LINE FOLLOWING ROBOT VEHICLE AND OBSTACLE DETECTION

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ABSTRACT:
An intelligent robot called a "line follower" can find and follow a visual line that is placed in the floor. The course is predetermined and can either be simple, such as magnetic markers or laser guide markers, or it can be complicated, such a black line on a white surface with a highly contrasting hue. Several sensors can be used to detect these lines. Infrared sensors are typically utilised to find the line that the robot must follow. The robot's movements are automated and have a vast range of usage. Giving a line follower the capacity to recognise obstacles might change it. Every object placed in the route will cause a typical line follower to attempt to shove the obstruction. The line follower can pause until the obstruction is eliminated by employing an ultrasonic sensor to identify obstacles. This class of robots is capable of executing a variety of jobs in various sectors. These robots can replace conventional conveyer belts in industries as automated equipment transporters. They also have domestic applications, and one of the most intriguing ones is in the administration of healthcare. This intelligent line-following robot will not be easily harmed since it has the capacity to identify obstacles and will halt moving until they are eliminated or the course is altered. Since barriers are widespread in any job and if the robot is not equipped with this capability, it will be more useful in some industries.

Keywords— Line Follower; Problems and solutions; Circuit; Programming.

I. INTRODUCTION:

By reading the above projects, we have observed that the line-following robot lacks a system for obstacle avoidance.So we are here to perform a line-following robot vehicle with obstacle avoidance.

The field of technology known as robotics is concerned with the creation, maintenance, use, and application of robots. Robots are machines that can perform a complicated series of tasks automatically, particularly ones that can be programmed by a computer. Moreover, the capacity of a robot to identify any impediments in its route and create its own obstacle-free path is referred to as obstacle avoidance.

By using an ultrasonic sensor to detect obstructions, the line follower may stop until it is removed. This class of robots is equipped to handle a range of tasks in diverse industries. In industries, these robots can serve as automated equipment carriers in place of traditional conveyer belts. They also have domestic uses, with healthcare administration being one of the more fascinating. As it can recognise impediments and will stop moving until they are removed or the path is changed, this intelligent line-following robot will not be easily damaged. Although obstacles are common in all occupations, the robot will be more beneficial in some industries if it is not outfitted with this skill.

II. HARDWARE DESCRIPTION:

IR Sensor: The infrared (IR) sensors are made up of infrared (IR) photodiodes and LEDs. Infrared LEDs are referred to as photoemitters and photodiodes as receivers. The surface is hit by the IR light the LED emits, which is then reflected back to the photodiode. The outputvoltage from the photodiode is thus proportional to the reflectance, which is high for a bright surface and low for a dark surface. Dark coloured items reflect less IR light, while bright coloured ones reflect more.

Figure 1- IR Sensor

Ultrasonic Sensor: An ultrasonic sensor is a tool that uses sound waves to gauge a distance to an item. A sound wave at a specific frequency will be sent out, and the distance will be measured by listening to the sound wave as it returns. Certain objects may not be detectable by an ultrasonic sensor because the reflected sound wave may diverge from its intended path and not be picked up by the sensor, rendering the barrier undetectable. Also, the sound wave won't be able to bounce back if the obstruction is too small. Although this component might be disregarded, the temperature and humidity of the region where the ultrasonic sensor is being utilised also affect its accuracy.

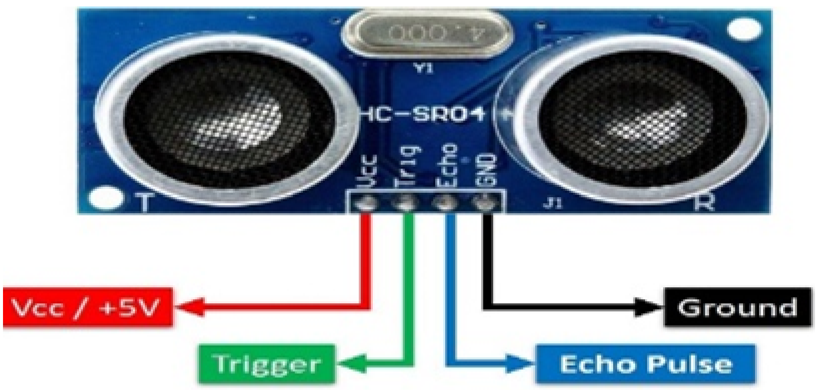

Figure 2- Ultrasonic sensor

Arduino: The Arduino project was launched in 2003 with the goal of giving experts an easy method to construct devices that can interact with the environment using sensors and actuators. An Atmel 8-bit AVR microprocessor with different quantities of flash memory, pins, and other features makes up the majority of the Arduino boards. The Universal Serial Bus, which is implemented using USB to Serial converter chips like the FTDI FT232, is used to programme Arduino boards. Any programming language with compilers that generate binary machine code for the target processor can be used to create an Arduino application. The integrated development environment (IDE), a cross-platform application created in the Java programming language, is offered by the Arduino. With the help of certain code organisation guidelines, this IDE also supports C and C++.

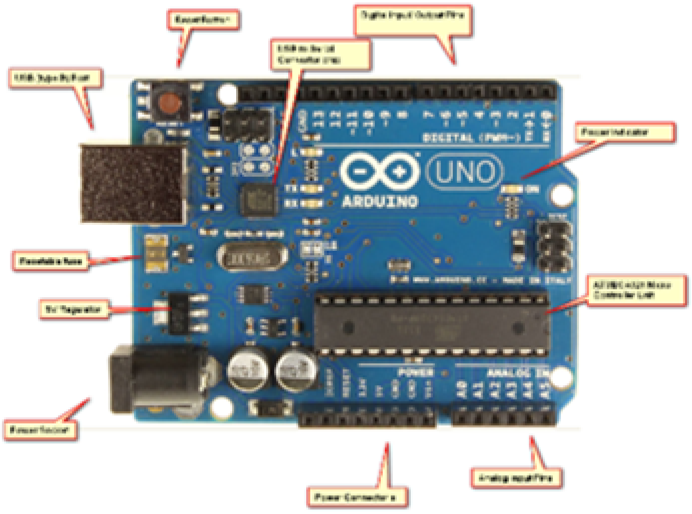

Figure 3-Arduino

Motor Driver: A motor driver amplifies current. The current in the motor is managed by the motor driver. When the circuit receives little current, the motor driver will provide the motor with high current. To operate these motors, a significant amount of electricity is required. Two DC motors may be controlled at once using the IC L293D. Both forward and backward rotation of the motor are possible. When the robot wants to turn left or right, the motor driver manages the motors. It entirely regulates how dc motors move.

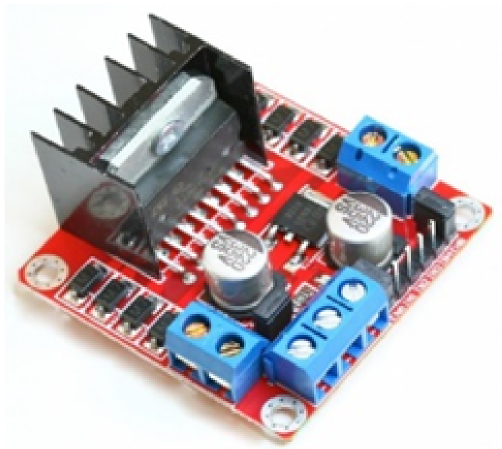

Figure 4-Motor Driver

Wheels and Motors: This line follower robot with obstacle sensing uses two dc motors. The robot's front is equipped with a castor wheel, which facilitates effortless mobility in all directions. The motor drive controls the two DC motors, and in response to the signal, the motors operate. Arduino is used to operate the entire system, and it receives instructions about the path and obstacles so that it may control the entire robot in accordance with the software that has been supplied to it.

III code:

```
#define enA 10//Enable1 L298 Pin enA

#define in1 9 //Motor1  L298 Pin in1

#define in2 8 //Motor1  L298 Pin in1
```

```
#define in3 7 //Motor2  L298 Pin in1
#define in4 6 //Motor2  L298 Pin in1
#define enB 5 //Enable2 L298 Pin enB

#define L_S A0 //ir sensor Left
#define R_S A1 //ir sensor Right

#define echo A2    //Echo pin
#define trigger A3 //Trigger pin
#define servo A5
int Set=15;
int distance_L, distance_F, distance_R;
void setup(){ // put your setup code here, to run once
Serial.begin(9600); // start serial communication at 9600bps
pinMode(R_S, INPUT); // declare if sensor as input
pinMode(L_S, INPUT); // declare ir sensor as input
pinMode(echo, INPUT );// declare ultrasonic sensor Echo pin as input
pinMode(trigger, OUTPUT); // declare ultrasonic sensor Trigger pin as Output
pinMode(enA, OUTPUT); // declare as output for L298 Pin enA
pinMode(in1, OUTPUT); // declare as output for L298 Pin in1
pinMode(in2, OUTPUT); // declare as output for L298 Pin in2
pinMode(in3, OUTPUT); // declare as output for L298 Pin in3
pinMode(in4, OUTPUT); // declare as output for L298 Pin in4
pinMode(enB, OUTPUT); // declare as output for L298 Pin enB

analogWrite(enA, 200); // Write The Duty Cycle 0 to 255 Enable Pin A for Motor1 Speed
analogWrite(enB, 200); // Write The Duty Cycle 0 to 255 Enable Pin B for Motor2 Speed

pinMode(servo, OUTPUT);

for (int angle = 70; angle <= 140; angle += 5)  {
servoPulse(servo, angle);  }
 for (int angle = 140; angle >= 0; angle -= 5)  {
servoPulse(servo, angle);  }
 for (int angle = 0; angle <= 70; angle += 5)  {
servoPulse(servo, angle);  }
distance_F = Ultrasonic_read();

delay(500);
}

void loop(){
//==============================================
//     Line Follower and Obstacle Avoiding
//==============================================

distance_F = Ultrasonic_read();
Serial.print("D F=");Serial.println(distance_F);

//if Right Sensor and Left Sensor are at White color then it will call forword function
```

```
 if((digitalRead(R_S) == 0)&&(digitalRead(L_S) == 0)){
if(distance_F> Set){forword();}
else{Check_side();}
 }
//if Right Sensor is Black and Left Sensor is White then it will call turn Right function
else if((digitalRead(R_S) == 1)&&(digitalRead(L_S) == 0)){turnRight();}

//if Right Sensor is White and Left Sensor is Black then it will call turn Left function
else if((digitalRead(R_S) == 0)&&(digitalRead(L_S) == 1)){turnLeft();}

delay(10);
}

void servoPulse (int pin, int angle){
int pwm = (angle*11) + 500;      // Convert angle to microseconds
digitalWrite(pin, HIGH);
 delayMicroseconds(pwm);
digitalWrite(pin, LOW);
delay(50); // Refresh cycle of servo
}

//*********************Ultrasonic_read****************************
long Ultrasonic_read(){
digitalWrite(trigger, LOW);
delayMicroseconds(2);
digitalWrite(trigger, HIGH);
delayMicroseconds(10);
long time = pulseIn (echo, HIGH);
return time / 29 / 2;
}
void compareDistance(){
if(distance_L>distance_R){
turnLeft();
delay(1500);
forword();
delay(1000);
turnRight();
delay(1500);
forword();
delay(800);
turnRight();
delay(1500);
  }
else{
turnLeft();
delay(1500);
forword();
delay(1000);
turnRight();
delay(1500);
```

```
forword();
delay(800);
turnRight();
delay(1500);/
  }
}
void Check_side(){
Stop();
delay(100);
 for (int angle = 70; angle <= 140; angle += 5)  {
servoPulse(servo, angle);  }
delay(300);
distance_R = Ultrasonic_read();
Serial.print("D R=");Serial.println(distance_R);
delay(100);
  for (int angle = 140; angle >= 0; angle -= 5)  {
servoPulse(servo, angle);  }
delay(500);
distance_L = Ultrasonic_read();
Serial.print("D L=");Serial.println(distance_L);
delay(100);
 for (int angle = 0; angle <= 70; angle += 5)  {
servoPulse(servo, angle);  }
delay(300);
compareDistance();
}
void forword(){  //forword
digitalWrite(in1, LOW); //Left Motor backword Pin
digitalWrite(in2, HIGH); //Left Motor forword Pin
digitalWrite(in3, HIGH); //Right Motor forword Pin
digitalWrite(in4, LOW); //Right Motor backword Pin
}
void backword(){ //backword
digitalWrite(in1, HIGH); //Left Motor backword Pin
digitalWrite(in2, LOW); //Left Motor forword Pin
digitalWrite(in3, LOW); //Right Motor forword Pin
digitalWrite(in4, HIGH); //Right Motor backword Pin
}
void turnRight(){ //turnRight
digitalWrite(in1, LOW); //Left Motor backword Pin
digitalWrite(in2, HIGH); //Left Motor forword Pin
digitalWrite(in3, LOW); //Right Motor forword Pin
digitalWrite(in4, HIGH); //Right Motor backword Pin
}
void turnLeft(){ //turnLeft
digitalWrite(in1, HIGH); //Left Motor backword Pin
digitalWrite(in2, LOW); //Left Motor forword Pin
digitalWrite(in3, HIGH); //Right Motor forword Pin
digitalWrite(in4, LOW); //Right Motor backword Pin
}
```

```
void Stop(){ //stop
digitalWrite(in1, LOW); //Left Motor backword Pin
digitalWrite(in2, LOW); //Left Motor forword Pin
digitalWrite(in3, LOW); //Right Motor forword Pin
digitalWrite(in4, LOW); //Right Motor backword Pin
}
```

IV.WORKING PRINCIPLE:

The Arduino IDE needs to have the ultrasonic sensor library loaded. Both IR sensors must be initialised in the application. The motor's four output pins need to be initialised. It is necessary to declare three variables- two for the IR sensors and one for the ultrasonic sensor.The values of IR sensors 1 and 2 will be read by the two variables that are specified for the IR sensor. The variable for the ultrasonic sensor is defined, and it looks for obstacles up to a certain distance. The four output pins of the motor drive should be set as LOW, which means they should stop functioning, if the ultrasonic sensor finds any obstruction in its route, causing all of the motors to halt.So, the robotic will halt until the barrier in its way isremoved when an obstacle is detected by the ultrasonic sensor, at which point the motors will also stop. The robot should move when neither an obstruction nor a black line are seen.

The motor's two side pins will each have one HIGH and two LOW connections. The robot advances as a result of the left and right motors rotating in a clockwise manner as a result. Just the right motor has to operate for the robot to turn left when the left IR sensor only sees a black line. The robot will turn left when the left motor stops and the right motor begins to rotate anticlockwise. All except one of the right motor's pins should be in the LOW position. Just the left motor must operate for the robot to turn right when the black line is only detected by the right IR sensor.

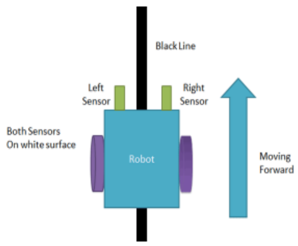

Figure 5: Forward movement

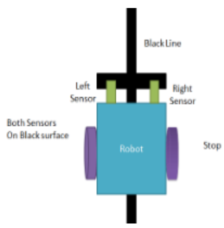

Figure 6: Stop the robot

The robot advances when both sensors are on a white surface, and it stops when both sensors are on a black surface. In this scenario, both sensors will pick up the black line, but depending on where they are placed, the robot will either halt or advance.

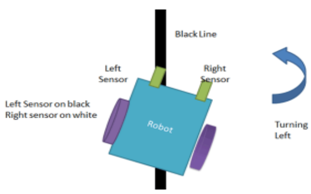

Figure 7: Turning left

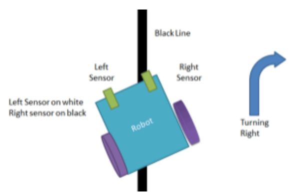

Figure 8: Turning right

The robot must turn left when the left sensor notices a black line and the right sensor is unable to do so. The robot must turn right when the right sensor notices a black line and the left sensor is unable to do so.

CONCLUSION:

The line follower robot has therefore been successfully created and put into use. These robots' more sophisticated versions can be utilised in public transportation systems and other types of public transit. They may be readily used without the usage of additional gadgets like cellphones, remote controls, WiFi, etc. With an Arduino microcontroller, this will run automatically while adhering to a certain line.

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