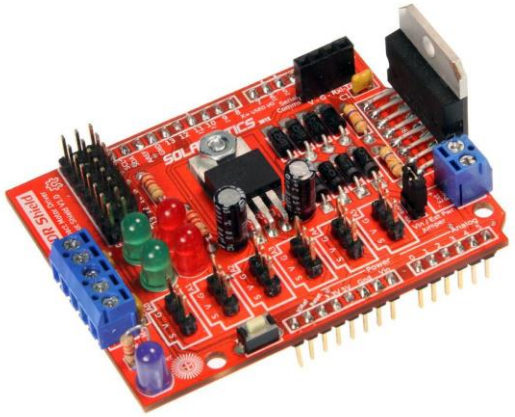
TINKERING LAB PROJECT



TOPIC NAME- WIRELESS SENSOR (ARDUINO OBSTACLE AVOIDING)

GROUP NO. - **G-4**

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WIRELESS SENSOR

Wireless Sensor (WS) is an infrastructure-less wireless network that is deployed in form of wireless sensors in an ad-hoc manner that is used to monitor the system, physical or environmental conditions.

Sensor nodes are used with the onboard processor that manages and monitors the environment in a particular area. They are connected to the Base Station which acts as a processing unit in the WS System.

Base Station in a WS System is connected through Arduino and motor driver.

As you all know that In today's era wireless communication is like a boon to this modern world, wireless communication is the transfer of information between two or more points without use of an electrical conductor, optical fiber or any other medium which can generate a continuous guided medium for the transfer.

So here we are for discussing about such case only, which will be **"ARDUINO OBSTACLE AVOIDING"**, in this case what we will do is that we will use Arduino with motor driver, using both with power supply and ultrasonic sensor we will present our project.

Obstacle Avoiding DIY car is a device that can avoid every obstacle in its path. It will use an ultrasonic distance sensor and a servo motor. The robot will check how far the nearest obstacle is (in every direction) and then decide upon the actions to be taken. The servo controls the direction in which the distance sensor faces and if an obstacle hinders the robot, the servo will rotate the sensor in different directions. Once the robot is convinced that a certain direction is clear of any obstacles, it will turn the robot in that particular direction and then move in a straight line along that direction till the next obstacle is found. If there is no way to go ahead the robot executes a full 180° turn.

HARDWARE USED

1) ARDUINO UNO
2) MOTOR DRIVER
3) SERVO MOTOR
4) HC-SR04 ULTRASONIC SENSOR
5) GEAR MOTOR
6) CELL BATTERY
7) WHEEL

SPECIFICATIONS OF MODEL

Using this model we are taking a particular case of wireless communication and showing that by using an ultrasonic sensor the car will automatically detect obstacles in its path and will change its direction.

Before going further to build the car, it is important to understand how the ultrasonic sensor works because this sensor will have an important role in detecting obstacles. The basic principle behind the working of an

ultrasonic sensor is to note down the time taken by the sensor to transmit ultrasonic beams and receive the ultrasonic beams after hitting the surface. Then further the distance is calculated using the formula. In this project, the widely available HC-SR04 Ultrasonic Sensor is used

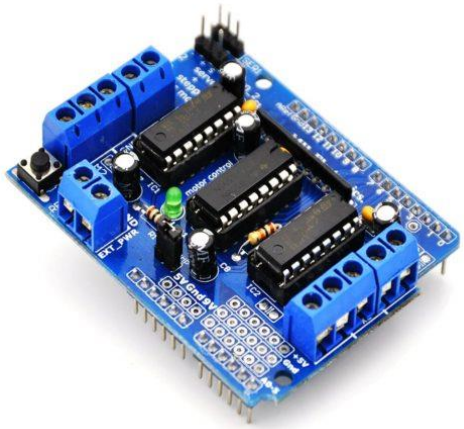
HARDWARE SPECIFICATIONS

ELECTRONIC COMPONENTS:

1. Arduino UNO

Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button.

2. Motor Driver



A motor driver is an electronic device that help us to convert electrical energy . Therefore, a motor driver enables us to perform tasks using electrical power.

3. Servo Motor

A servo motor is a type of motor that can rotate with great precision.

4. Ultrasonic Sensor

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal.

5. Gear Motor

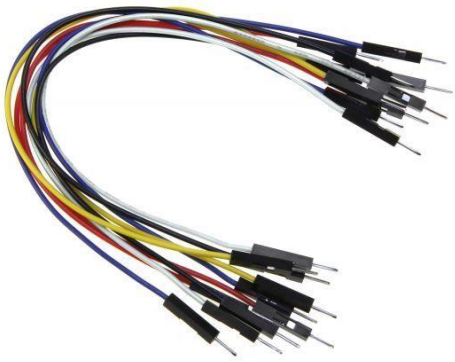
A gear motor is an electric motor coupled with a gearbox. In most cases, the addition of a gearbox is intended to limit the speed of the motor's shaft and increase the motor's output torque.

6. Battery

We have used 6 cells of each 1.5 V.

7.Male and Female Jumper wires

Female to female jumper wires



Male to male jumper wires

The difference between Male and Female Jumper wires is in the endpoint of the wire. **Male ends have a pin protruding and can plug into things, while female ends do not but are also used for plugging**. Moreover, a male connector is referred to as a plug and has a solid pin for center conduction.

8. Switch

The main function of a push button switch is **to switch something either on or off**.

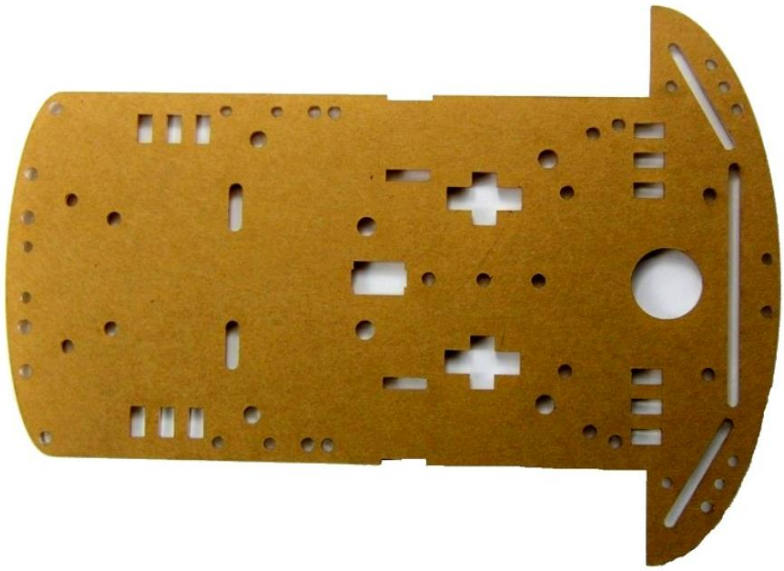
NON-ELECTRONIC COMPONENTS:

1) Wheels

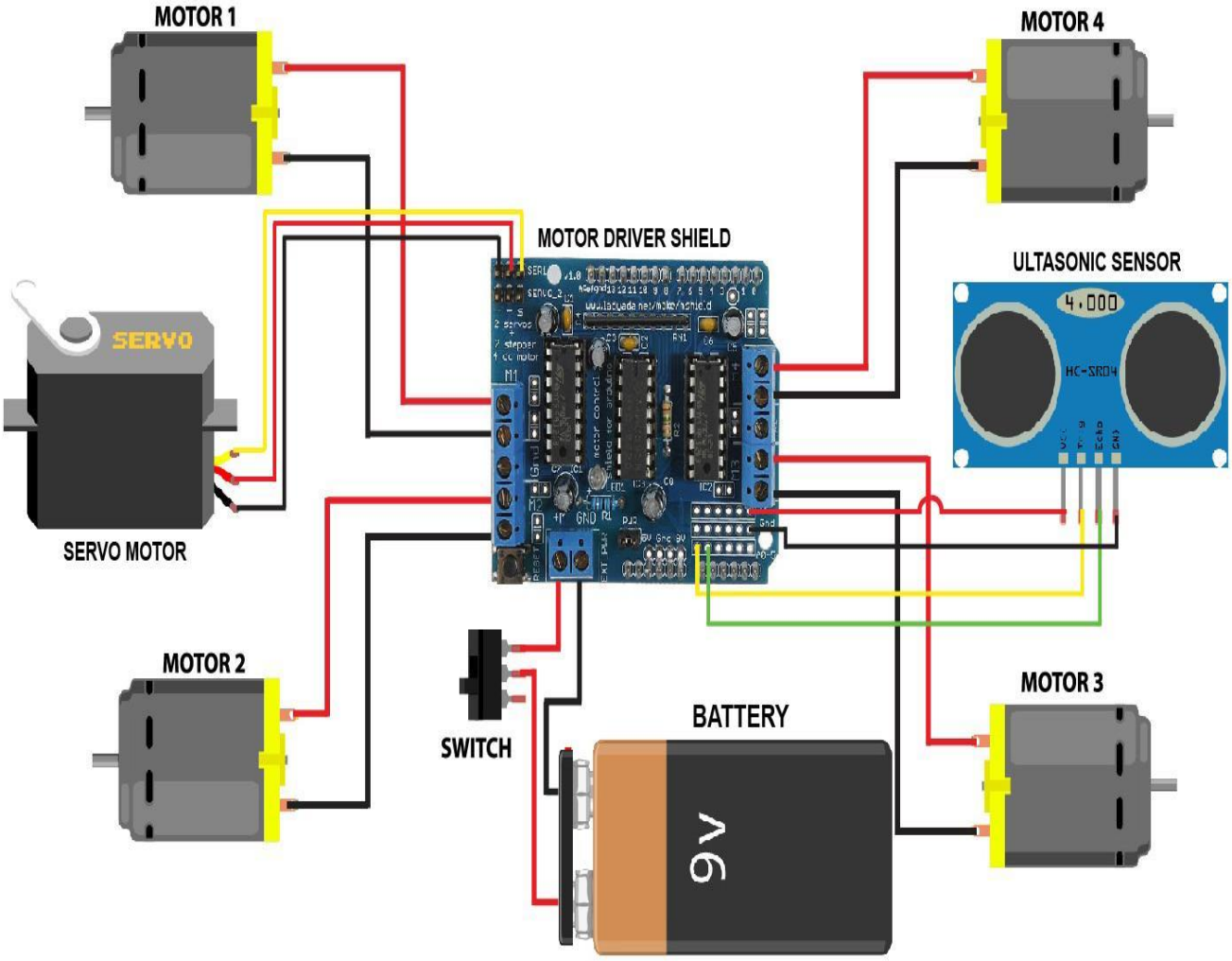
We have attached four wheels in our project .

2) Acrylic sheet (Wooden Sheet)

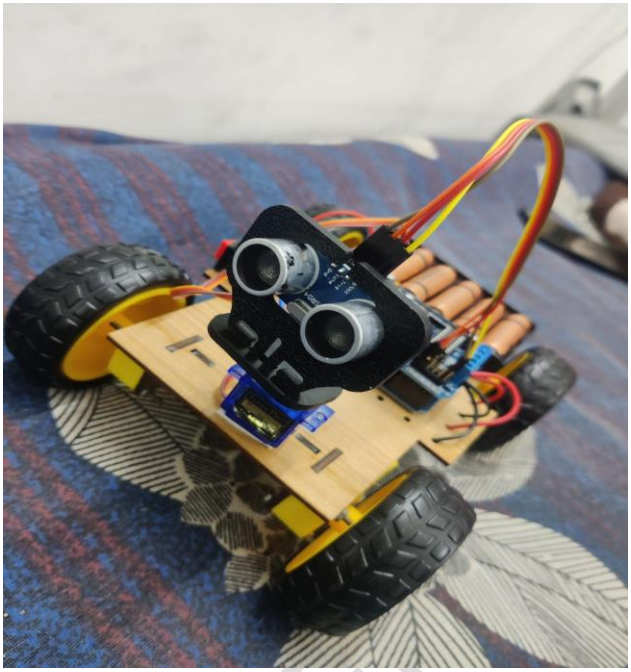
It is used as a base to put all components together and assemble them .

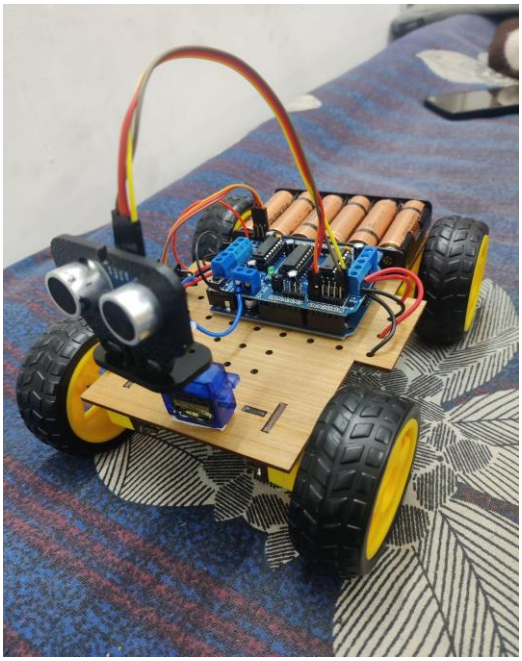


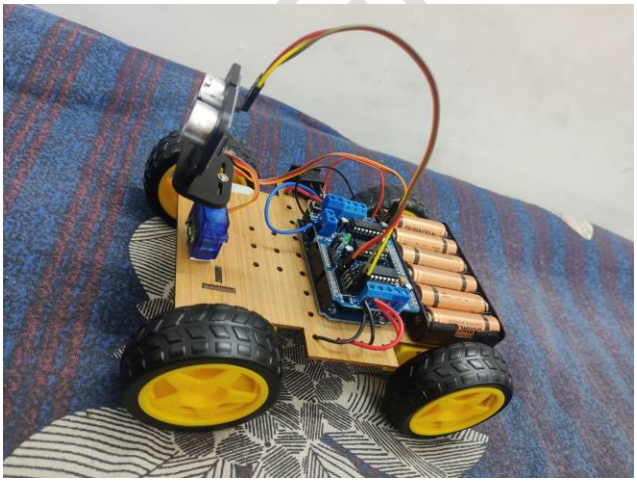
Details of the circuit diagram

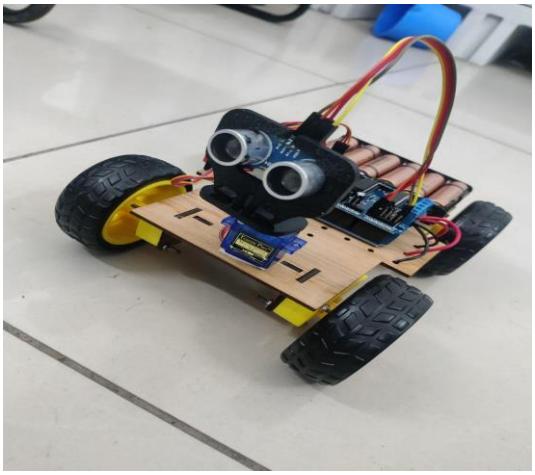


Actual Image of model









SPECIFICATIONS OF SOLUTION DEVELOPED

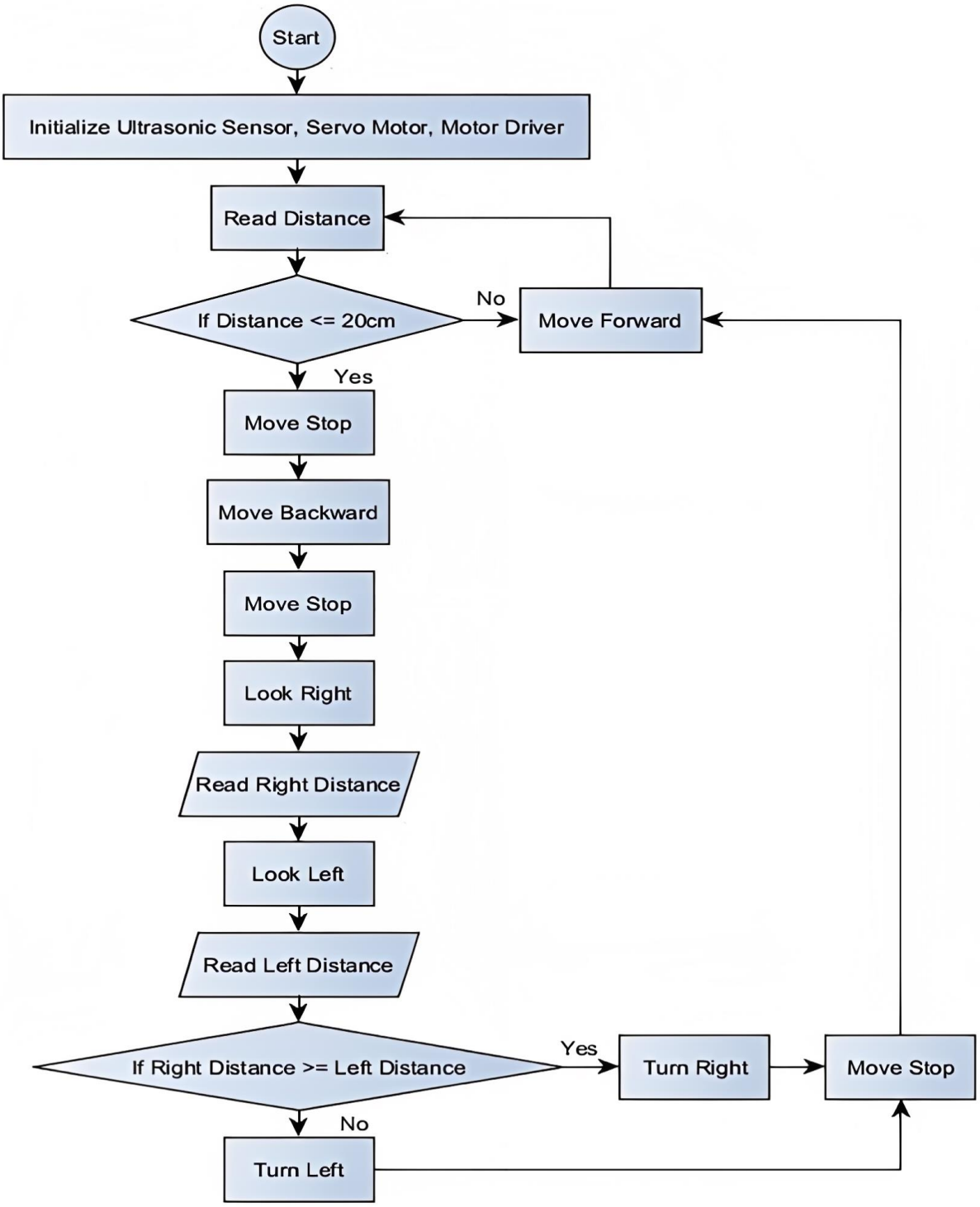
Software specifications (name of the software, packages, frontend, backend etc. used along with version no)

Name of the software: Arduino Integrated Development Environment

Packages (Name of the libraries):

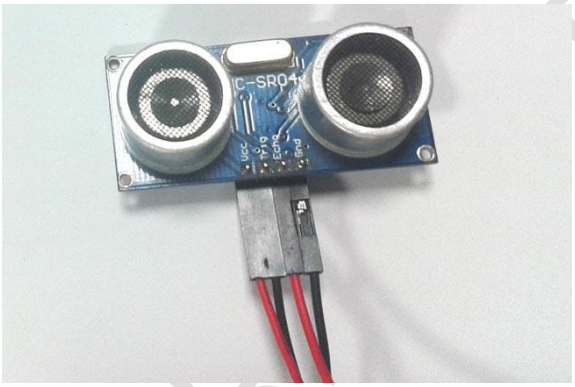
1) AF Motor Library
2) New Ping Library
3) Servo Library

Data flow diagram:

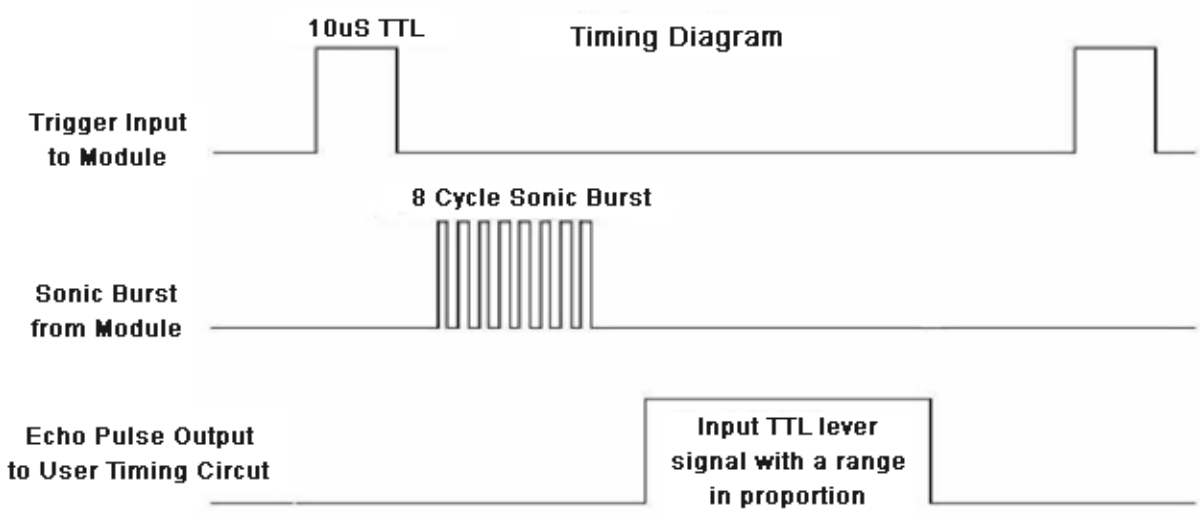


WORKING OF ULTRASONIC SENSOR

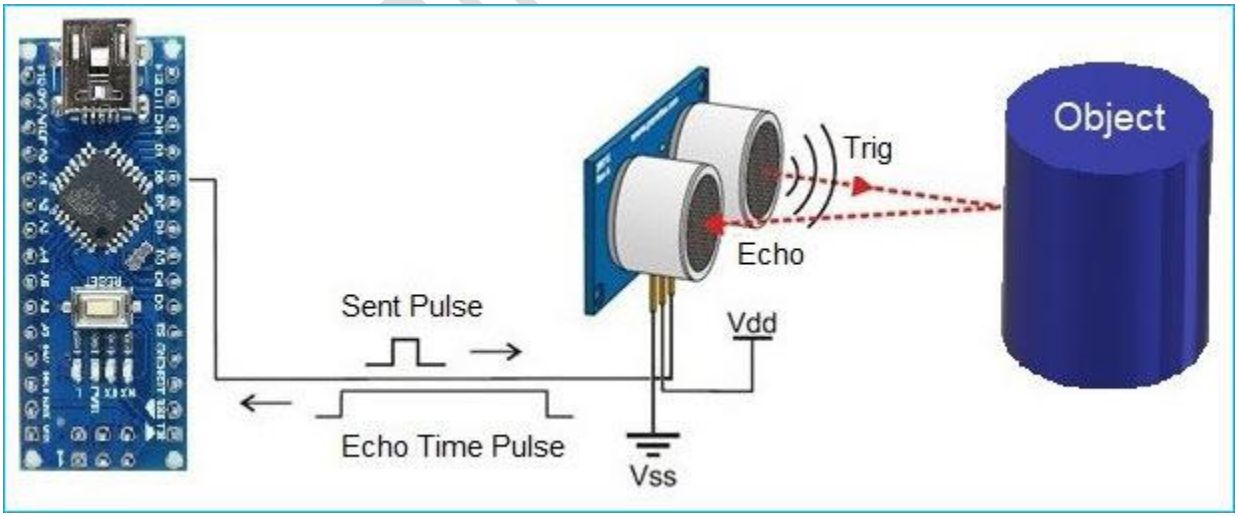
The basic principle behind the working of ultrasonic sensor is to note down the time taken by sensor to transmit ultrasonic beams and receiving the ultrasonic beams after hitting the surface. Then further the distance is calculated using the formula. In this project, the widely available **HC-SR04** is used.



So, the Trig pin of HC-SR04 is made high for at least 10 us. A sonic beam is transmitted with 8 pulses of 40KHz each.



The signal then hits the surface and return back and captured by the receiver Echo pin of HC-SR04. The Echo pin had already made high at the time sending high.



The time taken by beam to return back is saved in variable and converted to distance using appropriate calculations like below

Distance= (Time x Speed of Sound in Air (343 m/s))/2

WORKING OF OBSTACLE AVOIDING CAR

→ The obstacle avoidance robotic vehicle uses ultrasonic sensors for its movements. Arduino is used to achieve the desired operation.

→ The motors are connected through the motor driver IC to Arduino. The ultrasonic sensor is attached in front of the robot.

→ Whenever the robot is going on the desired path the ultrasonic sensor transmits the ultrasonic waves continuously from its sensor head.

→ Whenever an obstacle comes ahead of it the ultrasonic waves are reflected back from an object and that information is passed to the Arduino uno.

→ The Arduino controls the motors left, right, back, front, based on ultrasonic signals. In order to control the speed of each motor pulse width modulation is used (PWM).

→ When an ultrasonic sensor detects the object which is kept inside the path it will send the signal toward the Arduino uno and according to that it will rotate the motor.

→ M3 & M4 in forward direction and rotate the motor M1 & M2 in reverse direction such way that the car get moving in left direction.

→ Similarly, every time an obstacle is found to be in the path of a car it will detect it and rotate the car in the left direction to avoid the obstacle.

CONCLUSIONS

Today we are in a world of robotics and we use different types of robots daily in our life.

This "Obstacle Avoidance Robot Car" project is proved using the Ultrasonic sensor for detecting objects, Motor Driver Shield for driving the DC motors, DC motors for movement of the wheels of the robot with the help of the Arduino Microcontroller. The factors which affect the accuracy of the designed robot include the environment the robot was tested in and the number of present obstacles in the test space. These factors mainly affected the sensor which means that the accuracy of the robot is dependent on the sensor.
Actually, we enjoyed a lot in making this project and in our Tinkering lab . Throughout this course, we learned a lot of new things about Arduino uno.

RESULTS

The outcome of this thesis is a simple, Arduino-controlled robot car which moves around detecting

obstacles in its way and avoiding them. During operation of the robot, the ultrasonic sensor sends out an ultrasound wave to the front position (90 degrees), right position (36 degrees), and left position (144 degrees). When the wave strikes an obstacle, it bounces back and the distance is stored for the front, right, and left position. After this, the microcontroller compares the values based on its algorithm and determines whether to move forward or change path.

ISSUE AND FUTURE IMPROVEMENTS

The performance and accuracy of this robot majorly depends on the sensor used and the number of sensors

used. The ultrasonic sensor used is for commercial applications and it can easily encounter interference. This caused issues with getting accurate distance measurements under some certain conditions.

The sensor cannot accurately measure the distance between itself and an object when:
Distance is greater than 3 meters
The angle is too shallow
The object is too small
The object surface is not reflective

To make it function properly and efficiently, we can use multiple high-quality sensors, including ultrasonic ones

-THANK YOU