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BS IN COMPUTER SCIENCE

BS IN COMPUTER ENGINEERING

Electric Circuit Analysis (CSE 251)

First Semester - Academic Year 2016– 2017

Sem161

Project Title

Obstacle Avoiding Robot

Supervised by:

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Members of the group:

COURSE: CSE-251 **SECTION: 1**

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1. Objective:

The aim of this project is to create a robot which moves and avoids any obstacle in its path. This is a small-scale project which, if implemented at higher levels, can have many useful applications. It has benefits that can save lives and make life easier. This project is a prototype for a robot that can navigate difficult areas to perform rescue or salvage operations in times of need. Such a robot, with the optional addition of an embedded camera, may be able to find survivors in case of an accident. It can also be used for surveying landscapes. In addition to that, it can be used in the household such as to make an automated lawn mower, automated vacuum cleaner, or an object retriever. It can go through tight spaces and underneath furniture to find missing objects.

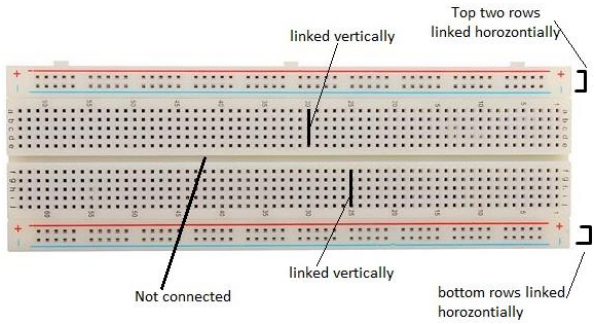
2. Introduction:

In the world of robotics, obstacle avoiding is using some technique to detect an obstacle and avoiding collision with it. Obstacle avoiding robots are autonomous robots that accomplish this task. Such robots have been a hot topic in the world for a while due to their wide range of uses. It has many real world applications such as automated appliances and guidance systems. This can be done using various methods such as by using IR emitters and sensors, or using lever switches.

In this project, the robot moves in a straight path until it detects an object in front of it. The detection is done using lever snap switches attached to the front. When the robot comes in contact with an obstacle, the switches are clicked. It then avoids the object by changing the direction of the wheels. Depending on which switch comes into contact with the object, it changes its path accordingly. It may turn to the right, left, or go backwards to avoid collision.

3. Hardware Components Used:

1- Bread board.



A breadboard which is used for testing prototype projects which has pins to insert components into it. The main benefit of it is that it can be reused for other projects. The holes in rows are linked horizontally, and column holes are linked vertically. Almost all people start to learn about electronics on this breadboard.

2- Jumper wires.

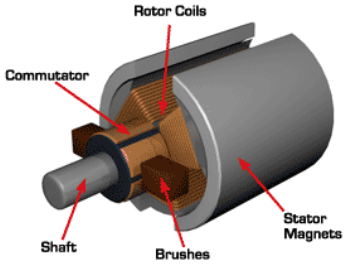
A jumper wire is a conducting wire used to transfer electrical signals between two points in a circuit. The wires can either be used to modify circuits or to diagnose problems within a circuit

3- 9 V battery with its clip.

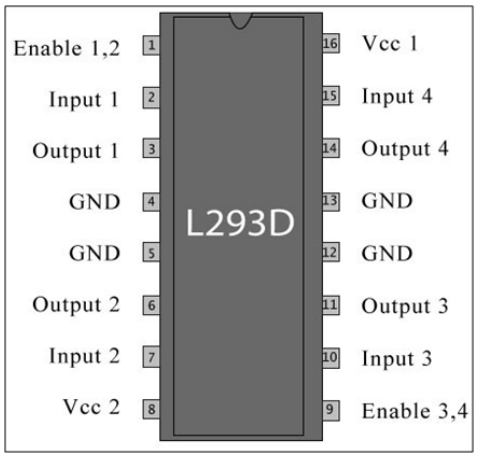
A battery is an electrochemical cell (an enclosed and protected material) that can be charged electrically to provide a static potential for power or released electrical charge when needed.

4- Two DC motors.

A **DC motor** is any of a class of rotary electrical machines that converts direct current electrical power into mechanical power.



5- L293D IC.



L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively.

Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

Pin Description:

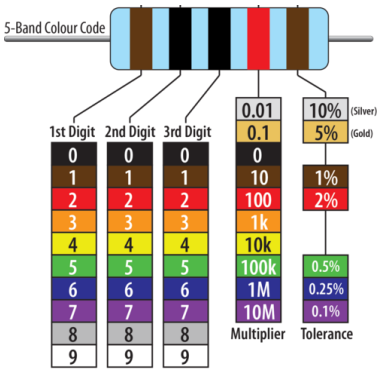
Pin No	Function	Name
1	Enable pin for Motor 1; active high	Enable 1,2
2	Input 1 for Motor 1	Input 1
3	Output 1 for Motor 1	Output 1
4	Ground (0V)	Ground
5	Ground (0V)	Ground
6	Output 2 for Motor 1	Output 2
7	Input 2 for Motor 1	Input 2
8	Supply voltage for Motors; 9-12V (up to 36V)	Vcc_2
9	Enable pin for Motor 2; active high	Enable 3,4
10	Input 1 for Motor 2	Input 3
11	Output 1 for Motor 2	Output 3
12	Ground (0V)	Ground
13	Ground (0V)	Ground
14	Output 2 for Motor 2	Output 4
15	Input2 for Motor 2	Input 4
16	Supply voltage; 5V (up to 36V)	Vcc_1

Truth table for robot movement:

Motor 1		Motor 2		Description
Pin2	Pin7	Pin15	Pin10	
0	0	0	0	Motors stops
0	1	0	1	Motors run anti-clockwise
1	0	1	0	Motors run clockwise
1	1	1	1	Motors stops

6- Five resistors(four 10k ohm, one 100 ohm)

A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit. It is a two-terminal device that has a fixed relationship between the current passing through it, and the voltage drop across it. This relationship is described in Ohm's law, which states that "the strength of a direct current is directly proportional to the potential difference and inversely proportional to the resistance of the circuit."



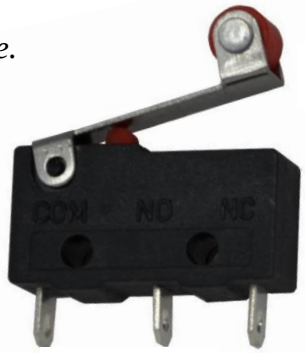
$I = \frac{V}{R}$. It does not have any polarity.

To find the value of a resistor, follow the table:

*(Brown, Black, Black, red, Brown)=100*100=10k ohm with 1% tolerance.*

(Brown, Black, Black, Black, Brown)=100 ohm with 1% tolerance.

7- Two micro switches with roller lever.



Lever

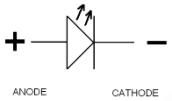
Common Normally Open Normally closed

Is an electric switch that is actuated by very little physical force, through the use of a tipping-point mechanism, called as its lever. A switch works by interrupting current flow around an electrical circuit. The switch is then said to be on when the lever is pressed, and electric current flows around the circuit. When the spring is released, the switch is open and the current flow is cut off.

8- Chassis of a toy car.

Chassis is the body of a robot. It can be constructed from a toy car.

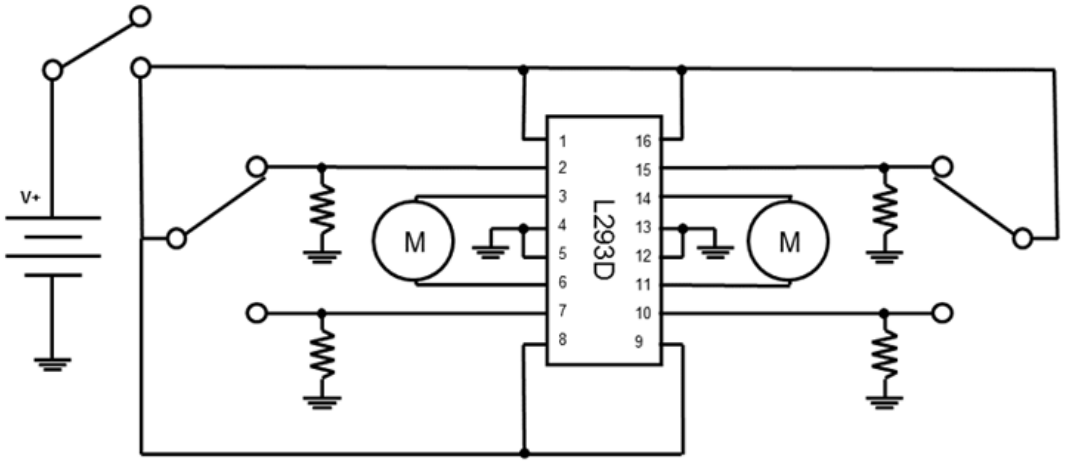
9- LED.



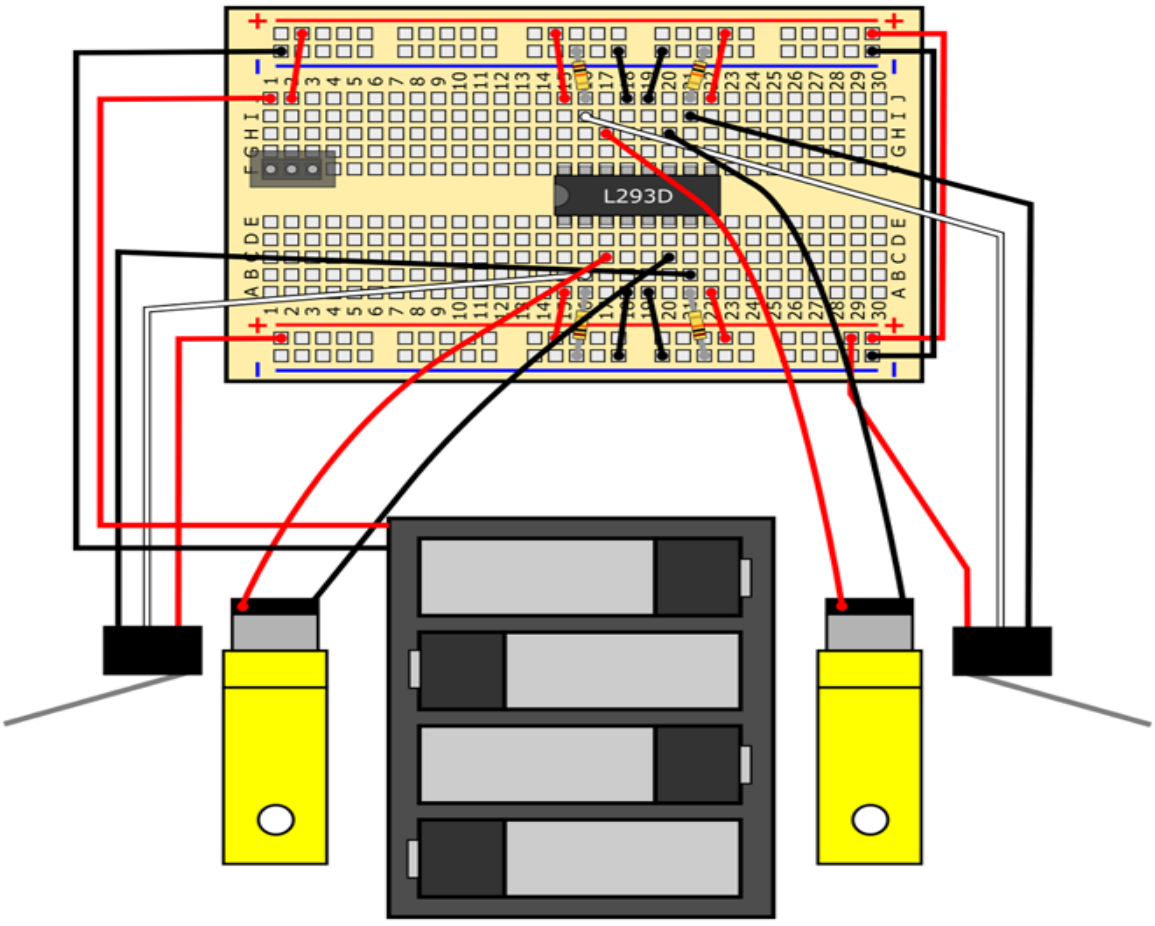
A light-emitting diode (a semiconductor diode which glows when a voltage is applied). The short pin is cathode which is the negative side. The longer pin is anode which is positive side. When an LED's anode lead has a voltage that is more positive than its cathode, the LED's voltage drops and current flows. Electrons are able to recombine with holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor.

4. Diagrams:

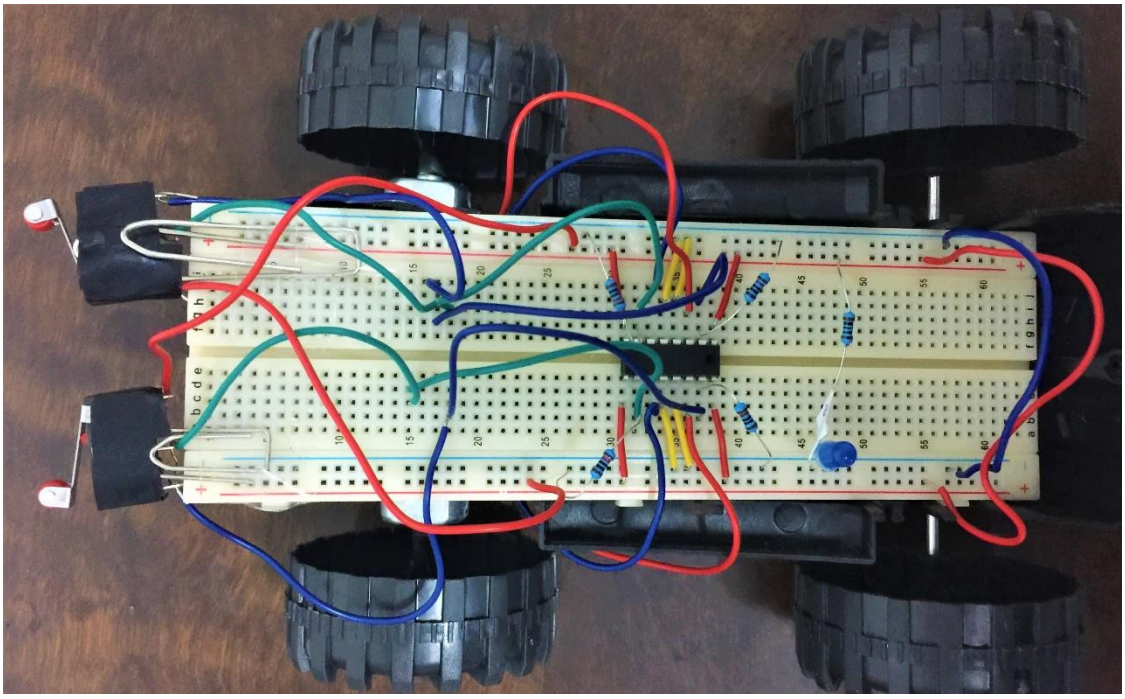
4.1 Circuit diagram

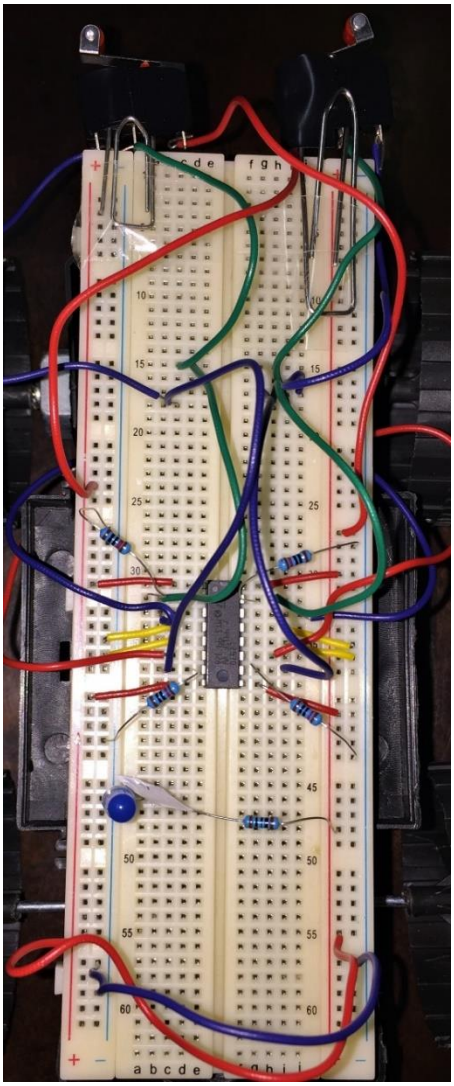


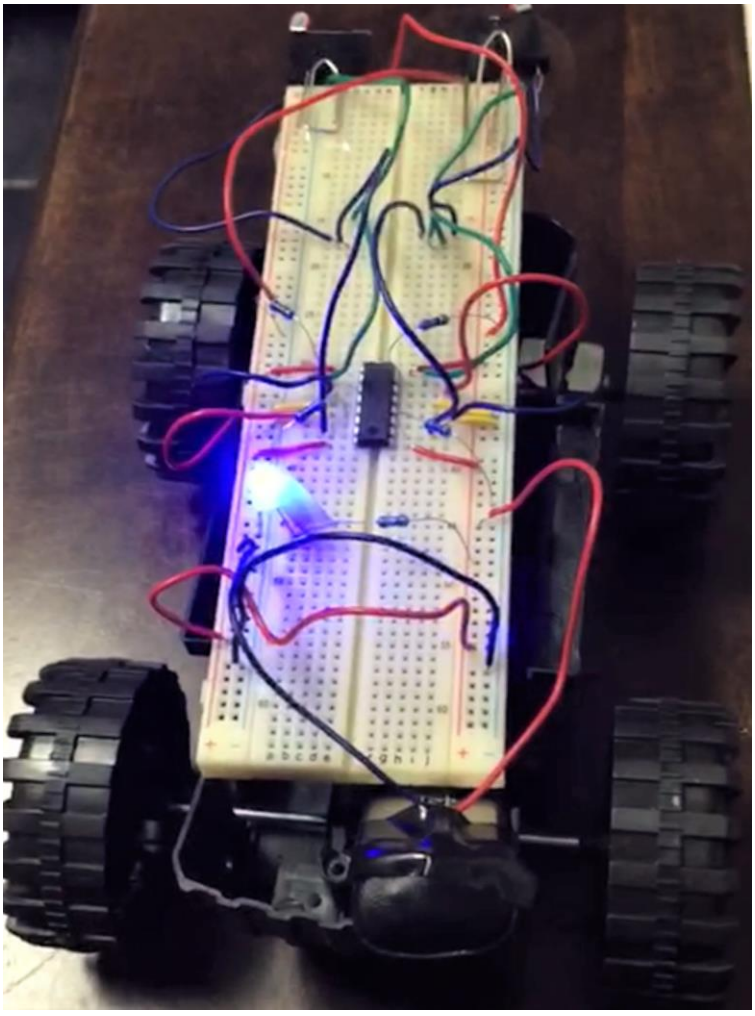
4.2 Simulation or Schematic diagram



4.3 Snapshot of the Original designed circuit.







5. Detailed Description of the Project:

An obstacle avoiding robot is controlled by the lever switches and L293D IC. The L293D enables the DC motors to move in either clockwise or anti-clockwise for as long as it is being supplied by the battery. Pins from 1 to 7 control the left DC motor 1, and pins from 9 to 15 control the right motor 2. Pin 16 is for the IC power, and pin 8 is for the motor power. The lever switches are the controls of the DC motor. It changes the movements of the DC motors when it detects an object. An LED is placed on the breadboard to verify that power is being supplied to the system. Thus, it is used for problem trouble shooting, so we can know if the battery is the issue or something else is.

When pin 1 is connected to the Vcc, it enables motor 1 on the left side and activates it. The DC motor 1 is connected to the output of IC through pin number 3 and 6. It is connected so that the logic input of pin 2 is 1 and pin 7 is 0 which is controlled and connected to the lever switch on the left side of the robot. Thus, enabling motor 1 to always move in a clockwise direction going forward. However, when an object comes in contact with the lever switch on left side of the robot, it reverses the logic inputs. Hence, the lever switch sends a signal that interrupts the current flow. When the object pushes the lever of the switch downwards, the switch sends a signal that reverses the polarity or logic inputs of pin number 2 and 7. Therefore, changing the motor 1's direction to anti-clockwise for as long as the lever is pressed. Then, when the switch's lever is released, the direction of motor 1 resumes as clockwise. Furthermore, when the direction switches from clockwise to anti-clockwise and vice versa, it allows the robot to have a slight turn to the left.

The same concept applied on motor 1 is being applied to motor 2. The only difference is the numbers of the connected pins. Output pins number 11 and 14 of the IC is connected to motor 2. Pins number 15 and 10 are the logic inputs of motor 2 which is controlled and connected to the lever switch on the right side of the robot. Pin 15 is 1 and pin 10 is 0, so the motor spins in clockwise going forward until the lever switch encounters an object. Thus, interrupting the current flow and reversing the logic inputs at pin 15 and 10 which make the robot move anti-clockwise. By switching from clockwise to anticlockwise and vice versa, the robot turns slightly to the right. When both lever switches are pressed, both motors move anticlockwise.

In conclusion, this robot uses the L293D and lever switches as its main components. Thus, controlling the robot to avoid any obstacle it comes across in its path.

6. Security Requirements:

- It is essential for all the pins to be connected correctly. Failure to do so can result in a malfunctioning robot. This is due to the fact that every pin has a specific purpose. For instance, if the power is connected to the trigger pin, the robot will not function. The wrong configuration may also result in damaged components if a certain pin is not designed to handle a power source.
- The ground and the power supply should be connected properly. Reversing them can result in components burning out. Most components are not designed to function if the polarity is reversed. Such a mistake can cause a short circuit and can result in smoke.
- Although the robot is autonomous and requires minimal human interception, it is necessary to make sure the surface on which the robot travels is free of water, and other such materials that can damage the machine. This is due to the fact that water is a conductor of electricity and can cause a short circuit.

7. Software Requirement :

1- InkScape: A free and open source design tool. The circuit diagram for this robot has been designed using this program.

2-

8. Keywords Used:

1- Vcc –voltage at the common collector.
2- V in ohm's law V=RI –Stands for voltage. Voltage is an electrical pressure which causes current to flow through a resistance.
3- I –Stands for current. Current is the motion of negative charges.
4- R –Stands for Resistance. Resistance is a hindrance/opposition to the passage of an electrical current.
5- V –Stands for volts. It is the derived unit which is a standard international unit for electric potential, electric potential difference (voltage). The difference of potential that would carry one ampere of current against one ohm resistance.
6- DC –Direct current. It is the direct flow or movement of electric charge carriers (which are usually electrons). The intensity of the current can vary with time, but the general direction of movement stays the same at all times.
7- IC –Integrated chip. Is a set of electronic circuits on one small flat piece (or "chip") of semiconductor material, normally silicon. The integration of large numbers of tiny transistors into a small chip resulted in circuits that are orders of magnitude smaller, cheaper, and faster than those constructed of discrete electronic components.
8- k is a symbol of a prefix or scale of a number. It has a value of 10^3=1000.

9. Conclusion:

In this project, a functional obstacle-avoiding robot was manufactured. It can safely be said that the objective set has been completed. The robot is capable of moving autonomously and avoiding objects or obstacles in its path. This was achieved with the help of an L293D motor driver IC, lever switches, and motors. As the robot comes into contact with an obstacle, the switch is clicked. Then, the IC changes the direction of the motors based on which side the contact occurs and moves the robot away from the obstruction. It is able to avoid obstacles it encounters in the front, on its left, and on its right. In the future, this system can further be modified to fit various needs such as to make a guidance robot.

10. References:

Websites:

1- *http://www.engineersgarage.com/electronic-components/l293d-motor-driver-ic*
2- *http://www.engineersgarage.com/electronic-circuits/h-bridge-motor-control*
3- *http://www.robometricschool.com/2013/01/electronic-circuit-schematic-dc-motor.html*
4- *https://en.wikipedia.org/wiki/DC_motor*
5- *https://www.reference.com/science/switch-work-circuit-e56d08c77a70f619#*
6- *http://whatis.techtarget.com/definition/integrated-circuit-IC*
7- *http://www.sciencebuddies.org/science-fair-projects/project_ideas/Robotics_p028/robotics/obstacle-avoiding-robot.shtml#summary*
8- https://en.m.wikipedia.org/wiki/Obstacle_avoidance

Books:

1- Engineering Circuit Analysis 8th edition.

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