Voice Controlled Car

Review Report

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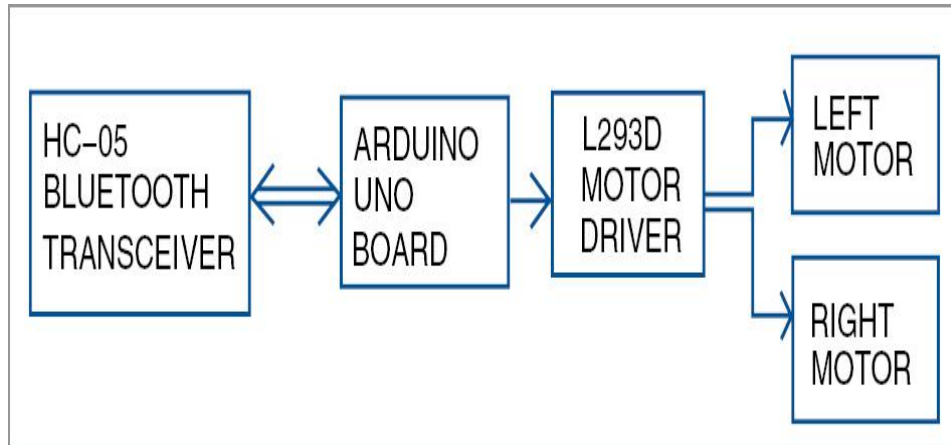
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Abstract

The paper is designed to control a robotic vehicle by voice commands for remote operation. An ARM series microcontroller is used together with an Android Application for the desired operation. The Android Application is connected to the Bluetooth module (HC-05) present on the Robot via Bluetooth. The commands are sent to the robot using push buttons or voice commands present on the android application. At the receiving end two dc servo motors are interfaced to the microcontroller where they are used for the movement of the vehicle. The RF transmitter of the Bluetooth can take either switch press or voice commands which are converted to encoded digital data for the advantage of adequate range (up to 100 meters) from the robot. The receiver decodes the data before feeding it to another microcontroller to drive DC motors via motor driver IC for necessary work. This technology has an advantage over long communication range as compared to RF technology. Further the project can be developed using IoT technology where a user can control the robot from any corner of the world.

Introduction

This project banks on two major concepts namely robotics and voice recognition technology. Robotics as a discipline has seen unparalleled development since the early 1960s. It finds application in industries, manufacturing, bio engineering, space exploration and recreational activities like drones. Whereas speech recognition technology has also seen rapid development in the recent time. Models which might require 'training' to better adapt to the voice of the user resulting in increased accuracy. While those which do not require training are called speaker independent system. The voice commands can be a fixed set of commands (as in this project) while more advanced ones come with natural speech recognition which can process complete sentences or phrases in multiple languages and accent of the speaker.

 Like any other robotic application this project also has three major dimensions –
(a) Mechanical Construction
(b) Electrical Circuitry
(c) Computer Programme.

 The mechanical construction of the project involves the frame of the vehicle and two DC motors which drive the vehicle. The electronic circuitry comprises of the Bluetooth module which facilitates the communication, Arduino Uno which interfaces with the motor driver also a part of the circuitry. The third is the computer programme written in IDE (Arduino) which acts the driver code for the vehicle. The driver code is installed on the arduino which process the command received, interacts accordingly with the motor driver which makes the vehicle move.

Proposed System

This project use an android smartphone as the transmitter to which commands are fed. Speech to text conversion takes place at this level using Google Speech to Text package available on the android device itself. The smartphone communicates with the vehicle with HC-05 bluetooth module which acts as an interface between the two. The HC-05 receives the signal and transmits it further to the arduino uno which is micro-controller based board which further process the signal and using the driver code fed to it commands the motor controller accordingly which in turn drives the vehicle using the two DC motors on each wheel providing the mechanical energy needed to do so.

The following steps are involved:

1. Start.

2. Establish connection between the smartphone and the vehicle.

3. Check if connection established.

4. If connection established, user will speak the predefined commands into the microphone of the smartphone.

5. Speech to Text conversion occurs and is further relayed.

6. Command is transmitted to the Bluetooth module.

7. It is further communicated with the Arduino Uno which further processes the command.

8. Arduino Uno commands the Motor Controller IC accordingly.

9. The Motor Controller in turn runs the two DC motors and vehicle executes the command as per user's desire.

10. Stop.

Existing System

Previously a many projects have ventured into the realm of vehicle which communicates with its operator using voice in one way or the other. These projects function around the basic tenet of voice recognition or speech to text, the difference arises in the implementation vis-a-vis driving code, sensor or mechanical part used. Some also include additional features like obstacle detection, conformation on receiving command, automatic breaking and speed limiting system. The purpose is to make innovation in the field of vehicle automation so that it caters to multi-dimensional requirements from critical applications space exploration and military use to humanitarian innovation to help those with disabilities to drive themselves. Some the projects might require 'training' to better adapt to the voice of the user resulting in increased accuracy. While those which do not require training are called speaker independent system. The voice commands can be a fixed set of commands (as in this project) while more advanced ones come with natural speech recognition which can process complete sentences or phrases in multiple languages and accent of the speaker.

The following project might be considered for further reading:

[1] A.N Khan, K. Priya, S. Kumar-"Implementation of Voice Controlled Robotic Vehicle with Automatic Braking and Obstacle Avoidance". In INROADS Vol. 7 (Special Issue), 2018

[2] Prof. B. Jolad, M. Arora, R. Ganu, C. Bhatia -"Voice Controlled Robotic Vehicle". In IRJET Volume: 04 Issue: 06, June-2017

[3] Dr. M. Narayana, A. Alishety, H. Chapala -"Voice Controlled Robot using Android Application". In International Journal of Engineering Innovation and Research Volume: 04 Issue: 02

Implementation

The setup that we are going to use in this project is as follows:

User speaks the predefined commands into the microphone of the android smartphone or he may use buttons on the application BT VOICE CONTROL FOR ARDUINO. Then Google Speech to Text conversion is done and the smartphone relays the command to the HC-05 trans-receiver Bluetooth module A driver code is fed into the arduino microcontroller to which the incoming commands are processed and entered into. After processing of the command the arduino uno microcontroller commands the motor driver according to the user's request. The motor driver which can control the direction and speed of two DC motors runs the Dc motors accordingly, thus the vehicle executes the command received from the user via the smartphone.

The following table shows the predefined commands that the user can give to the voice controlled Bluetooth vehicle:

TABLE I
FUNCTIONS OF DIFFERENT VOICE COMMAND

| Voice command	Function
Forward	• Robotic car moves forward
Backward	• Robotic car moves backward
Right	• If previous command was forward, the car turns right and continues to move forward • If previous command was backward, the car turns right in backward direction and continues to move backward
Left	• If previous command was forward, the car turns left and continues to move forward • If previous command was backward, the car turns left in backward direction and continues to move backward
Stop	• Robotic car stops moving

Materials:

- **Arduino Uno:** The Uno is a micro-controller board based on the ATmega328P. It has 14 digital input/output pins (of which 6can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the micro-controller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The ATmega328 has 32 KB(with 0.5 KB occupied by the boot loader). It also has 2 KB of SRAM and 1 KB of EEPROM.

- **DC Motors:** A DC motor is an electric motor that runs on direct current (DC) electricity. Modern DC motors are nearly always operated in conjunction with power electronic devices. 300 RPM Side Shaft Heavy Duty DC Gear Motor is suitable for large robots / automation systems. It has sturdy construction with gear box built to handle stall torque produced by the motor. Drive shaft is supported from both sides with metal bushes. Motor runs smoothly from 4V to 12V and gives 300 RPM at 12V. Motor has 8mm diameter, 17.5mm length drive shaft with D shape for excellent coupling.

- **L293N motor drivers:** This device is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays solenoids, DC and stepping motors) and switching power transistors. Each pair of channels is equipped with an enable input. A separate supply input is provided for the logic, allowing operation at a lower voltage and internal clamp diodes are included. This device is suitable for use in switching applications at frequencies up to 5 kHz. The Motor Shield is able to drive 2 servo motors, and has 8 half-bridge outputs for 2 stepper motors or 4 full H-bridge motor outputs or 8 half-bridge drivers, or a combination.The servo motors use the +5V of the Arduino board. The voltage regulator on the Arduino board could get hot. To avoid this, the newer Motor Shields have connection points for a separate +5V for the servo motors.

- **HC-05 Bluetooth Module:** It is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration. Bluetooth serial modules allow all serial enabled devices to communicate with each other using Bluetooth. It has six pins and two modes - Data Mode & Command Mode.

- **Arduino IDE:** The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them. A program written with the IDE for Arduino is called a "sketch" .

Result
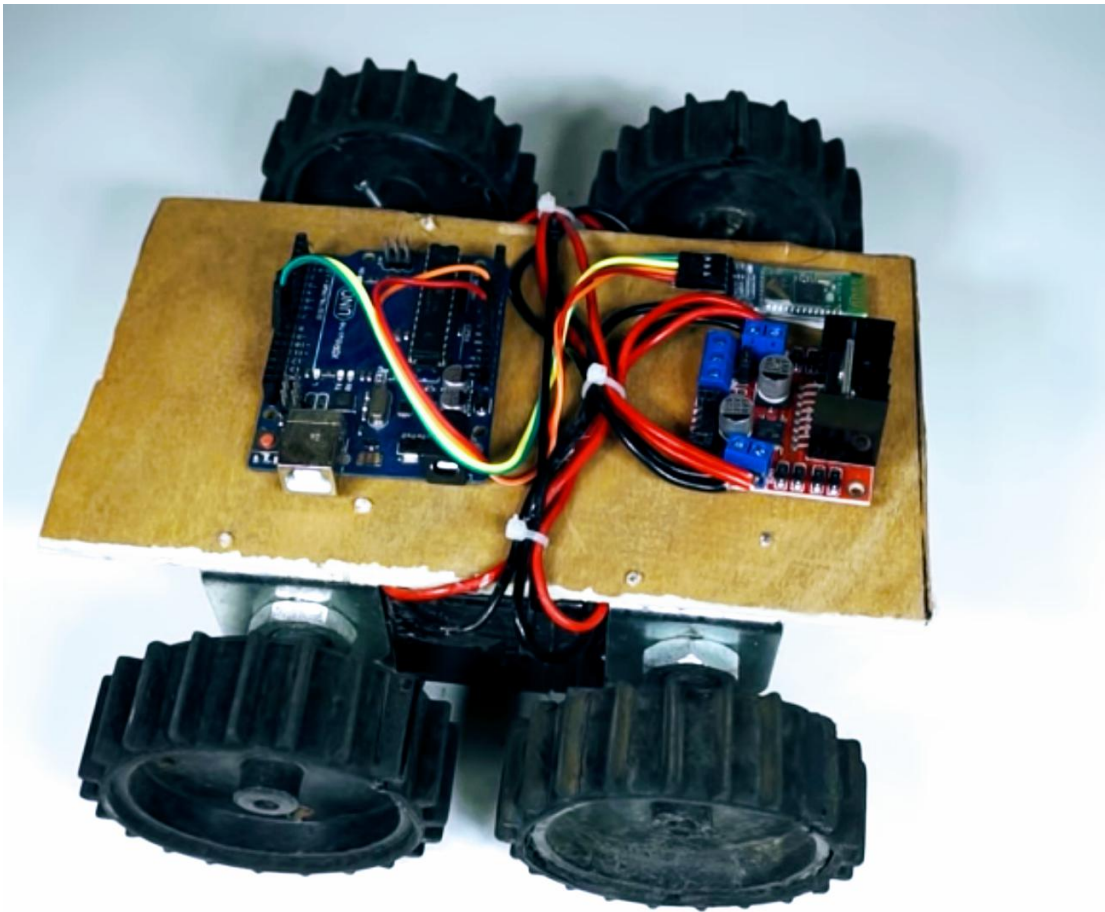
This project presents a simple robotic vehicle which can be controlled using the voice commands over a distance of up to 100m. This allows the user to be able to manipulate the movement of the vehicle wirelessly while maintaining proper distance from the vehicle itself. The vehicle do not require to be trained to adapt to the user's voice and can be operated easily over longer range compared to RF based remote controlled vehicles.

Conclusion

In today's fast moving world driven by globalisation and technological advances smart solution are required to tackle daily life issues. This voice controlled robotic vehicle is a simple demonstration of the fact. With the advent of speech recognition systems we are able to explore new avenue to data sharing and processing. The ability of this project to be controlled from a safe distance allows it to be of potential use in many promising sectors. This simple robot can find applications in various fields like –

• Hands free delivery of essential commodities to high risk areas in cases of catastrophes like COVID 19 outbreak, earthquake or flood.

• Military Operations

• Surveillance

• Recreational Activities

Future Enhancement

This project acts as step towards vehicle automation, which many automotive giants like Tesla are eyeing on. If implemented on a large scale model it can come very handy to people with disabilities to help them drive their own car.

This project can further be improved by incorporating the concepts of following –

- Internet of Things – Will allow the user to control the vehicle from anywhere in the world.
- Machine Learning – Will allow the vehicle to be trained or to learn by itself so that it become truly autonomous and can operate without human intervention of any sorts.

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[3] Android phone controlled robot using Bluetooth by Arpit Sharma, Reetesh Verma, Saurabh Gupta, Sukhdeep kaur bhatia, IJEEE, Vol.7,pp-443-448, Nov- 2014.

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