Automatic Obstacle Detection Car Along With Color Sensor

1st Shreeya Singh
2020102011

2nd Srujana Vanka
2020102005

***Abstract*—In this project, an automatic obstacle detecting car was made. The car uses ultrasonic sensors to detect obstacles and avoid them. Color sensor is used to start and stop the car. An algorithm of the navigation of the car was created and implemented to the Arduino.**

***Index Terms*—Ultrasonic senor, Motors, Arduino, Color sensor, Obstacle detection car**

I. Introduction

Autonomous robots are freely moving and can operate without direct human supervision. An obstacle detecting autonomous robot has many applications. For driving the wheels, two servo motors were used. The robot consisted of four wheels, two in the back to which the DC motors were attached and two in the front. This made it possible to implement differential drive which enabled quick and tight turns. Tests were performed which showed that the car could successfully navigate in a room with various obstacles placed out. To start and stop the car, a color sensor has also been incorporated.

II. hardware requirements

- Breadboard
- Ultrasonic sensor
- L293D IC
- Batteries
- TCS3200 colour sensor
- DC motors
- Wheels
- Chassi
- Arduino UNO
- Connecting wires

III. Approach

A. Obstacle detection car

A battery-powered automatic obstacle detection car is built. The car will be able to detect obstacles with the help of ultrasonic sensors that will be mounted in front of the car. On detecting an obstacle, it turns right.

B. Controlling the car using the color sensor

The color sensor will be used for stopping and moving the car. The TCS3200 Color Sensor will be mounted on the car, and on detecting red color, it will stop and move on detecting green.

IV. Working

A. Motor module

The L293D chip is used for controlling the motors. It can actually control one motor independently. Pins on the right hand side of the chip are for controlling a one motor. Pins on the left hand side of the chip are for controlling second motor. Each chip contains two full H-bridges (four half H-bridges). That means you can drive four solenoids, two DC motors bi-directionally. The motors are connected to the rear wheels of the car. On detecting an obstacle, the car is to be turning right. Hence the left motor is turned off on sensing an obstacle.

B. Ultrasonic sensor module

An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. The sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity.High-frequency sound waves reflect from boundaries to produce distinct echo patterns. The working principle of this module is simple. It sends an ultrasonic pulse out at 40kHz which travels through the air and if there is an obstacle or object, it will bounce back to the sensor. By calculating the travel time and the speed of sound, the distance can be calculated. For presence detection, ultrasonic sensors detect objects regardless of the color, surface, or material (unless the material is very soft like wool, as it would absorb sound.)

$$Distance = 1/2 * T * C \tag{1}$$

(where D is the distance, T is the time, and C is the speed of sound 343 meters/second or 29us/cm). The car runs on battery in forward direction and whenever it detects an obstacle within 35 centimeters in front of it, the car turns left until there is no obstacle in front of it.

C. Colour sensor module

The TSC3200 IC is the colour sensor used. TCS3200 contains white LEDs to illuminate the object's surface whose color has to be detected. The intensity of the light reflected back by the object is calculated.

$$I = P/4r2 \tag{2}$$

We know that, P = hf (h is the plank's constant and f is the frequency of light). Hence a frequency proportional to the intensity is produced by the converter. Based on the frequency, the colour is detected.

V. Hardware Implementation

The rear wheels were controlled by two DC motors. We attached the ultrasonic sensor to the front of the vehicle for it to detect any obstacle that comes in front of the car. The color sensor was also attached above the ultrasonic sensor.

VI. Code

```
#define s0 6       //Module pins wiring
#define s1 7
#define s2 8
#define s3 9
#define out 10

const int trig = 12;
const int echo = 11;
const int leftForward = 2;
const int leftBackward = 3;
const int rightForward = 4;
const int rightBackward = 5;

int duration = 0;
int distance = 0;

int Red=0, Blue=0, Green=0;  //RGB values

void setup()
{
   pinMode(s0,OUTPUT);    //pin modes
   pinMode(s1,OUTPUT);
   pinMode(s2,OUTPUT);
   pinMode(s3,OUTPUT);
   pinMode(out,INPUT);

   Serial.begin(9600);   //intialize the serial
    monitor baud rate

  pinMode(trig , OUTPUT);
  pinMode(echo , INPUT);
  pinMode(leftForward , OUTPUT);
  pinMode(leftBackward , OUTPUT);
  pinMode(rightForward , OUTPUT);
  pinMode(rightBackward , OUTPUT);

   digitalWrite(s0,HIGH); //Putting S0/S1 on HIGH/
    HIGH levels means the output frequency scalling
    is at 100% (recommended)
   digitalWrite(s1,HIGH); //LOW/LOW is off HIGH/LOW
    is 20% and LOW/HIGH is  2%

}

void loop(){
  // ultrasonic sensor
  digitalWrite(trig , HIGH);
  delayMicroseconds(1000);
  digitalWrite(trig , LOW);


  duration = pulseIn(echo , HIGH);
  distance = (duration/2) / 28.5 ;
  Serial.print("Distance = ");
  Serial.println(distance);


  if ( distance > 35


         )
  {
    digitalWrite(leftForward , LOW);
    digitalWrite(leftBackward , HIGH);
    digitalWrite(rightForward , HIGH);
    digitalWrite(rightBackward , LOW);
    delay(100);
  }
  else
  {
    digitalWrite(leftForward , HIGH);
    digitalWrite(leftBackward , LOW);
    digitalWrite(rightForward , HIGH);
    digitalWrite(rightBackward , LOW);
  }

  // colour sensor
  GetColors();
    //Execute the GetColors function to get the
    value of each RGB color

    //Depending of the RGB values given by the
    sensor we can define the color and displays it
    on the monitor

  if (Red <=15 && Green <=15 && Blue <=15)
    //If the values are low it's likely the white
    color (all the colors are present)
      Serial.println("White");

  else if (Red<Blue && Red<=Green && Red<23) //if
    Red value is the lowest one and smaller thant 23
     it's likely Red
      {
    digitalWrite(leftForward, LOW);
    digitalWrite(leftBackward, LOW);
    digitalWrite(rightForward, LOW);
    digitalWrite(rightBackward, LOW);  //Stops the
    car
        Serial.println("Red");
      }

  else if (Blue<Green && Blue<Red && Blue<20)   //
    //Same thing for Green
     {
    digitalWrite(leftForward , HIGH);
    digitalWrite(leftBackward , HIGH);
    digitalWrite(rightForward , HIGH);
    digitalWrite(rightBackward , LOW);
      Serial.println("Green");
     }

  else if (Green<Red && Green-Blue<= 8)           //
    Blue
        Serial.println("Blue");


  else
     Serial.println("Unknown");                  //
    if the color is not recognized, you can add as
    many as you want


  delay(2000);                                    //2
    s delay you can modify if you want


}


void GetColors()
{
  digitalWrite(s2, LOW);
                  //S2/S3 levels define which set
    of photodiodes we are using LOW/LOW is for RED
    LOW/HIGH is for Blue and HIGH/HIGH is for green
  digitalWrite(s3, LOW);
```

```
  Red = pulseIn(out, digitalRead(out) == HIGH ? LOW
    : HIGH);       //here we wait until "out" go LOW
    , we start measuring the duration and stops when
     "out" is HIGH again, if you have trouble with
    this expression check the bottom of the code
  delay(20);
  digitalWrite(s3, HIGH);
                 //Here we select the other color (
    set of photodiodes) and measure the other colors
     value using the same techinque
  Blue = pulseIn(out, digitalRead(out) == HIGH ? LOW
     : HIGH);
  delay(20);
  digitalWrite(s2, HIGH);
  Green = pulseIn(out, digitalRead(out) == HIGH ?
    LOW : HIGH);
  delay(20);
}
```

VII. Applications and uses

- With the help of ultrasonic sensors, it will help protect the vehicle from obstacles and make sure the vehicle remains unharmed.
- The color sensor will make sure the vehicle stops on a red color and moves again on seeing green. This will help in following of traffic rules and thus, help in preventing road accidents.
- Other benefits of autonomous vehicles could be improved energy efficiency and reduced driving costs

VIII. Further ideas

- An accelerometer can be used to detect the speed of the car. A buzzer can be attached, such that it beeps on detecting an obstacle or when over-speeding.
- Programming the color sensor to detect more colors and increase the operations for the car.
- A clap detector can be used to control the car. The car will be able to detect clap sound with the help of sound sensing circuit which will consist of high pass filter and microphone.

IX. Conclusion

With the help of ultrasonic sensors, it will help protect the vehicle from obstacles and using the color sensor will make sure the vehicle stops on a red color and moves again on seeing green. This will help in following of traffic rules and thus, help in preventing road accidents.

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