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Voice Controlled with Obstacle Avoiding Robotic Vehicle

Guided By

[1]D.U.Chavan , [2]A.S.Mali,

[1]Assistant professor at TKIET, [2] Assistant professor at TKIET

Students

[1]Miss. Pallavi Gaikwad, [2]Miss.Aditi Jamdade, [3]Miss.Sanika Kumbhar

[1]Student at TKIET, [2]Student at TKIET, [3]Student at TKIET

[1]Electronics and Telecommunication,

[1]Tatyasaheb Kore Institute of Engineering and Technology, City, Country

Abstract: This project describes about a robotic vehicle which can be controlled by human voice as well as this robotic vehicle can be able to avoid obstacle which come across his way. Bluetooth module is attached to provide human command. These commands are send through human mobile device which is connected to Bluetooth module attached to robotic vehicle. This robotic vehicle follows the command and changes its direction by moving wheels. Ultrasonic sensor is used in this robotic vehicle which helps to detect obstacle. Once it detects obstacle, it changes its path towards obstacle free environment. This vehicle is used to reduce collision as well as to reduce human efforts by automatic operating system.

KEYWORDS: Obstacle avoiding, Voice Controlled, Robotic vehicle.

I. INTRODUCTION

The combination of various engineering fields such as mechanical, electrical and electronics provides automation systems which are known as Robots. The growth and development in robotic field are playing essential role in human's life by reducing manual effort and increasing interaction between robots and human. Due to its precision and accuracy in its work it can be used in various fields such as education, chemical, bio-medical and so on.

The controlling device may be any android based Smartphone/tab etc. having an android OS. The android controlling system provides a good interactive GUI that makes it easy for the user to control the vehicle. The transmitter uses an android application required for transmitting the data. The receiver end reads these commands and interprets them into controlling the robotic vehicle .The android device sends commands to move the vehicle in forward, backward, right and left directions. After receiving the commands, the microcontroller then operates the motors order to move the vehicle in four directions. The communication between android device and receiver is sent as serial communication data. The microcontroller program is designed to move the motor through a motor driver IC as per the commands sent by android device.

This Voice controlled robotic device also includes some additional features like Obstacle avoiding which can be done with the help of sensors. An obstacle avoiding robot is a fully autonomous robot which can be able to avoid any obstacle which it faces when it moves. Simply, when it meets an obstacle while it is moving forward, it automatically stops moving forward and makes a step back. Then it looks its two sides left & right and starts to move the best possible way, which means either in left direction if there is another obstacle in right or in right direction if there is another obstacle in left side.

A. Voice control

The ability of the machine to receive human voice and understand it and carry outspoken command can be calculated as voice controlling. Voice controlled robotic vehicle helps to control robot through voice command send via mobile device. This robotic vehicle uses Bluetooth module to receive the command through mobile device and works according to it. We installed one android application in our mobile which helps to provide human voice to Bluetooth module. For these 8051 microcontrollers is integrated in the system which makes it possible to operate the vehicle through android application. Voice controlled feature of robotic vehicle helps specifically for blind people to perform their daily work.

B. Obstacle avoidance

This robotic vehicle has one more feature which plays an important role to reduce collision that is obstacle avoiding. It uses ultrasonic sensor to detect the obstacle and changes its path according to it. Ultrasonic sensor is connected to the L293D motor shield followed by Arduino UNO. It detects the obstacle at the distance 15cm away from the vehicle. This distance is defined in software program, we can change it later also. The distance will get calculated of the transmitted signal and receive echo in the control system. This vehicle moves in four direction that is forward, backward, right and left.

II. LITERATURE REVIEW

The main purpose of this research is developing the essential robotic vehicle which has the functionalities such as voice controlling and obstacle avoiding. Utilization of Bluetooth module helps to receive command from android application given by human. This helps to run robotic vehicle according to given command. The RF transmitter of the Bluetooth module can take human voice orders. These orders can be taken 100 meters away from the vehicle. An Arduino UNO is modified to connect software program to hardware. Whatever instructions written in software program that are transferred to motors which are connected to vehicle. L293D motor driver is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take low current control signal and provide a higher current signal. These higher signals are used to drive motors. After receiving command from Bluetooth module, motors will be operated to move forward, backward, left and right. Lithium-ion battery cells are attached which provide power supply of 3 to 7 volt. Utilization of Ultrasonic sensor helps to detect obstacle.

III. WORKING PRINCIPLE

The robotic vehicle uses ultrasonic sensor to detect obstacle and Bluetooth module to receive human voice.

1. BLUETOOTH MODULE: The Bluetooth module allows communication between the robot and a smartphone or another device for sending commands wirelessly.
2. L293D MOTOR DRIVER SHIELD: This shield controls the motors of the robotic vehicle based on the commands received from the Arduino.
3. ULTRASONIC SENSOR: These sensors detect obstacles by sending and receiving ultrasonic waves to calculate distances.
4. ARDUINO BOARD: The Arduino processes data from the ultrasonic sensors and Bluetooth module to make decisions for the robot's movement.
5. WHEELS AND MOTORS: These components physically move the robot based on the commands processed by the Arduino.
6. POWER SUPPLY: Provides the necessary power for all the components to function.

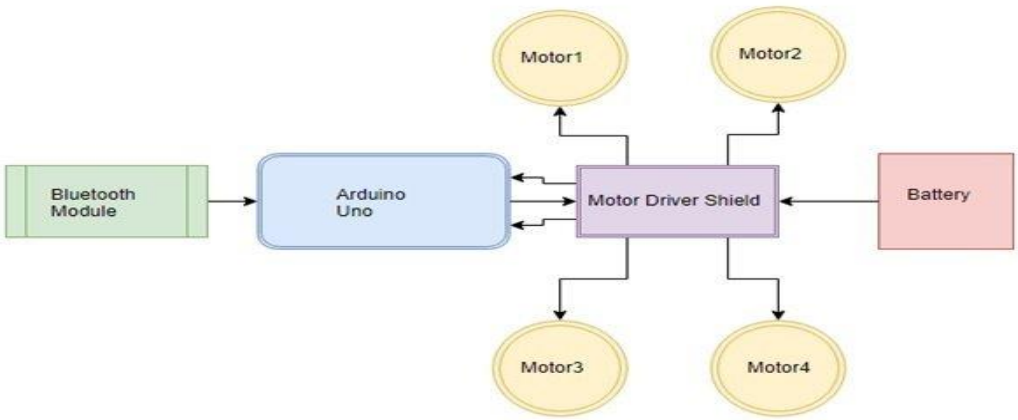

Fig. Block Diagram

The ultrasonic sensors detect obstacles, and the Arduino processes this information to navigate the robot around obstacles. The Bluetooth module allows you to wirelessly send commands to the robot from a smartphone or another device. The L293D motor driver shield controls the motors based on the commands received, enabling the robot to move as directed. By combining these components and their functions, the robot can be controlled wirelessly via Bluetooth, avoid obstacles using the ultrasonic sensors, and move accordingly using the motor driver shield.

IV. METHODOLOGY

The methodology typically involves combination of hardware and software components. Here's a basic overview of the methodology for both voice-controlled and obstacle-avoiding robots.

1. VOICE-CONTROLLED ROBOT METHODOLOGY:

Hardware: It includes microcontroller or a single-board computer like Arduino to control the robot. Additionally, it involves Bluetooth module to capture voice commands.

Software: The software side involves programming the microcontroller to recognize specific voice commands. This can be done using libraries like EasyVR for Arduino or using speech recognition APIs like Google Speech Recognition.

Integration: The software processes the voice input, interprets the command, and translates it into actions for the robot to execute, such as moving forward, turning, or stopping.

2. OBSTACLE-AVOIDING ROBOT METHODOLOGY:

Hardware: An obstacle-avoiding robot typically uses ultrasonic sensors to detect obstacles in its path. These sensors send out ultrasonic waves and measure the time it takes for the waves to bounce back, calculating the distance to objects.

Software: The software part involves programming the microcontroller to read data from the sensors, interpret the distance measurements, and make decisions based on that information to avoid obstacles.

Control Logic: The robot's control logic will determine how the robot reacts to obstacles. For example, if an obstacle is detected within a certain range, the robot might stop, back up, and then turn to avoid the obstacle.

Combining this methodology, created a robot that responds to voice commands and navigates around obstacles effectively.

V. MATERIALS

1. ARDUINO UNO: Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards can read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.

Fig. Arduino UNO board

2. BLUETOOTH MODULE: Bluetooth module is a PCBA board which integrated Bluetooth functions. Bluetooth module can be used in short-distance wireless communication, which can be divided into the Bluetooth module and Bluetooth voice module according to its usage.

Fig. Bluetooth Module

3. ULTRASONIC SENSOR: An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity.

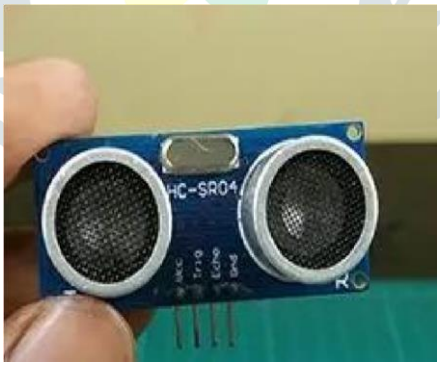

Fig. Ultrasonic Sensor

4. L293D MOTOR DRIEVER: L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. L293D contains two inbuilt H-bridge driver circuits.

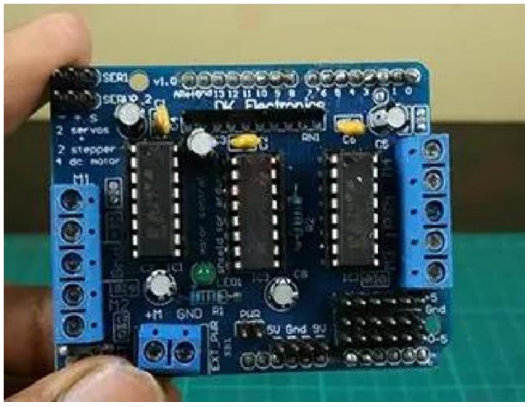

Fig. L293D Motor Driver Shield

5. SERVO MOTOR: The position sensor provides a feedback signal corresponding to the present position of the load. This sensor is normally a potentiometer that produces the voltage corresponding to the absolute angle of the motor shaft through gear mechanism.

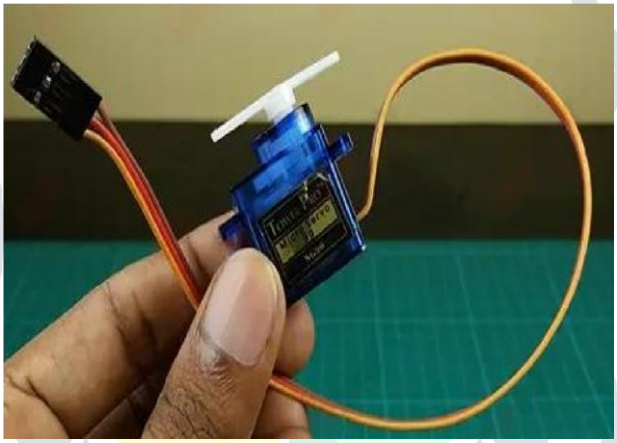

Fig. Servo Motor

6. GEAR MOTOR: A gear motor is a motor designed with an integrated gearbox. Gear motors function as torque multipliers and speed reducers thus requiring less power to move a given load. The design of the gearbox structure, type of gears, lubrication and type of coupling affects its performance.

Fig. Gear Motor

VI. CIRCUIT DIAGRAM

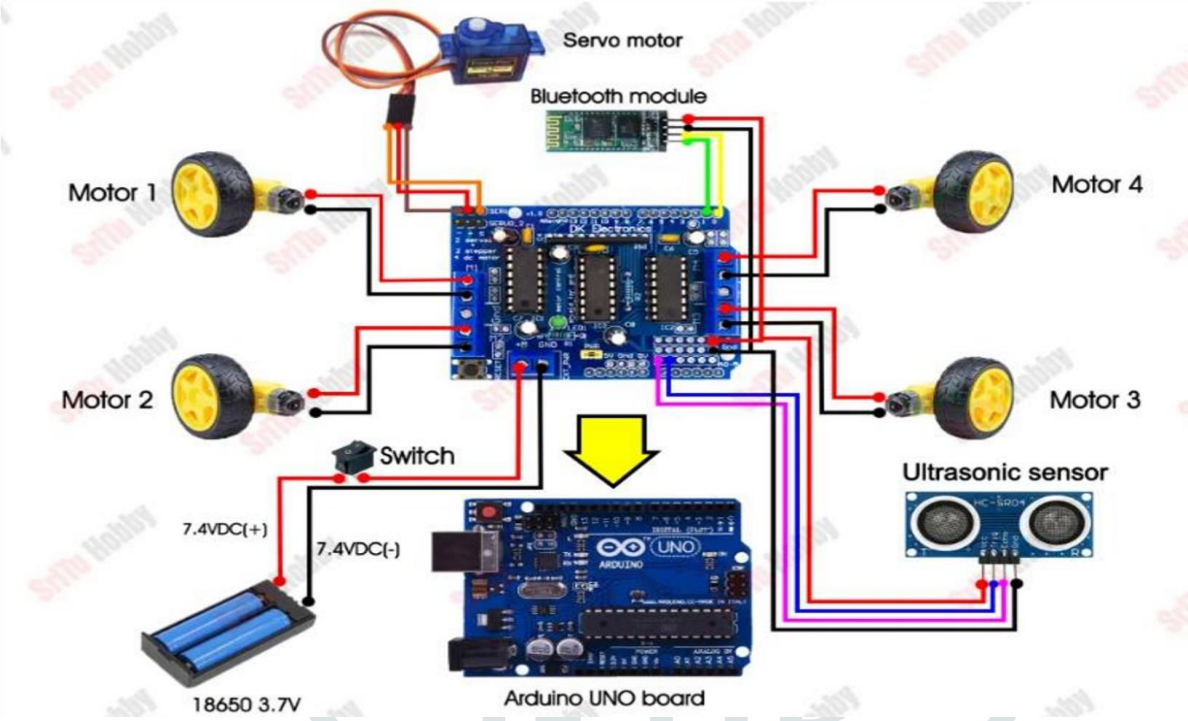

Fig. Circuit diagram of Voice controlled robotic vehicle.

VII. ADVANTAGES

1. Commands are more efficient than typing it, so in today's advanced world voice commands play a crucial role for making tasks easy.
2. Companies are implementing this type of robotic vehicle to increase work efficiency and enhance human and robot interaction.
3. The most essential role it may have is in the workplace where it can provide support and assistance to task-management duties. Amazon's Alexa can be used for managing and setting up conference calls as well as scheduling meetings and setting up reminders – this enables a company to streamline the process for everyone – which boosts productivity and efficiency levels.

VIII. APPLICATION

1. For daily use in houses this robotic vehicle helps human to reduce their work and brings efficiency.
2. In various industries such as chemical, bio-medical, military etc. Robotic vehicle plays an important role
3. In hospitals as an assistant this robotic vehicle can be used in surgical operations.
4. For blind people it helps to do their work by sending human command.

IX. CONCLUSION

Our voice-controlled and obstacle-avoiding robotic vehicle project has shown promising results in navigating environments while reducing manual effort and avoiding obstacles. Through sensor and Bluetooth module integration, the vehicle demonstrated effective voice control and obstacle avoidance capabilities. Challenges remain, including sensor limitations and environmental complexities, but future research can address these. Overall, our project highlights the potential of voice and obstacle-controlled vehicles in autonomous systems, paving the way for advancements in various industries.

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