

# Surface Detection and Avoidance Robot

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**ABSTRACT**— Robotics is the field which occupies vast section in today's world. Most of them are autonomous, self-intelligent, and they reduce most of human work. Here we have designed a robot that will avoid absence of surface underneath automatically without any control. So human life is saved while driving an automobile if this arrangement is placed in front of driving automobiles. IR Sensor is used for detecting the surface below the robot. L293D motor driver is used for controlling the motors in the robot. We have avoided the use of microcontroller in this robot, so designing the circuit is much easier.

**KEYWORDS:** IR LED's, LM358 IC, 7404 NOT Gate IC, L293D Motor Controller IC, Voltage Regulator 7805, Trimmer Potentiometers, DC Motors.

## 1 INTRODUCTION

Today in most places, accidents are occurring. Some of the accidents are occurring in highways and mountain regions. Travelling on mountains in an automobile is not much easier. There will be so many Edges in the mountains. Driving the vehicle even in medium speed will sometimes lead to accidents. So to avoid accidents while travelling in mountains, we have designed a model robot that avoid falling of the robot in absence of surface. We haven't used any microcontroller and programming for the robot, so designing is much easier.

IR Sensor is used for the detecting the surface below the robot. IR Sensor will give output if it finds any object in front of it. To perform the reverse operation of IR sensor we have used IC 7404. This IC is a NOT GATE IC. The IR Sensor is connected to this IC and from this IC the output is given to L293D motor controller. This Motor controller controls the motors. By this designing we can able to avoid falling of robot if there is no surface underneath.

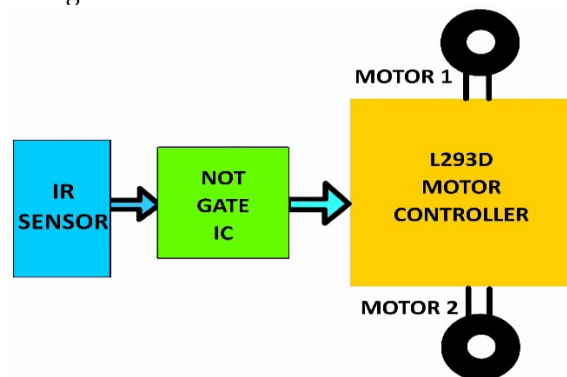


Fig. 1 Block diagram of Fall Avoider Robot.

## 2 SYSTEM ANALYSIS

We have mainly designed this robot to avoid accidents, while travelling in mountains and slopes. The robot is controlled by using the IR Sensor which is placed in front of the vehicle or robot. The IR sensor will sense the surface below it. If there is any absence of surface, it turns the vehicle to the safest position. Thus we can avoid falling of the robot.

## 3 HARDWARE TOOLS USED

- Two pairs of IR Sensor
- Hex inverter 7404 IC
- L293D motor controller IC
- 12V 200RPM Motors
- 12V battery
- Robot Chassis
- Castor Wheels

## 4 HARDWARE DESCRIPTION

### 4.1 IR Sensor

A sensor is a device that converts physical varying parameters to digital form. IR Sensor is used to detect the objects before it.

### 4.2 IR LED and Photodiode

IR Sensor consists of two diodes in it. One is the Transmitter diode known as IR LED and the Receiver diode known as the Photo Diode. Invisible rays are transmitted from IR Led, which in turn reflected back to photo diode if it falls on any object. This photo diode receives the rays and converts to electric current in binary form.

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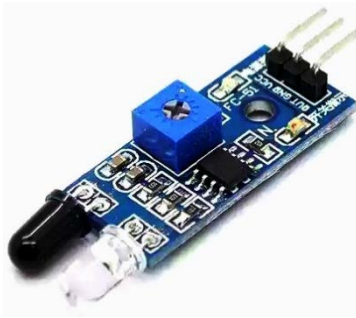


Fig 1.1 IR Sensor

### 4.3 LM 358 IC

LM358 IC is a Single Supply Dual Op-Amp IC which performs some mathematical calculations. Here we used it as a comparator. Here it is used for comparing white and black surfaces. Most IR Sensor will reflect rays only if the surface is light coloured such as white. Black surfaces will not reflect the transmitted rays.

It is a Dual Op-Amp IC; so from a single LM 358 IC we can make two IR Sensors with a single supply. In this robot we need two IR Sensors and for driving those two IR Sensors we need a 9V power supply. So we have used voltage regulator 7809 for IR Sensor.

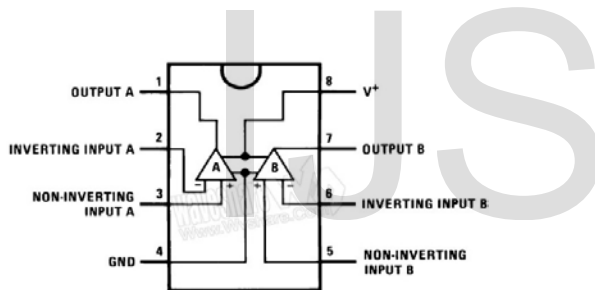


Fig 1.2 Pin configuration of LM 358 IC.

### 4.4 Voltage Regulator 7805 And 7809

Voltage regulator is an electrical component which is used to maintain a constant voltage output even if its input varies. But for better output voltage efficiency of voltage regulator, the input voltage should be greater than the output voltage (marked on top of voltage regulator IC).

In this robot we have used two voltage regulators; 7805 and 7809. 7809 is used to maintain only 9V output supply for the IR Sensor from the input supply. i.e. 12V.

7805 is used to maintain only 5V output voltage for pins 1,9,16 in L293D motor driver IC.



Fig. 1.3 Voltage Regulator 7805

### 4.5 Trimmer Potentiometer

Trimmer potentiometers is a type of resistor which can be tuned. i.e. the value of resistances can be varied. Here we have used this trimmer potentiometer for varying the sensitivity of the sensor. In this robot we have made use of 10k Trimpot for varying the sensitivity of the IR Sensor.



Fig 1.4 Trimmer Potentiometer

### 4.6 Hex Inverter NOT Gate IC

NOT GATE IC is also known as inverter IC that inverts the input signal. i.e. it converts 0's to 1's and 1's to 0's. It reads only binary form. Here in this robot we have used hex inverter IC 7404 which performs NOT GATE operation. The output from IR Sensor is given to the NOT GATE IC for inverting the operation of IR Sensor.

NOT GATE IC 7404 is used to invert the received signal. Since IR Sensor will stops the movement of the robot if it finds any objects in front of it i.e. like an obstacle avoider robot. So to invert the operation of the IR Sensor we have used this NOT GATE IC 7404.

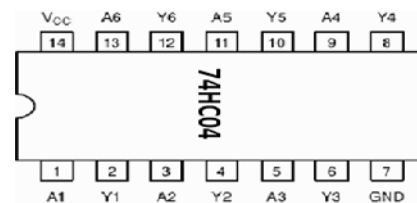


Fig. 1.5 Pin configuration of IC 7404.

We can also use Hex Buffer CD 4049 IC, which has maximum voltage handling capacity of 18V. But here we have used IC 7404 which has voltage rating of 6V, since it is the well-known NOT Gate Inverter IC.

### 4.7 L293D Motor Controller

L293D is a quadruple high-current H-bridge drivers which was designed to offer bidirectional drive currents up to 600mA and a voltage handling capacity of up to 4.5 V to 36 V. This is designed for operating inductive loads such as solenoids, relays, dc motors etc..

Here we have used it for controlling the 12 V dc motors which causes the movement of the robot. Pin 3 and pin 6 controls motor 1 and pin 11 and pin 14 controls motor 2. The outputs from IR Sensor are given to IC 7404 IC and

then the inverted output from the IC 7404 IC is given to pin 2 and pin 15 of L293D IC.

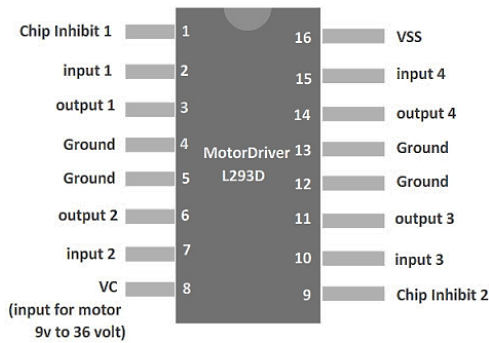


Fig 1.6 Pin configuration of L293D IC

## 5 CIRCUIT DIAGRAM

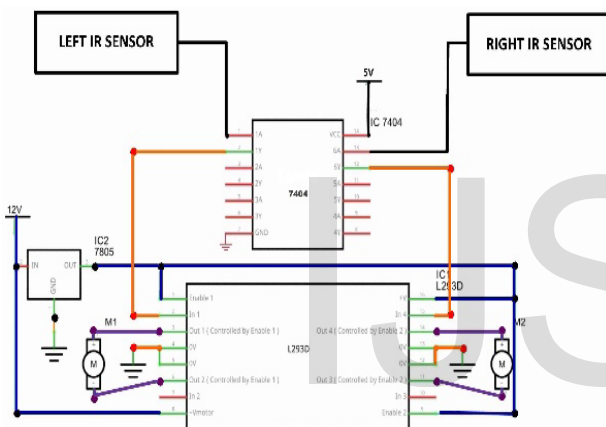


Fig 1.7 Circuit diagram of the robot

## 6 WORKING OF THE ROBOT

The IR Sensors are placed in front of the robot. The figure below shows, how to place the IR Sensor in front of the robot.

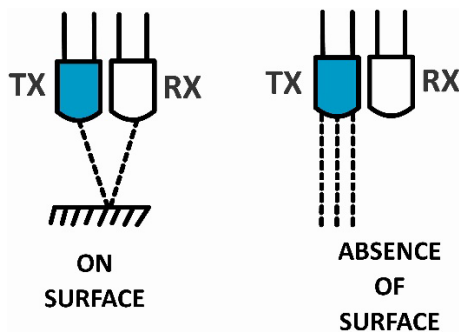


Fig 1.8 Front view of the robot.

The IR LED and the photodiode are bent to face the ground below, so that it can sense the surface underneath. The rays

transmitted from the IR LED falls on the surface of the ground beneath and gets reflected back to the photodiode. The photodiode converts the received signal to binary form.

The output from IR Sensor if given to IC 7404 IC and the inverted output from IC 7404 is given to input pins of L293D IC. If both the inputs are "high" then the robot will move forward. If any one of the input is "low" the robot will stop the alternative motor. If both the inputs are "low" then the robot will not move in any direction.

Initially the robot starts moving forward. The IR Sensor gives the output continuously till it senses the surface below it. If there is any absence of surface, it stops the movement of the alternative wheel. So it turns to the safest position. It is based on the principle that, which sensor senses first, the robot will turn in the opposite direction. That is if the right sensor senses first the robot will turn in the opposite (left) direction. Similarly if left sensor senses first it turns right. The robot will keep on turning till the IR Sensor senses the ground. So the robot will keep on searching for the ground make it safer from falling.

Suppose if both the sensor senses that there is no surface below it, the robot will totally stop its movement. i.e. the robot will not move further. Since both the sensor will sense only if there is no surface in front of it or there will be a sharp corner as shown in figure.

Thus the robot will turn to the safest position and thus saves the life of human's.

## 7 APPLICATIONS

If the arrangement similar to the robot is placed in front of the driving automobile many accidents can be avoided.

It can be placed in front of surveillance robots.

It can be used in automobiles while driving on hills and mountains.

Not only robots and automobiles. With buzzer or speaker the arrangement can be placed in sticks used by visually challenged persons.

## 8 CONCLUSION

The arrangement in this robot is very useful while travelling in mountains. We can also use ultrasonic sensor for wide range of sensitivity.

This robot is very useful for photography's and also for identifying objects by the method of image processing techniques.

In future it is very useful for many purposes if some modifications can be done in this robot.

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