International Journal of Modern Computation, Information and Communication Technology
2020;3(2):24-29.
ISSN: 2581-5954
http://ijmcict.gjpublications.com

Research Article

Smart Voice and Gesture Control Vehicle by using Arduino

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Abstract

An adaptable human vehicle interface with 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. A fixed number of specific commands to the vehicle. During driving the vehicle nor gesture commands of a person is entered as input to the vehicle.

Keywords: Arduino UNO; Lily pad Arduino; MPU6050; Motor shield; Bluetooth.

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 The classical way of controlling robots is outdated. 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. Authors in [5-7].

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 principle of the proposed system

Working principle of the gesture control of the robotic veicle

The working principle 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. 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. Which is again mainly divided into

Received: 28.01.2020; Received after Revision: 25.02.2020; Accepted: 26.02.2020; Published: 29.02.2020

two parts are Transmitter end and 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 is transmit the signals & the receiver is receive those signals and move accordingly.

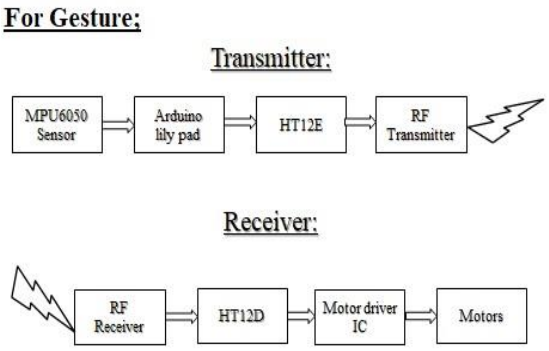

Fig. 1. Block diagram of the working principle of the robotic vehicle for gesture control

The transmitter part: 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. The receiver part: 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.

Working principle of 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 a ideal method for robotic control and communication.

Fig. 2 illustrates the overall working principle of the voice control of the robotic vehicle. Where the transmitter transmit the voice commands & the receiver is receive the commands and move in a specified direction. Similarly the voice control has Arduino Uno that consists of AT mega 328 microcontroller. For wireless control Bluetooth module HC05 has been used, which is mainly divided in to two parts.

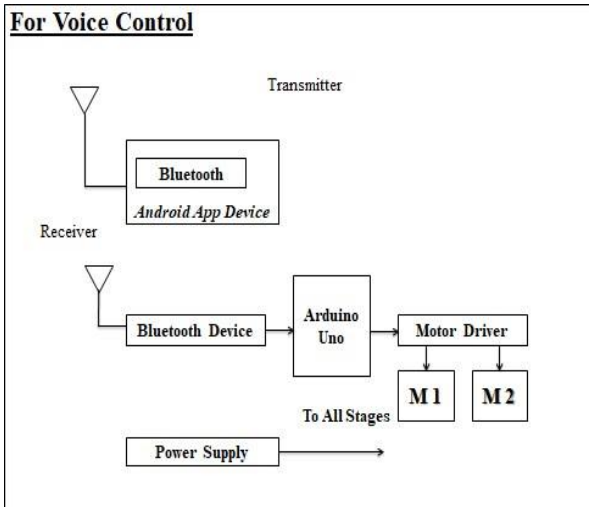

Fig. 2. Block diagram of the working principle of the robotic vehicle for voice control

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.

Description of key components

MPU6050

MPU6050 sensor module is complete 6-axis Motion tracking device. It combines 3-axis Gyroscope, 3-axis Accelerometer and Digital motion processor all in small chip. Also, it has 12C bus interface to communicate with the microcontrollers. It is used to measure the motion of the objects.

Arduino Uno

Arduino Uno is a microcontroller board based on AT mega328 which has 14 Digital I/O and 6 Analog pins. It has everything that is needed to support the microcontroller. Simply connect it to the computer with a USB cable to get started with the Arduino Uno board. It is flexible, easy to use hardware and software. Arduino Uno can sense the environment by receiving input from a variety of sensors and can affect it's the microcontroller, simply connect it to computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

RF module

An RF module is a small electronic device used to transmit and receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly. This wireless communication may be accomplished through optical communication or through radio frequency communication. The frequency range is 433MHZ.

Motor driver

L293D is a typical motor Driver or motor Driver IC which allows DC motor to drive on either direction. L293D is a 16pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. It is very much used in robotic application for speed control of the DC motors.

Bluetooth module

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. The HC-05 Bluetooth module can be used in a Master or Slave configuration, making it a great solution for wireless communication. This serial port Bluetooth module is fully qualified Bluetooth V2.0+ERD (Enhanced Data Rate) 3Mpbs modulation with complete 2.4GHZ radio transceiver and baseband.

Lilypad Arduino

The Lily pad Arduino is a wearable e-textile technology developed by Leah and cooperatively designed by Leah and spark Fun. Each Lily pad was creatively designed with large connecting pads and a flat back to allow them to be sewn into clothing with conductive thread. They're even washable.

Ultrasonic sensor

The Ultrasonic sensor sends out a high-frequency sound pulse and then times how long it takes for the echo of the sound to reflect back. The sensor has two openings in its front. One opening transmits ultrasonic waves (like a tiny speakers), the other receives them (like a tiny microphone). The speed of sound is approximately 341 meters/second in air.

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 RF module. The Arduino Uno is connected with the MPU6050 and RF module. Similarly, the movement of the hand with the transmitter end to generate necessary commands. Fig. 3 and 4 shows the sample for

hardware implementation of Gesture and Voice control robotic vehicle.

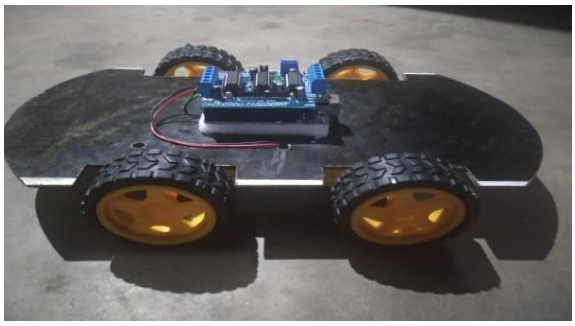

Fig. 3. Sample for hardware implementation of gesture control robotic vehicle

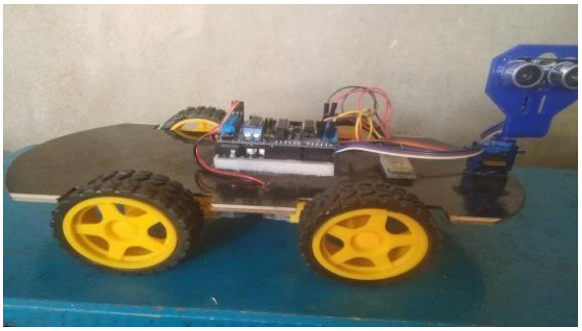

Fig. 4. Sample for hardware implementation of voice control robotic vehicle

One of the most important characteristics is used in interaction between people and robots. The motions and voice can be used to control a robotic vehicle. This is generally done by incorporating an MPU6050 sensor to control the robotic vehicle wirelessly.

Software 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. 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.

Program

```
#include <AF Motor. h> //Ada fruit Motor Shield Library. First you must download and install AF Motor library #include <Servo. h> //Servo library. This is standard library. (Sketch -> Include Library -> Servo)
String voice;
AF_DC Motor motor1 (1, MOTOR12_1KHZ); //create motor #1 using M1 output on Motor Drive Shield, set to 1kHz PWM frequency
AF_ DC Motor motor2 (2, MOTOR12_1KHZ); //create motor #2 using M2 output on Motor Drive Shield, set to 1kHz PWM
frequency
Servo my Servo; //define servo name
void setup()
{
  Serial. begin(9600); //start serial communication   my Servo. attach(10); //define our servo pin (the motor shield servo1 input = digital pin 10)
  my Servo. write(90);  //servo position is 90 degrees
}
void
loop(
)  {
  while (Serial. available()){ //Check if there is an available byte to read      delay(10); //Delay added to make thing stable      char c = Serial. read(); //Conduct a serial read     if (c == '#') {break;} //Exit the loop when the # is detected after the word
    voice += c; //Shorthand for voice = voice + c
  }   if (voice.
length() > 0){
if(voice ==
"*go ahead"){
      forward_ car();
      }
    else if(voice == "*go back"){
      back_ car();
      }
    else if(voice == "*right") {       right_
car();
    }     else if(voice == "*left") {
left_ car();
```



```
   }
   else if(voice == "*stop") {       stop_
car();
   }
  voice=""; //Reset the variable after initiating
  }
}
void forward_ car()
{
  motor1.run(FORWARD);
motor1.setSpeed(700);
motor2.run(FORWARD);
motor2.setSpeed(700);   delay(2000);
motor1.run(RELEASE);
motor2.run(RELEASE);
}
void back_ car()
{
  motor1.run(BACKWARD);
motor1.setSpeed(700);
motor2.run(BACKWARD);
motor2.setSpeed(700);   delay(2000);
motor1.run(RELEASE);
motor2.run(RELEASE);
}
void right_ car() {   My Servo.
write(0);   delay(1000);   my
Servo. write(90);   delay(1000);
motor1.run(FORWARD);
  motor1.setSpeed(250);
motor2.run(BACKWARD);
motor2.setSpeed(250);   delay(1000);
motor1.run(RELEASE);
motor2.run(RELEASE);
}
void left_ car()
{
  My Servo.
write(180);
delay(1000);
my Servo.
write(90);
delay(1000);
motor1.run(BACKWA);
motor1.setSpeed(250);
motor2.run(FORWARD)
;  motor2.setSpeed(250);
delay(1000);
motor1.run(RELEASE);
motor2.run(RELEASE);
}
void stop_ car ()
{
motor1.run(RE
LEASE);
motor2.run(RE
LEASE);
}
```

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 433MHz. GPS system can added to the robot by help of which its location can be tracked.

Conflicts of interest

Authors declare no conflict of interest.

References

[1] Shruthi BN, Shivraj, Sumathi S. Handgesture Based Direction Control of Robocar using Arduino Microcontroller. International Journal of Recent Technology and Engineering 2014;3:32-5.

[2] Vicky S, Roshan G, Sandeepkakde. Design and Implementation of Gesture Controlled Robot using Flex sensor and Accelerometer. International Journal of Advanced research in Electronics and Communication Engineering 2014;3:1546-7.

[3] Gaurav G, Abhijeet A, Anil Kumar, Avdesh. Wirelessly Hand Glove Operated Robot. International Journal of Advanced Research in Electronics and Communication Engineering 2014;3:1545-7.

[4] Harish KK, Vipul H, Sayali P, Pravish S. Gesture Controlled Robot using Image Processing. International Journal of Advanced Research in Artificial Intelligence 2013;2:69-71.

[5] Aditya P, Akhil DP, Arunav B, Akshay kumar G, Pankaj S. Hand Gestures Controlled Robotic Arm. Journal of International Academic Research For Multidisciplinary 2014;2:234-40.

[6] Zaman HU, Joy AA, Akash KM, Fayad ST. A Simple and Effective Way of

Controlling Robot by Hand Gesture. International conference on Intelligent Computing and Control Systems 2017;330-3.

[7] Murat KB, Yuksek LT, Tuykce Komultari Taniyan Ses Tanima Sistemi Gelistirilmesi. Hand Gesture Recognition. International Journal of Advance Foundation and Research in Science and Engineering 2015;1;52-8.

[8] Asokan A, Pothen AJ, Vijayaraj RK. ARMatrona wearable gesture recognition glove: For control of robotic devices in disaster management and human rehabilitation. IEEE International Conference on Robotics and Automation for Humanitarian Applications, Kollam, India. 2016.

[9] Bannach D, Amft O, Kunze KS, Heinz EA, Troster G, Lukowicz P. Waving real hand gestures recorded by wearable motion sensors to a virtual car and driver in a mixed-reality parking game. IEEE Symposium on Computational Intelligence and Game, Honolulu, HI, USA. 2007.

[10] Bodiroza S, Stern HI, Edan Y. Dynamic gesture vocabulary design for intuitive human-robot dialog. Proceedings of the seventh annual ACM/IEEE International Conference on Human-Robot Interaction, Boston, MA, USA. 2012.

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