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Gesture and Voice Controlled Robotic Car using Arduino

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Abstract

Robot vehicles are preferred instead of people for the use of dangerous and difficult jobs in technologically developed today's world so controlling of these robot vehicle is more important these days. Although robot vehicles used to be controlled only manually by remote controllers, today it is possible to control them via voice and gesture, which is quite popular practices. Including this an obstacle detection sensor has been added additionally to stop the vehicle when facing an obstacle. The main objective of the project is to develop a robotic vehicle with a total protection of the driver and the passengers inside the vehicle and made ease of controlling the vehicle. During driving the vehicle, voice nor gesture commands of a person is entered as input to the vehicle.

Keywords*:* Arduino UNO, Lilypad Arduino, Ultrasonic sensor, Motor Shield

INTRODUCTION

Robotics is the new booming field, which will be of great use to society in the coming years. Though robots can be a replacement to humans, they still need to be controlled by humans itself. These days many types of wireless robots are being developed and are put to varied applications and uses. Controlling robots or electronic device by voice and gesture provides both easy use and rise in efficiency and affectively. When people use robots and automation system, then daily life will be easier, fertility will increase, cost and dissipation of time will increase. One of the most important characteristics used in robot is the interaction between the people and robot. Many robots are expected to fulfil the people's directive. Beyond controlling the robotic system through physical devices, recent method of gesture control and voice control has become very popular. The whole circuitry is powered using a 12V rechargeable battery mounted on the system. The motor driver circuit is used to control the speed of robotic system. The robot stops when it is parallel to the ground.

PROPOSED METHOD

The Block diagram for both the gesture and voice controlled robotic car is shown in figure 1 and figure 2. The whole project is divided into two sections one for gesture control and voice control. Getting enter into the Gesture it has two modules one is transmitter section and other is receiver section. The circuit diagram and the transmitter prototype is shown in figure 3, and figure 4 respectively, and the transmitter section consists of one Lilypad Arduino, one 3-axis accelerometer and one RF transmitter module.The

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circuit diagram of receiver module is shown in figure 1 respectively. The receiver section consists of one RF receiver module, one motor driver IC, two Gear motor, two wheels. Here,two separate 12volt power supply is applied to both the sections. Finally, the Lilypad Arduino reads the analog output values i.e., x-axis and y-axis values from the 3 axis accelerometer and converts the analog value to respective digital value. The digital values are processed by the Lilypad Arduino and send to the RF transmitter which is received by the Receiver and is processed at the receiver end which drives the motor to a particular direction. The robot moves forward, backward, right and left when there is tilt in the palm of user in forward, backward, right and left respectively directions.

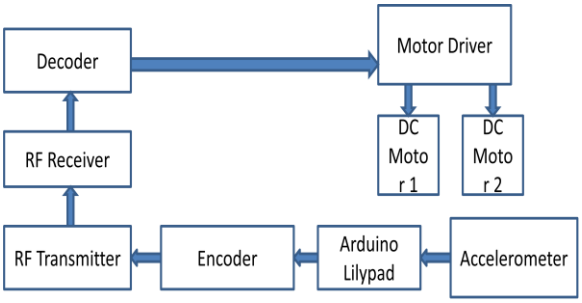

Fig.1 Block Diagram of Gesture Control

Similarly the voice control has, Arduino UNO that consist of AT mega 328 microcontroller. For wireless control Bluetooth module HC05 has been used. Ultrasonic sensor is connected in order to avoid the obstacle when come front of the robotic car.

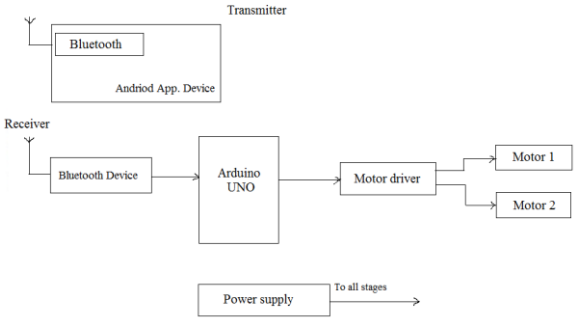

Fig.2 Block Diagram of Voice Control

IMPLEMENTATION

Software Used

The program is written in Arduino Integrated Development Environment (IDE). Here, the version used is 1.6.1.It connects to the Arduino hardware to upload programs. But before uploading the program there is a need to select appropriate Microcontroller so, “Arduino Uno” from the Tool menu has been chosen.

And for proper communication with computer and Arduino Uno boards there is a need to select COM port from the Tool menu.

Hardware Used

This paper consists of the following hardwares:

Arduino Uno

It is a microcontroller board based on ATmega328 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 its surroundings by controlling lights, motors, and other actuators. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. Figure 3 shows the Arduino Uno

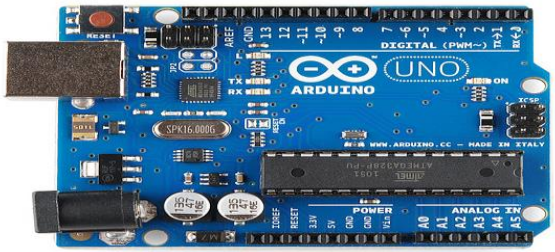

Fig.3 Front side surface of Arduino Uno

Accelerometer

The ADXL335[9] is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. It has 6 pins. 3 pins is for X,Y,Z axis. First pin for power supply (VCC), second pin for ground (GND) and the last one for self-test (ST). It operates on 3.3V from the Arduino Uno board. X and Y axis pins are connected to A0 and A1 pin of Arduino Uno board respectively. It can measure the static acceleration of gravity from tiltsensing applications as well as dynamic acceleration resulting from motion, shock or vibration and gives corresponding analog values through X,Y,Z axis pins. The ADXL335 is available in a small, low profile, 4mm x 4mm x 1.45 mm, 16-lead, plastic lead frame chip scale package. The low cost and small sixe of 3-axis accelerometer, are the two factor that makes it effetctive to detect the hand gesture.

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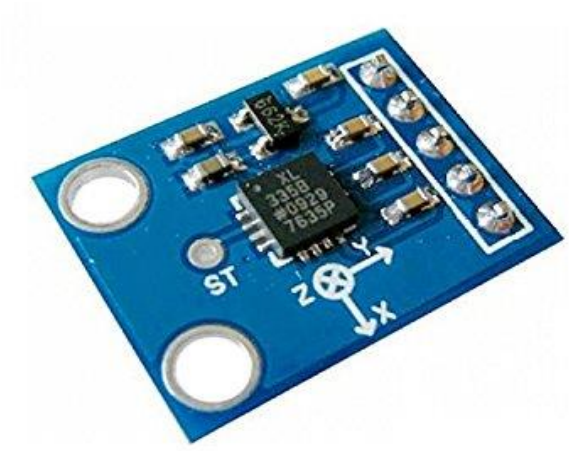

Fig.4 ADXL334 Accelerometer

Lilypad Arduino

This is LilyPad Arduino main board! LilyPad is a wearable e-textile technology developed by Leah Buechley and cooperatively designed by Leah and SparkFun. Each LilyPad was creatively designed with large connecting pads and a flat back to allow them to be sewn into clothing with conductive thread. The LilyPad also has its own family of input, output, power, and sensor boards that are also built specifically for e-textiles. They're even washable.

Figure 4 shows Lilypad Arduino

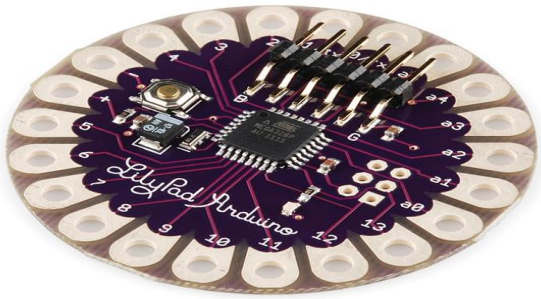

Fig.5 Lilypad Arduino

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 2 openings on its front. One opening transmits ultrasonic waves, (like a tiny speaker), the other receives them, (like a tiny microphone). The speed of sound is approximately 341 meters (1100 feet) per second in air. The ultrasonic sensor uses

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this information along with the time difference between sending and receiving the sound pulse to determine the distance to an object. It uses the following mathematical equation:

Distance = Time x Speed of Sound divided by 2

Figure 5 shows the detailed view of ultrasonic sensor

Fig.6 Ultrasonic Sensor

L293D Motor Driver

L293D Motor driver Integration is a driver system which has 20 pins motor in which there are 2H bridges. L293D, which is generally preferred motor driver to control DC motors, and the two motors can be independently controlled in bidirectional ways. It is possible to control PWM by using enable pins. L293D within the range of 4.5 V to 36 V can be used maximum 600 mA current limit.

SIMULATION DIAGRAM WITH RESULT

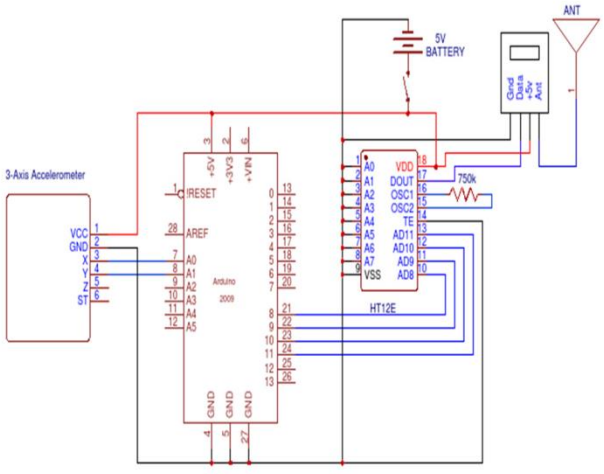

Fig.7 Gesture Control Transmitter Circuit

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The design of the Gesture and Voice controlled robotic car are show in Figure 6,7 and Figure 8. Figure 5 shows the transmitter circuit for gesture control and similary Figure 6 shows the receiver circuit

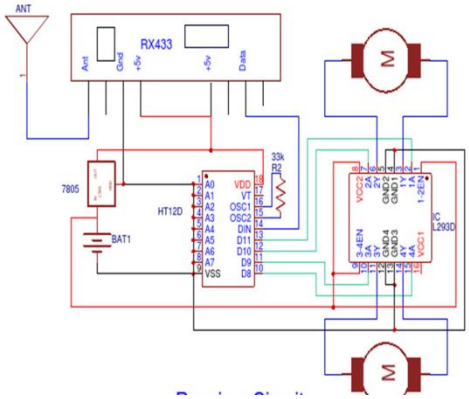

Fig.8 Gesture Control Receiver Circuit

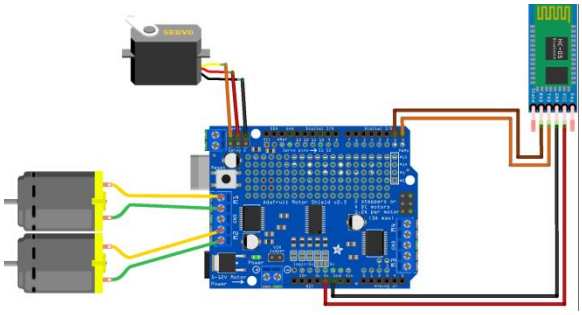

Fig.9 Voice Controlled Circuit

First most The transmitter prototype is kept on the palm and the receiver prototype (i.e robot car) moves according to the palm movement. This paper explains about the 5 different gesture position of the hand i.e stop condition, forward movement, backward movement, moves towards right and moves towards left. Similarly for Voice control When a user giver voice command " go ahead", "go back", left and right, stop motor move in clockwise direction if there is no object nearer than 10 cm in front of the robotic vehicle. If an object appears in front of it, the motor stops while going forward. If the user gives "go back" command the ultrasonic sensors immediately check any barriers nearer to 10 cm. If the user gives the command "stop" both motors stop. The command "right" lets the motor turn the clockwise direction and the right motor turn the anticlockwise direction. If the user gives the command "right" to the vehicle, the left engine turns the anticlockwise direction and the right motor turns the direction of a clockwise.

Whenever the robot is going on the desired path the ultrasonic sensor transmits the ultrasonic waves continuously from its sensor head. Whenever an obstacle comes ahead of it the ultrasonic waves are reflected back from an object and that information is passed to the microcontroller. The microcontroller controls the motors left, right, back, front, based on ultrasonic signals. In order to control the speed of each motor pulse width modulation is used (PWM).

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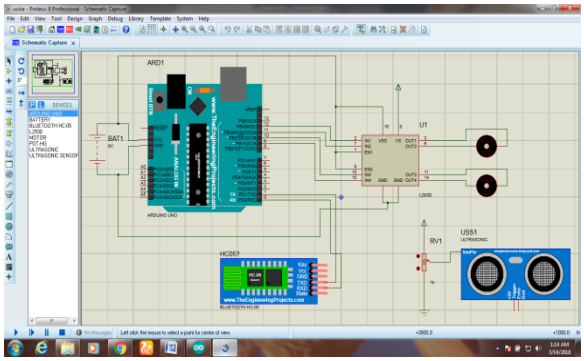
COMPARISON WITH EXISTING SYSTEM

The major advantage of this system over other systems is that it provides real time palm gesture recognition as well as voice controlling, leading to an effective and natural way of controlling robots. Additional advantage—many existing system have used Bluetooth wireless control which is replaced by RF modules in this paper, and due to which the range has been enhanced.

SIMULATION



CONCLUSION

Robot 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 be added to the robot by the help of which its location can be tracked.

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