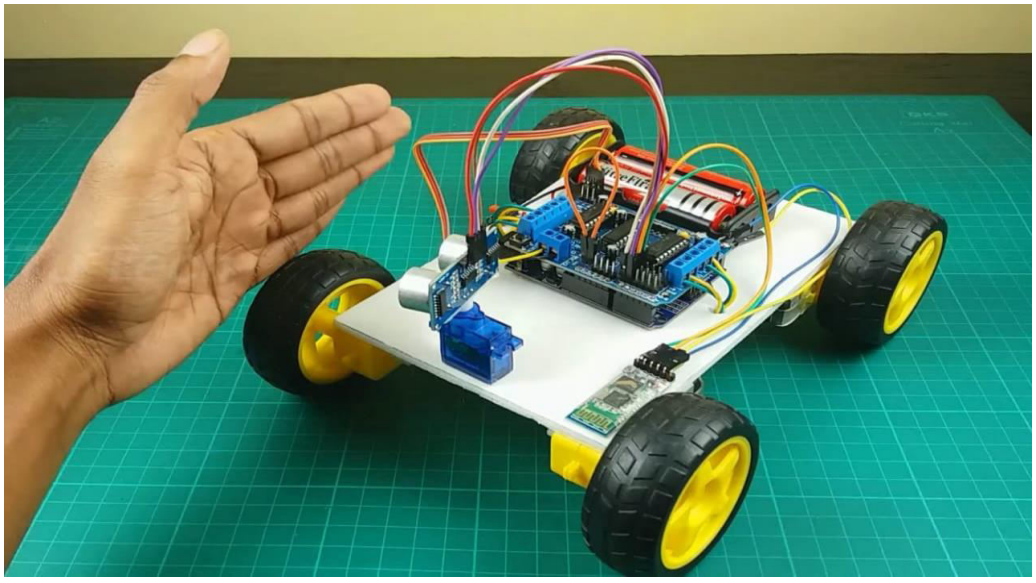

V. CONCLUSION

Voice-controlled robots are very useful for environments where humans are at greater risk of death. This system decreases human effort and allows for quicker travel to areas where it is risky or unsafe for humans to go .This device is connected via voice commands received by android. An integrated Bluetooth module is used to receive and read commands. The robotic car can move according to commands given via android. A controlling device can be any smart phone having an Android OS. The Android OS uses an android application to transmit the data. The robotic car controls it by executing the user's commands. The Arduino sends commands to moves the robotic car in right, left, forward and backward directions. The Arduino software moves the motor according to commands sent from the mobile device. Obstacles are detected with an ultrasonic sensor

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| ISSN: 2394-2975 | www.ijarety.in| | Impact Factor: 7.394| A Bi-Monthly, Double-Blind Peer Reviewed & Referred Journal |

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International Journal of Advanced Research in Education and Technology

ISSN: 2394-2975 **Impact Factor: 7.394**

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