GUESTURE CONTROL CAR (USING AURDINO)

A Course End Project Submitted in Partial Fulfillment of the Requirements for the Course of

ENGINEERING EXPLORATION

In

Department of Freshman Engineering

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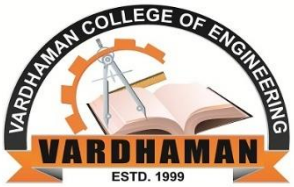

VARDHAMAN COLLEGE OF ENGINEERING

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OCTOBER 2021

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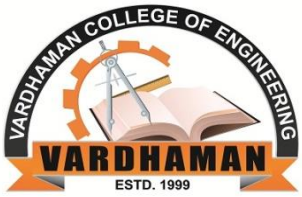

CERTIFICATE

Certified that this is a bonafide of the course end project work entitled, **"Gesture Control Car (Using Arduino)"**, done by, **Bipin Yadav (20881A1211), Srithin Chillamcharla (20881A1213)**, **Rangineni Anvitha (20881A1244)** submitted to the faculty of **Freshman Engineering**, in partial fulfillment of the requirements for the course of **ENGINEERING EXPLORATION** during the year 2020-2021 (II Semester).

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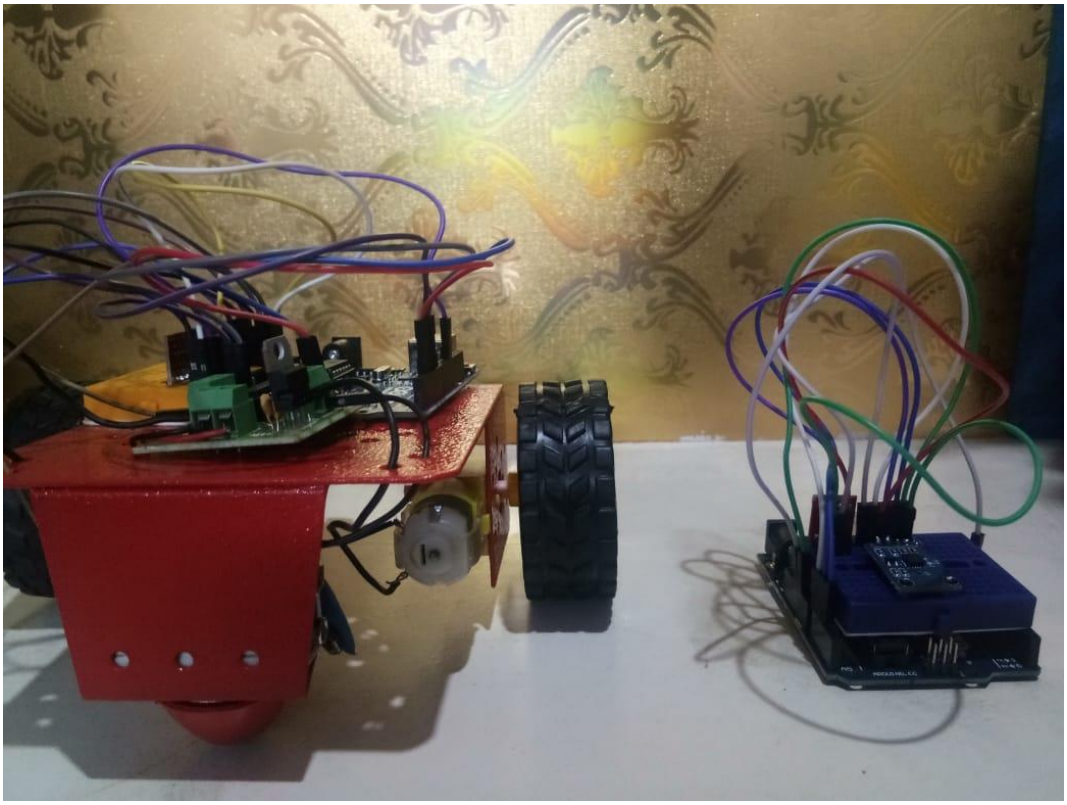
ABSTRACT

Gesture Controlled Car is a robot which can be controlled by simple human gestures. The user just needs to wear a gesture device in which a sensor is included. The sensor will record the movement of hand in a specific direction which will result in the motion of the robot in the respective directions. The robot and the Gesture instrument are connected wirelessly through radio waves. User can interact with the robot in a more friendly way due to the wireless communication. We can control the car using accelerometer sensors connected to a hand glove. The sensors are intended to replace the remote control that is generally used to run the car. It will allow user to control the forward, backward, leftward and rightward movements, while using the same accelerometer sensor to control the throttle of the car. Movement of car is controlled by the differential mechanism. The main advantage of this mechanism is the car with this mechanism can take sharp turn without any difficulty.



Contents

Chapter – 1

Introduction

INTRODUCTION:

The robot is an electro-mechanical machine that can perform tasks automatically. Some robots require some degree of guidance, which may be done using a remote control or with a computer interface. Robots can be autonomous, semi-autonomous or remotely controlled. Robots have evolved so much and are capable of mimicking humans that they seem to have a mind of their own. An important aspect of a successful robotic system is the Human-Machine interaction. In the early years the only way to communicate with a robot was to program which required extensive hard work. With the development in science and robotics, gesture based recognition came into life.

Gestures originate from any bodily motion or state but commonly originate from the face or hand. Gesture recognition can be considered as a way for computer to understand human body language. This has minimized the need for text interfaces and GUIs (Graphical User Interface). Gesture recognition technologies are much younger in the world of today. At this time there is much active research in the field and little in the way of publicly available implementations. Several approaches have been developed for sensing gestures and controlling robots. Glove based technique is a well-known means of recognizing hand gestures. It utilizes a sensor attached to a glove that directly measures hand movements.

A Gesture Controlled robot is a kind of robot which can be controlled by hand gestures and not the old fashioned way by using buttons. The user just needs to wear a small transmitting device on his hand which includes a sensor which is an accelerometer in our case. Movement of the hand in a specific direction will transmit a command to the robot which will then move in a specific direction. The transmitting device includes a Comparator IC for assigning proper levels to the input voltages from the accelerometer and an Encoder IC which is used to encode the four bit data and then it will be transmitted by an RF Transmitter module. At the receiving end an RF Receiver module will receive the encoded data and decode it by using a decoder IC. This data is then processed by a microcontroller and passed onto a motor driver to rotate the motors in a special configuration to make the robot move in the same direction as that of the hand.

HUMAN MACHINE INTERACTION:

An important aspect of a successful robotic system is the Human-Machine interaction. In the early years the only way to communicate with a robot was to program which required extensive hard work. With the development in science and robotics, gesture based recognition came into life. Gestures originate from any bodily motion or state but commonly originate from the face or hand. Gesture recognition can be considered as a way for computer to understand human body language. This has minimized the need for text interfaces and GUIs (Graphical User Interface).

GESTURE:

A gesture is an action that has to be seen by someone else and has to convey some piece of information. Gesture is usually considered as a movement of part of the body, esp. a hand or the head, to express an idea or meaning.

OBJECTIVE OF PROJECT:

Our objective is to make this device simple as well as cheap so that it could be mass produced and can be used for a number of purposes.

Chapter – 2

Literature Survey

2.1 Hand Gesture Controlled Robot using Arduino

A Robot is an electro-mechanical system that is operated by a computer program. Robots can be autonomous or semi-autonomous. An autonomous robot is not controlled by human and acts on its own decision by sensing its environment. Majority of the industrial robots are autonomous as they are required to operate at high speed and with great accuracy. But some applications require semi-autonomous or human controlled robots. Some of the most commonly used control systems are voice recognition, tactile or touch controlled and motion controlled. One of the frequently implemented motion controlled robot is a Hand Gesture Controlled Robot. In this project, a hand gesture controlled robot is developed using MPU6050, which is a 3-axis Accelerometer and 3-axis Gyroscope sensor and the controller part is Arduino Nano. Instead of using a remote control with buttons or a joystick, the gestures of the hand are used to control the motion of the robot. The project is based on wireless communication, where the data from the hand gestures is transmitted to the robot over RF link (RF Transmitter – Receiver pair).The project is divided into transmitter and receiver section. The circuit diagram and components are explained separately for both transmitter and receiver sections.

2.1.2 Accelerometer based Gesture Control Robot

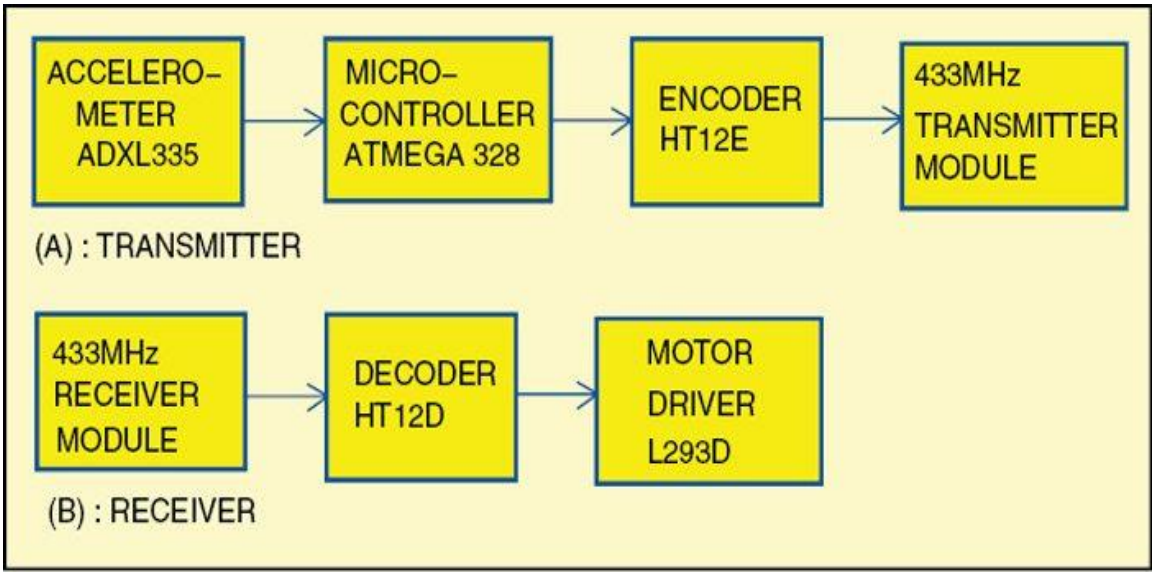
Nowadays, robotics is becoming one of the most advanced in the field of technology. The applications of robotics mainly involve in automobiles, medical, construction, defense and also used as a fire fighting robot to help the people from the fire accident. But, controlling the robot with a remote or a switch is quite complicated. So, a new project is developed that is, an accelerometer based gesture control robot. The main goal of this project is to control the movement of the robot with hand gesture using accelerometer.

Chapter – 3

Project Implementation

3.1 WORKING PRINCIPLE:

Our gesture controlled Car works on the principle of accelerometer which records hand movements and sends that data to the comparator which assigns proper voltage levels to the recorded movements. That information is then transferred to encoder which makes it ready for RF transmission. On the receiving end, the information is received wirelessly via RF, decoded and then passed onto the microcontroller which takes various decisions based on the received information. These decisions are passed to the motor driver IC which triggers the motors in different configurations to make the robot move in a specific direction. The following block diagram helps to understand the working of the robot:



We divided our task into two parts to make the task easy and simple and to avoid complexity and make it error free. The first is the transmitting section which includes the following components:

1) Accelerometer

2) Atmega328 (MCU)

3) Encoder IC

4) RF Transmitter Module

The second is the receiving end which comprises of following main components:

1) RF Receiver Module

2) Decoder IC

3) Motor Driver IC

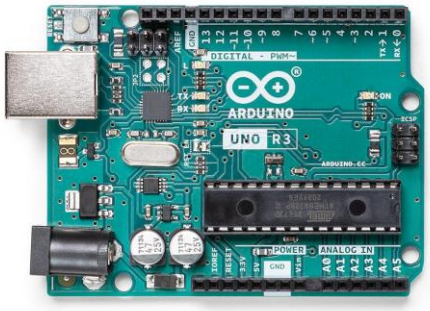
4) DC Geared Motors

3.1.1 ACCELEROMETER (ADXL335):

An Accelerometer is an electromechanical device that measures acceleration forces. These forces may be static, like the constant force of gravity pulling at your feet, or they could be dynamic – caused by moving or vibrating the accelerometer. It is a kind of sensor which record acceleration and gives an analog data while moving in X, Y, Z direction or may be X, Y direction only depending on the type of the sensor.

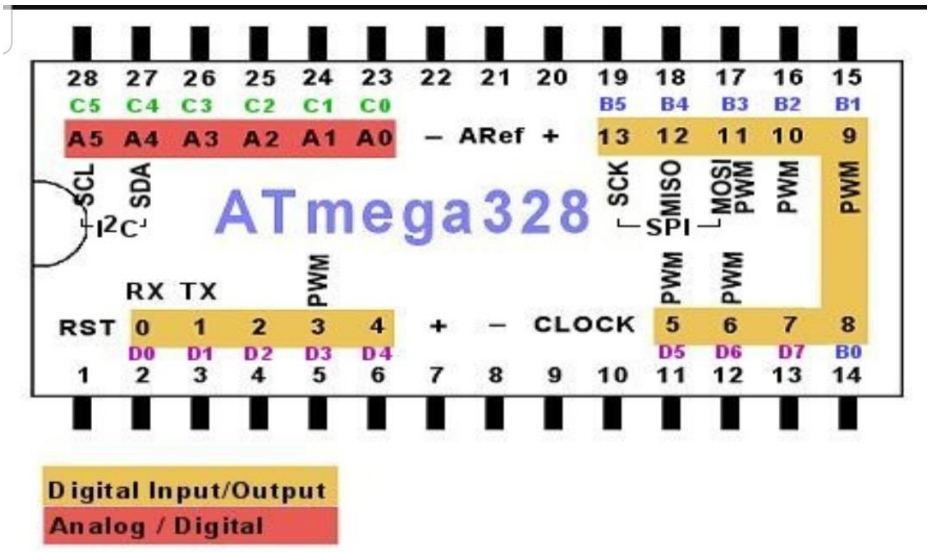
3.1.2 AURDINO UNO:

Arduino is an open-source computer hardware and software company, project and user community that designs and manufactures kits for building digital devices and interactive objects that can sense and control the physical world.



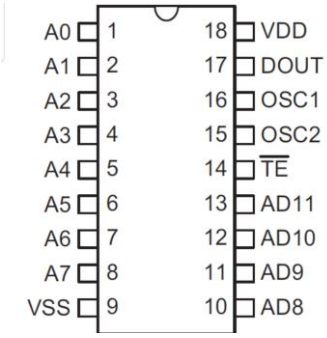
3.1.3 ATmega328:

ATmega328 is a single-chip micro controller from Atmel and belongs to the mega AVR series. The Atmel 8-bit AVR RISC based microcontroller combines 32kB ISP flash memory with read while write capabilities, 1kB EEPROM, 2kB SRAM, 23 general-purpose I/O lines, 32 general-purpose working register, three flexible timers/counters with compare modes, internal and external interrupts, serial programmable USART, a byte oriented 2-wire serial interface, SPI serial port, 10 bit A/D converter, programmable watch-dog timer with an internal oscillator and five software-selectable power-saving modes. The device operates between 1.8 and 5.5 volts. It achieves throughputs approaching one MIPS per MHz An alternative to ATmega328 is ATmega328p.



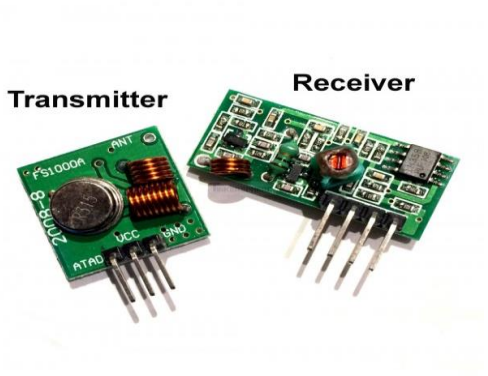
3.1.4 ENCODER IC (HT12E)

PT2262 is a remote control encoder paired with PT2272 utilizing CMOS technology. It encodes data and address pins into serial coded waveform suitable for RF or IR modulation. PT2262 has a maximum of 12 bits of tri-state address pins providing up to 312 address codes; thereby, drastically reducing any code collision and unauthorized code scanning possibilities. The pin description is shown below. It has 4 input while 1 output pin. The address pins can also be utilized as data pins.



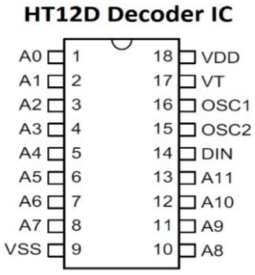
3.1.5 RF MODULE (Rx/Tx)

Radio frequency (RF) is a rate of oscillation in the range of about 3 KHz to 300 GHz, which corresponds to the frequency of radio waves, and the alternating currents which carry radio signals. Although radio frequency is a rate of oscillation, the term "radio frequency" or its abbreviation "RF" are also used as a synonym for radio – i.e. to describe the use of wireless communication, as opposed to communication via electric wires The RF module is working on the frequency of 433 MHz and has a range of 100-200 meters.



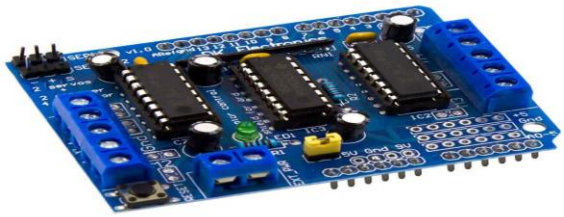
3.1.6 DECODER IC (HT12D)

PT2272 is a remote control decoder paired with PT2262 utilizing CMOS Technology. It has 12 bits of tri-state address pins providing a maximum of 312 address codes; thereby, drastically reducing any code collision and unauthorized code scanning possibilities. The input data is decoded when no error or unmatched codes are found. It has 1 input while 4 output pins. The address pins can also be utilized as data pins.



3.1.7 MOTOR DRIVER IC (L293D)

It is also known as H-Bridge or Actuator IC. Actuators are those devices which actually gives the movement to do a task like that of a motor. In the real world there are different types of motors available which work on different voltages. So we need a motor driver for running them through the controller. The output from the microcontroller is a low current signal. The motor driver amplifies that current which can control and drive a motor. In most cases, a transistor can act as a switch and perform this task which drives the motor in a single direction.

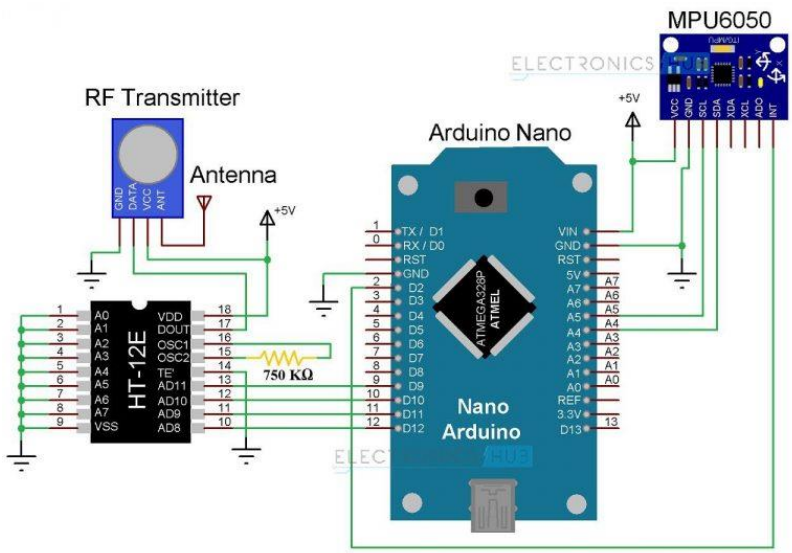


3.1.8 DC MOTORS

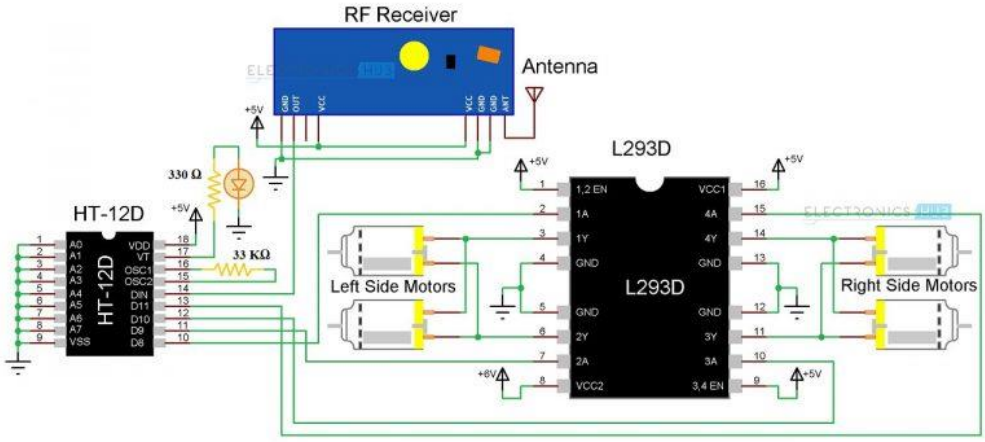
A machine that converts DC power into mechanical power is known as a DC motor. Its operation is based on the principle that when a current carrying conductor is placed in a magnetic field, the conductor experiences a mechanical force. DC motors have a revolving armature winding but non-revolving armature magnetic field and a stationary field winding or permanent magnet. Different connections of the field and armature winding provide different speed/torque regulation features. The speed of a DC motor can be controlled by changing the voltage applied to the armature or by changing the field current.

3.2 CIRCUIT DIAGRAM

TRANSMITTER CIRCUIT:



RECIEVER CIRCUIT:



3.3 CONNECTIONS

TRANSMITTER CIRCUIT:

The Transmitting Circuit consists of:

1. An Arduino UNO

2. Accelerometer sensor (ADXL335)

3. RF Transmitter

4. A bread board

5. Jumper wires

The connections are given as follows:

Initially the ground of the sensor is connected to the ground of the Arduino as shown in the figure. The X-out, Y-out, Z-out pins of accelerometer sensor are connected to the A0, A1, A2 pins of Arduino respectively as shown. VCC pins of both the accelerometer and RF receiver are connected to the 5V supply. GND, DATA pins of RF Transmitter are connected to Ground and 12V of Arduino.

RECEIVER CIRCUIT:

The receiver circuit consists of:

1. An Arduino UNO

2. RF Receiver

3. L293D Motor driver

4. A bread board, jumper wires

5. Dc Motors with wheels

The connections are given as follows:

All the three GND pins of the RF receiver are connected to ground of Arduino as shown. Both the VCC pins are connected to 5V and the output pin is connected to 12V. Input pins 1, 2, 3, 4 of L293D Motor driver are connected to 2, 3, 4, 5 volts of Arduino respectively. V in pins and Motor pins of the same are connected to the battery terminals and to motors respectively as shown in figure.

3.4 OPERATION:

Our system controls four movements of the car. Right, left, forward and stop. Once the accelerometer starts, it takes some time to calibrate its value as to the initial position. After 3seconds, it gets ready to function. It takes the movements of the hand as input. The arduino gets the values from the accelerometer through an analogue channel. It gets three values: acceleration in x-axis, y-axis and z-axis. Arduino calculates the difference of the present value and the calibrated value, and from the result, it decides the command that the hand is trying to signal. It, then, sends the signal through a Bluetooth module.

There is another Bluetooth module residing at the car. It has been paired with the module in hand so that no noise interferes with the connection. According to the command received (F for forward, L for left, R for right, S for stop), the arduino controls the motors to move the car accordingly.

3.5 SOURCE CODE

TRANSMITTER CODE:

```
#include <VirtualWire.h>

#define x A0

#define y A1

#define z A2

char *data;

int x_val;

int y_val;

int z_val;

int x_val2;

int y_val2;

int z_val2;


void setup()

{

 vw_set_tx_pin(12);

 vw_setup(2000);

 pinMode(x, INPUT);

pinMode(y, INPUT);

pinMode(z, INPUT);

Serial.begin(9600);
```

```
x_val2 = analogRead(x);
 y_val2 = analogRead(y);
z_val2 = analogRead(z);
}
void loop()
{
  x_val = analogRead(x);
  y_val = analogRead(y);
  z_val = analogRead(z);
int x_axis = x_val - x_val2;
int y_axis = y_val - y_val2;
int z_axis = z_val - z_val2;

  if(y_axis >= 60)
  {
    data="f";
    vw_send((uint8_t *)data, strlen(data));
    vw_wait_tx();
    delay(500);
    Serial.println("Forward");
  }
  else if(y_axis <= -60)
```

```
{
  data="b";
  vw_send((uint8_t *)data, strlen(data));
  vw_wait_tx();
  delay(500);
  Serial.println("Backward");
}
else if(x_axis >= 60)
{
  data="r";
  vw_send((uint8_t *)data, strlen(data));
  vw_wait_tx();
  delay(500);
  Serial.println("Right");
}
else if(x_axis <= -60)
{
  data="l";
  vw_send((uint8_t *)data, strlen(data));
  vw_wait_tx();
  delay(500);
  Serial.println("Left");
```

```
  }
  else
  {
    data="s";
    vw_send((uint8_t *)data, strlen(data));
    vw_wait_tx();
    delay(500);
    Serial.println("Stop");
  }
}
```

RECEIVER CODE:

```
#include <VirtualWire.h>
#define m1 2
#define m2 3
#define m3 4
#define m4 5
void setup()
{
    vw_set_rx_pin(11);
    vw_setup(2000);
    pinMode(m1, OUTPUT);
    pinMode(m2, OUTPUT);
```

```
    pinMode(m3, OUTPUT);
    pinMode(m4, OUTPUT);
    vw_rx_start();
    Serial.begin(9600);
}
void loop()
{
    uint8_t buf[VW_MAX_MESSAGE_LEN];
    uint8_t buflen = VW_MAX_MESSAGE_LEN;
    if (vw_get_message(buf, &buflen))
    {
      if(buf[0]=='f')
      {
       digitalWrite(m1,HIGH);
       digitalWrite(m2,LOW);
       digitalWrite(m3,HIGH);
       digitalWrite(m4,LOW);
       Serial.println("Forward");
      }
      else if(buf[0]=='b')
      {
       digitalWrite(m1,LOW);
```

```
 digitalWrite(m2,HIGH);
 digitalWrite(m3,LOW);
 digitalWrite(m4,HIGH);
 Serial.println("Backward");
}
else if(buf[0]=='r')
{
 digitalWrite(m1,HIGH);
 digitalWrite(m2,LOW);
 digitalWrite(m3,LOW);
 digitalWrite(m4,LOW);
 Serial.println("Left");
}
else if(buf[0]=='l')
{
 digitalWrite(m1,LOW);
 digitalWrite(m2,LOW);
 digitalWrite(m3,HIGH);
 digitalWrite(m4,LOW);
 Serial.println("Right");
}
else if(buf[0]=='s')
```

```
      {
       digitalWrite(m1,LOW);
       digitalWrite(m2,LOW);
       digitalWrite(m3,LOW);
       digitalWrite(m4,LOW);
       Serial.println("Stop");
      }
    }
}
```

Chapter – 4

Experimental Results

Gesture controlled robot moves according to hand movement as we place transmitter in our hand. When we tilt hand in front side, robot start to moving forward and continues moving forward until next command is given. When we tilt hand in backward side, robot change its state and start moving in backwards direction until other command is given. When we tilt it in left side Robot get turn left till next command. When we tilt hand in right side robot turned to right. And for stopping robot we keeps hand in stable.

Chapter – 5

Advantages and Applications

ADVANTAGES:

1. Operation Of the system is simple with complex background.
2. The production cost of the robot is very low.
3. Low Maintenance is required.
4. Operation Is Completely Wireless.
5. Simple, Fast and Easy Installation.
6. No training is required.

APPLICATIONS:

1. Wireless Controlled Robots are very useful in many applications like Remote Surveillance military applications, Bomb Diffusion Robots, etc.
2. Hand Gestures controlled robots can be used by Physically challenged in wheelchairs
3. Hand Gesture controlled industrial grade robotic arms can be developed.
4. These robots can also be used on construction Fields and civil works.
5. These robots are used in medical applications for the purpose of surgery.
6. These robotics are used in industries to control trolley and lift.

Chapter – 6

Conclusions and Future Scope

CONCLUSIONS:

The purpose of project is to control a toy car using accelerometer sensors attached to a hand glove. The sensors are intended to replace the remote control that is generally used to run the car. It will allow us to control the forward and backward, and left and right movements, while using the same accelerometer sensor to control the throttle of the car.

FUTURE SCOPE:

The on-board batteries occupy a lot of space and are also quite heavy. We can either use some alternate power source for the batteries or replace the current DC Motors with ones which require less power. Secondly, as we are using RF for wireless transmission, the range is quite limited; nearly 50- 80m. This problem can be solved by utilizing a GSM module for wireless transmission. The GSM infrastructure is installed almost all over the world. GSM will not only provide wireless connectivity but also quite a large range. Thirdly, an on-board camera can be installed for monitoring the robot from faraway places. All we need is a wireless camera which will broadcast and a receiver module which will provide live streaming.

REFERENCES

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2. Bhosale Prasad S., Bunage Yogesh B. and Shinde Swapnil V. “Hand Gesture Controlled Robot”