Research Article

Hand Gesture and Voice Controlled Smart Vehicle

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Abstract

An adaptable human vehicle interface is interaction to the people and robots. Working robots will cooperate to the people makes the work more effortless and uncomplicated. The purpose of robotics in commercial & residential intention has come to be quite essential for executing challenging work into more conveniently simple way. There are a lot of researches working on to enhance the connection between humans and robot. The main objective of the project is to develop a robotic vehicle using Arduino and to controls the vehicle with the help of voice based information. The whole mechanism of the project is based upon the device namely Arduino. The feature of "hand gesture" helps it to move wirelessly depending upon the Radio Frequency, which is placed upon the hand of the user. Another aspect of the present work is, it can recognize the command of the user in other words it is a voice controlled.

Keywords: Voice controlled vehicle; Robotics and voice recognition; Arduino; Motor driver; Modular.

Introduction

Robot one kind of electromechanical device is directed with the help of internal circuitry. Robotics is the new booming field, which will be of great use to society in the coming years. Therefore, beginning from the industry to the education, hospital, transportation, restaurant, and many other sectors, the demand of using robot is increasing day by day [1]. The classical way of controlling robots is out dated. For the bulky nature and the long wires to control a robot has made it less efficient [2]. That is why the movement of the hand is applied in this paper to control a robotic vehicle. So, the robotic vehicle can move just with the help of hand movements only [3]. Furthermore, the control system of the proposed robotic vehicle is designed wirelessly, which makes this system more efficient [4]. So, a person can control the movement of this robotic vehicle in forward, backward, left, and right directions by only using the hand movement. Moreover, live monitoring or surveillance has become another momentous issue in our quotidian life and its demand is increasing rapidly. To satiate that demand, our proposed system can be used to send the robotic vehicle in any directions with a camera connected to it to capture live video footage around it. [5-7]. If human can control machines totally by their voice, gestures and other activities, then interactions will be easier. There are many high technologies which can do these things but still normal people are still far away from that types of technology mainly due to high price of that products. Our objective is to make low cost smart products which can easily be bought.

Propose a system to use an on-board camera to provide surveillance facility from remote places. Furthermore, alternative studies show that wireless live streaming ability of this system makes it applicable to use in hazardous environment [8,9]. This proposed system will offer that wireless live streaming feature so that the user can observe everything from the user end. There are some precarious places or situations, where this system will be more useful rather than sending a human. Furthermore, there are some benefits of using a robotic system compared to human being. For instance, a robot can work tirelessly with high pressure, resistant or even at the dangerous environment [10].

Working operation of the proposed system

The working operation of the proposed design is divided into two parts. One is to control the

gesture of the robotic vehicle in different direction by using the hand movements and another is to voice control of the vehicle [11]. Thus, the components are required to control the gesture of the robotic vehicle are MPU6050 Sensor, Arduino Uno, RF Module, Motor Driver and Gear(Bo) Motors. The proposed system is divided into two parts. One is Transmitter end and another one is Receiver end. The transmitter section consists of one Lily pad Arduino, one 6-

axis MPU6050 and one RF transmitter module. The receiver section consists of one RF receiver module, one motor driver IC, two Gear (Bo) motors with wheels. Here, two separate 12V power supply applied to both the sections. Fig. 1 illustrates the overall working principle of the gesture control of the robotic vehicle where the transmitter end which transmit the signals & the receiver end which receive those signals and move accordingly.
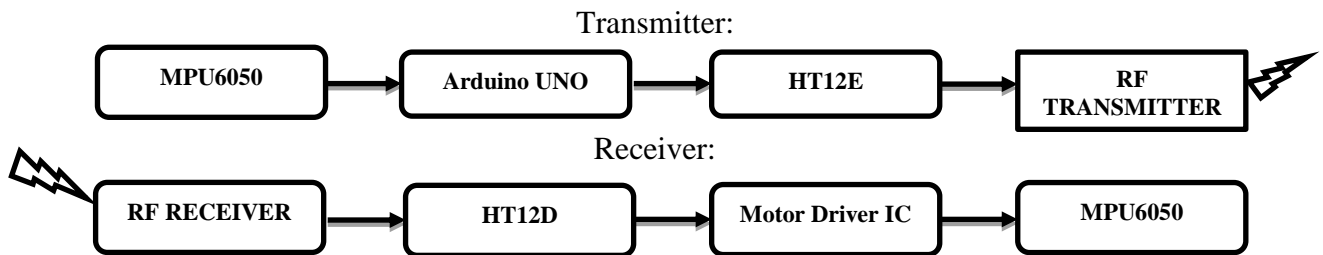
Transmitter:

| MPU6050 | → | Arduino UNO | → | HT12E | → | RF TRANSMITTER |

Receiver:

| RF RECEIVER | → | HT12D | → | Motor Driver IC | → | MPU6050 |

Fig. 1. Block Diagram of the robotic vehicle for gesture control

The transmitter part of the proposed system is placed on the hand of the uses to control the movement of the robotic vehicle in different direction. In the transmitter section, there is an MPU6050 which is connected to a microcontroller called Arduino Uno. This MPU6050 is one kind of sensor that can sense the position of the hand in different axis. MPU6050 is based on MEMS (Micro Electro Mechanical System) sensor, which is used to measure the motion of the objects and angular velocity. The generator commands by using the Lily pad Arduino compared to its pitch and values. At last, the RF transmitter transmits those control commands to the receiver through RF module.

In the receiver section, the control command which is transmitted by the RF transmitter received by the RF receiver. Then the Lily pad Arduino encoded these commands by comparing with programmed value to creates digital signals and output to the motor driver. Finally, the motor driver runs the motors in different directions. The robotic vehicle moves left, right, forward and backward directions. The motor driver circuit is used to control the speed of the motors.

The voice control of the robotic vehicle

The voice controlled robotic system is very beneficial in areas where there is high risk for humans to enter. Voice controlled robotic system is controlled through voice commands via

android device. The integration of control unit with Bluetooth device id achieved using Bluetooth module to capture and read the voice commands. Speech recognition is a technology where the system understands the words not its meaning given through speech. Speech is an ideal method for robotic control and communication. Similarly, the voice control has Arduino Uno that consists of AT mega 328 microcontroller, Bluetooth module HC05. Fig. 2 and 3 illustrates the overall working principle of the voice control of the robotic vehicle in transmitter and receiver end respectively. Table 1 shows the list of components and their specifications used in the system.

The proposed system will be designed based on microcontroller which is connected to smart android phone through Bluetooth module for receiving voice commands. The voice commands are perceived using an android application which converts speech to text. This text is in the form of a string. It is then sent to Arduino via the Bluetooth module. Then the code compares it to the command. The voice commands have become a primary way to interact with devices after the development of devices like Alexa and google home. Through this project, control of the robots becomes handy. A robot which can be controlled using specific voice commands.

Table 1. List of Components and their specifications

| S. No.	Components	Specifications & Parameters
1	BLUETOOTH MODULE	HC-05 module with fully qualified Bluetooth V2.0+ERD (Enhanced Data Rate) 3Mpbs modulation with complete 2.4GHZ radio transceiver and baseband
2	DC POWER SUPPLY	230 volts
3	MPU6050 SENSORS	6-axis motion tracking device. It combines 3-axis Gyroscope, 3-axis Accelerometer and Digital motion processor
4	ULTRASONIC SENSOR	The speed of sound is approximately 341 meter/second in air.
5	AN RF MODULE	Frequency range is 433MHZ
6	L293D MOTOR DRIVER	16pin IC
7	A SERVO MOTOR	3 wires for controlling the rotation and its rotation limited to 180 degrees
8	HT12D AND HT12E	An encoder IC and decoder IC. Both are 12 bits
9	ARDUINO UNO	AT mega328 which has 14 Digital I/O and 6 Analog pins
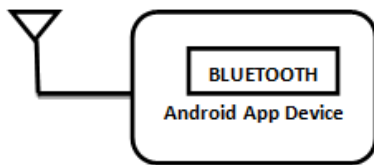
Fig. 2. Block Diagram of Voice control systems of robotic vehicle –Transistor section
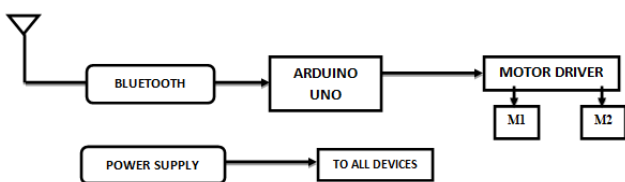
Fig. 3. Block diagram of Voice control systems of robotic vehicle- Receiver Section

Hardware implementation

In this proposed model, six commands are required to control the robotic vehicle in all directions. Those commands are forward, backward, left, right, and stop. To take all those commands, an MPU 6050 has been placed on the hand of the user along with Arduino lily pad which sense the movement of the hand in x and y axis and creates corresponding Analog signals and passes those signals to the Arduino Uno for further processing. In the next step, the Arduino lily pad transmits this processed command to the receiver end by using RFmodule. The fig. 4 gives Arduino Uno is connected with the MPU6050 and RF module. Similarly, the movement of the hand with the transmitter end to generate necessary commands.

One of the most important characteristics is used in interaction between people and robots. The fig. 5 states the motions and voice remotely controlled robotic vehicle. This is generally done by incorporating an MPU6050 sensor to control the robotic vehicle wirelessly.
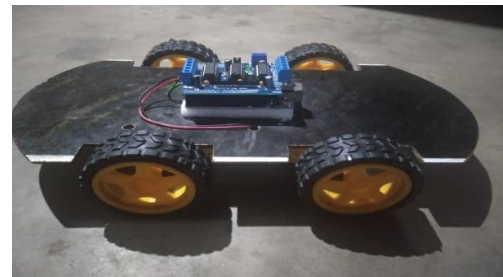
Fig. 4. Image of robotic control vehicle with MPU6050 Controller – Top view

Fig. 5. Image of robotic control vehicle with MPU6050 Controller – Side View

Embedded programming implementation

The program is written in Arduino Integrated Development Environment (IDE). Here, the version used is 1.6.1. The software based on C programming supplied from vendor. An Android software is create that gets voice command information and transform into text

content utilizing Google speech recognition technology [1]. The Android software using speech to text technology to convert voice command into text and then the text is sent to the Arduino Uno. The proper communication with computer and Arduino Uno boards there is a need to select COM port. Arduino Uno is programmed to receive a command via Bluetooth and according to the command; it is move forward, back, left, right, stop and rotate [12].

Conclusions

Robotic vehicles can be controlled from the distance of maximum 1500m outdoor. In this paper, an automated robot has been developed which works according to your hand gesture and voice control. The robot moves wirelessly according to palm gesture and voice. The RF module is working on the frequency of 433 MHz. GPS system can added to the robot by help of which its location can be tracked. The project is not that much costly. It will help us in reduce human load and it has ability to work in any environment.

Conflict of interest

The authors declare no conflict of interests.

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