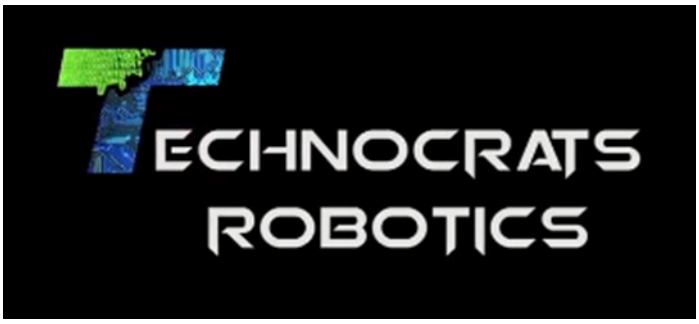

VACATION TASKS

SET-1

INTERFACING ULTRASONIC SENSOR WITH ARDUINO

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Tanush Biju

INTERFACING ULTRASONIC SENSOR WITH ARDUINO

An Ultrasonic Sensor is a device that measures distance to an object using Sound Waves. It works by sending out a sound wave at ultrasonic frequency and waits for it to bounce back from the object. Then, the time delay between transmission of sound and receiving of the sound is used to calculate the distance.

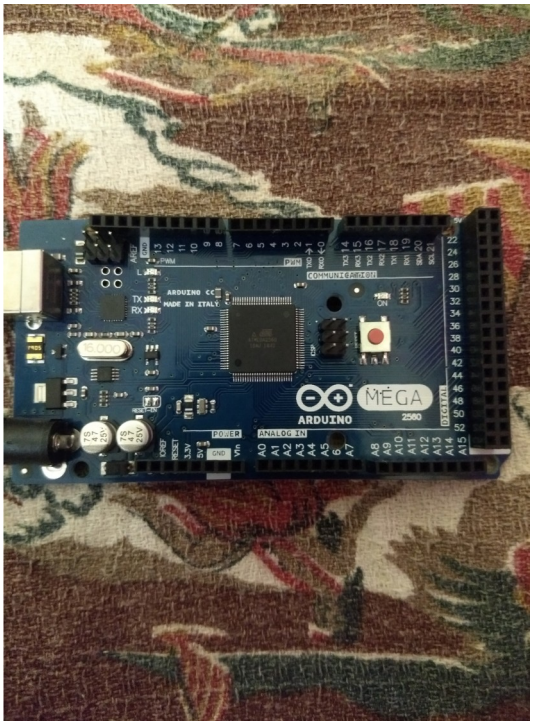
It is done using the formula Distance = (Speed of sound * Time delay) / 2

We divide the distance formula by 2 because the sound waves travel a round trip i.e from the sensor and back to the sensor which doubles the actual distance.

The HC-SR04 is a typical ultrasonic sensor which is used in many projects such as obstacle detector and electronic distance measurement tapes. In this Instructable I'll teach you how to interface the HC-SC04 with an Arduino Mega.

Components Required

HC-SR04 Ultrasonic sensor



Arduino Mega 2560

4 Male-Female Jumper wires

To interface an Ultrasonic Sensor with an Arduino and view the distance on the serial monitor you'll need:

- Arduino Mega
- HC-SR04 Module
- Jumper wires

About the Module

The HC-SR04 is an ultrasonic ranging module. This economical sensor provides 2cm to 400cm of non-contact measurement functionality with a ranging accuracy that can reach up to 3mm. Each HC-SR04 module includes an ultrasonic transmitter, a receiver and a control circuit.

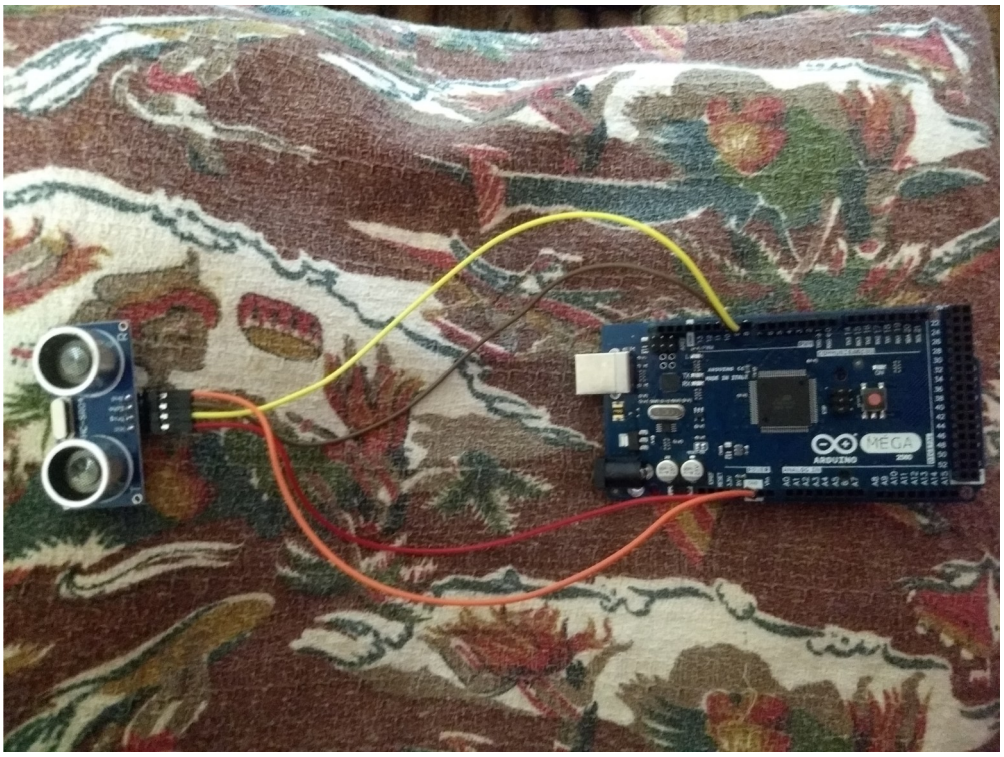
There are Four Pins on the HC-SR04. They are :

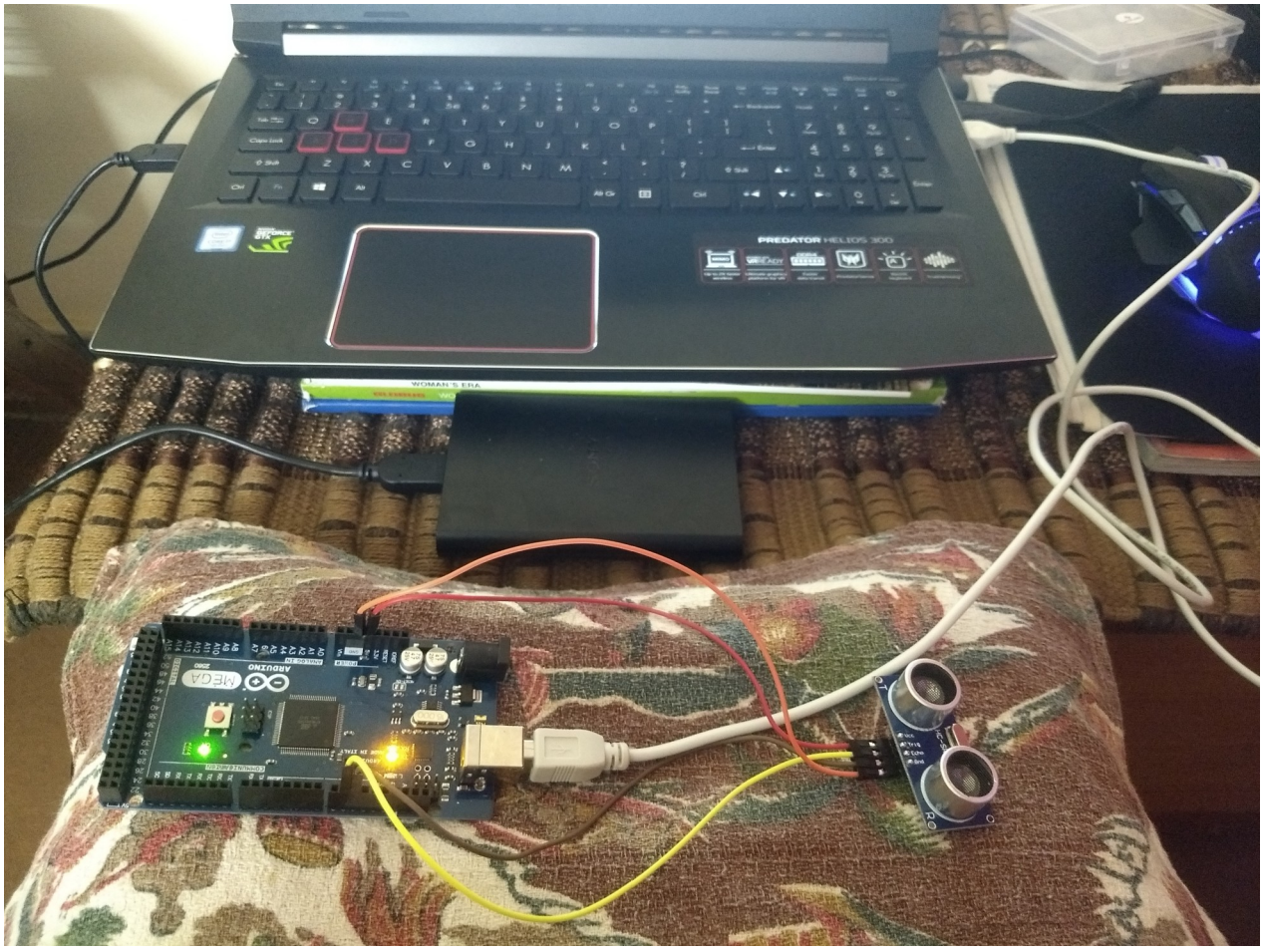
- Vcc (5V supply)
- Gnd (Ground)
- Trig (Trigger)
- Echo (Receive)

The key features to be noted are:

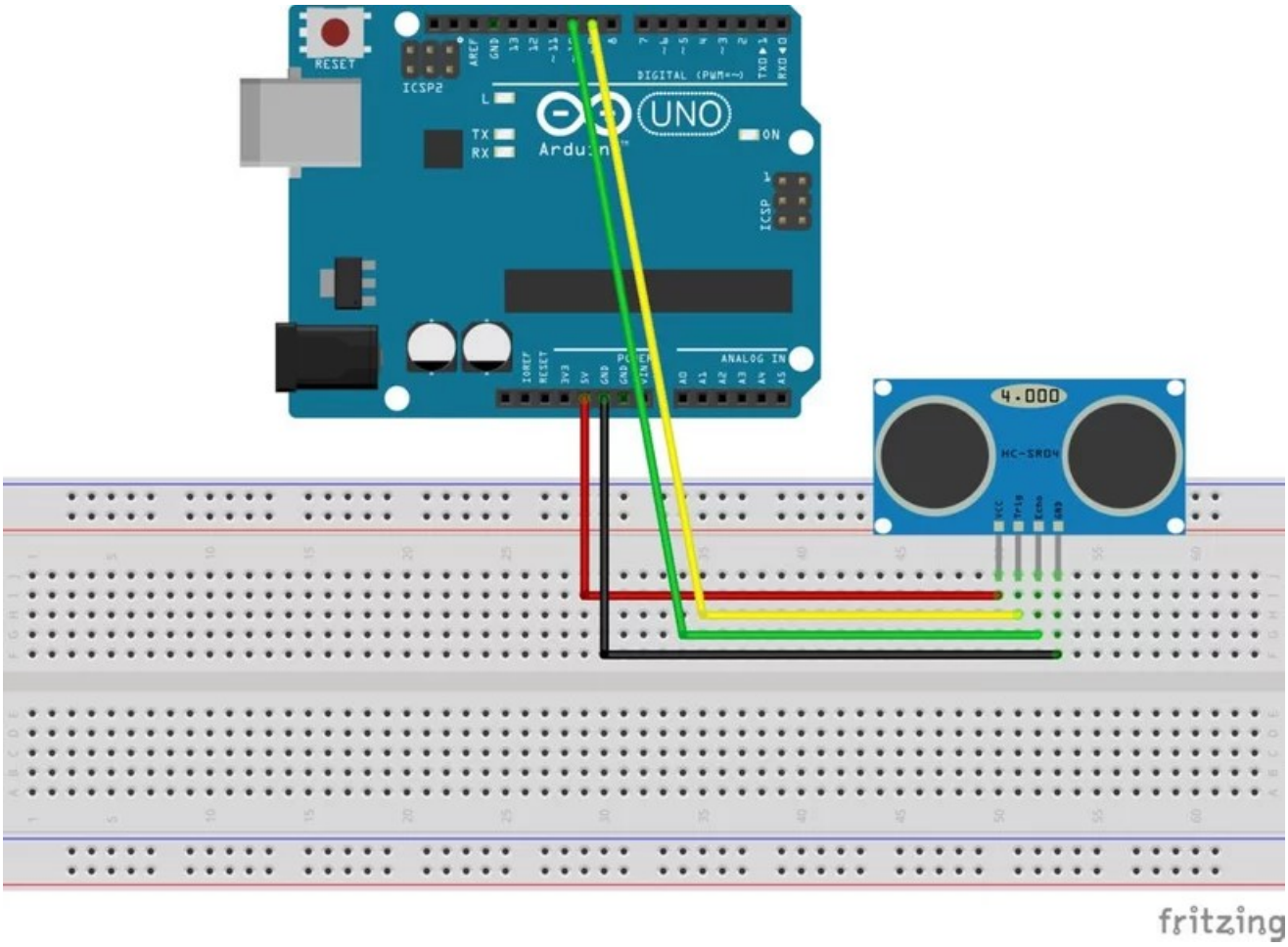
- Operating Voltage: 5V DC
- Operating Current: 15mA
- Measure Angle: 15°
- Ranging Distance: 2cm - 400cm

Connections Made





The Circuit



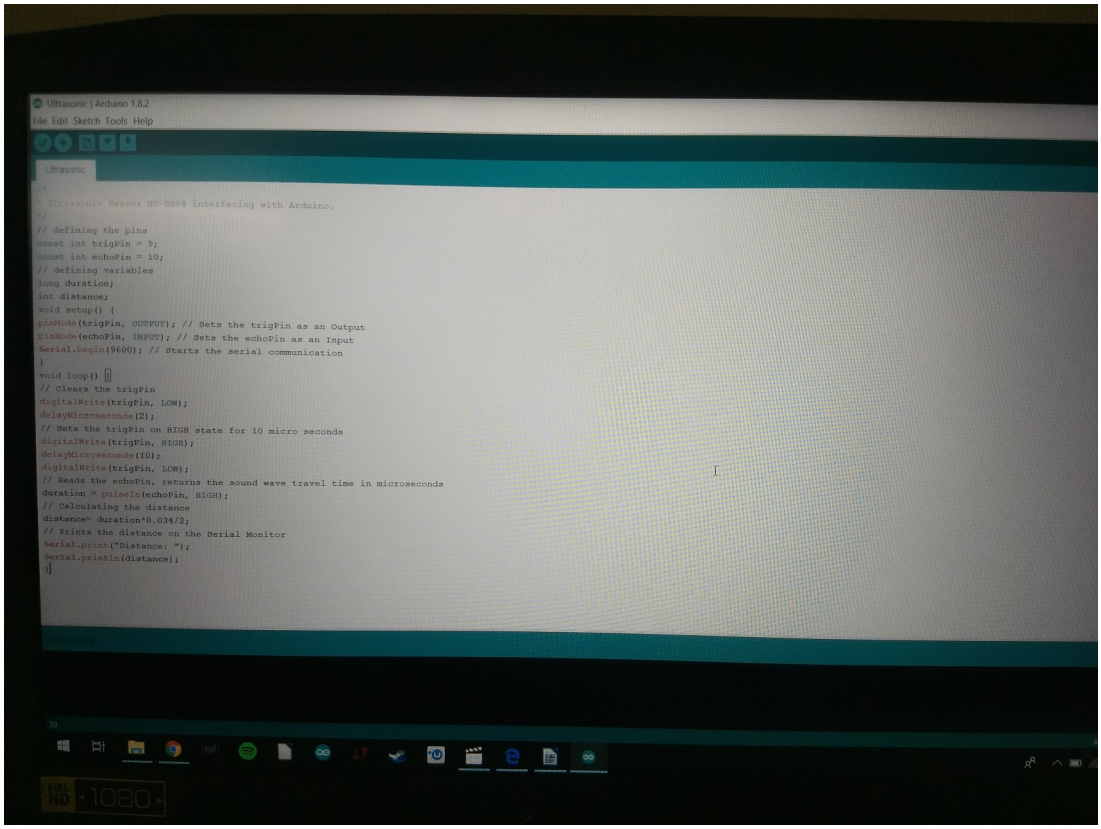
The connections are as follows:

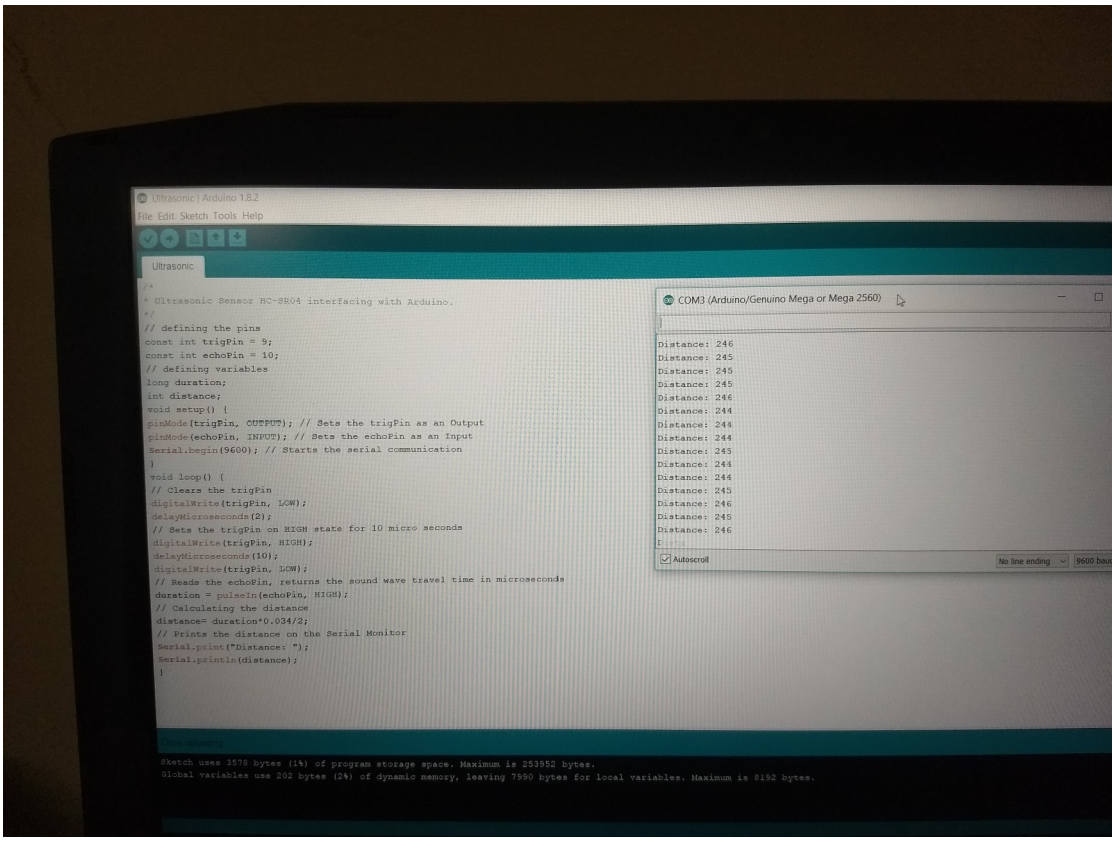
- Vcc to 5V Pin of the Arduino.
- Gnd to Gnd Pin of the Arduino.
- Trig to Digital Pin 9.
- Echo to Digital Pin 10.

The Code

```
/*
* Ultrasonic Sensor HC-SR04 interfacing with Arduino.
*/
// defining the pins
const int trigPin = 9;
const int echoPin = 10;
// defining variables
long duration;
int distance;
void setup() {
pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
pinMode(echoPin, INPUT); // Sets the echoPin as an Input
Serial.begin(9600); // Starts the serial communication
}
void loop() {
// Clears the trigPin
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
// Sets the trigPin on HIGH state for 10 micro seconds
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
// Reads the echoPin, returns the sound wave travel time in microseconds
duration = pulseIn(echoPin, HIGH);
// Calculating the distance
distance= duration*0.034/2;
// Prints the distance on the Serial Monitor
Serial.print("Distance: ");
Serial.println(distance);
}
```

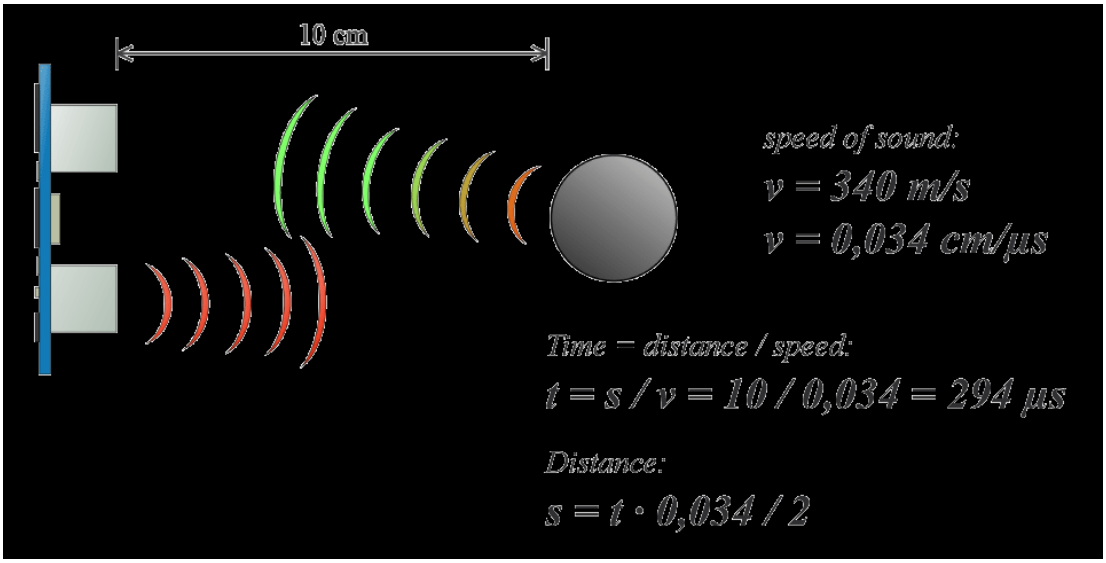
Uploading and Testing the Code



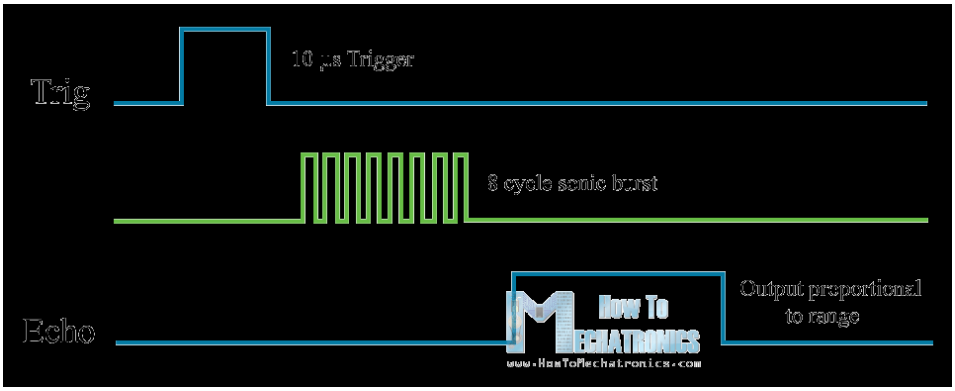


Working

It emits an ultrasound at 40 000 Hz which travels through the air and if there is an object or obstacle on its path It will bounce back to the module. Considering the travel time and the speed of the sound you can calculate the distance.



In order to generate the ultrasound you need to set the Trig on a High State for 10 µs. That will send out an 8 cycle sonic burst which will travel at the speed sound and it will be received in the Echo pin. The Echo pin will output the time in microseconds the sound wave traveled.



For example, if the object is 10 cm away from the sensor, and the speed of the sound is 340 m/s or 0.034 cm/µs the sound wave will need to travel about 294 u seconds. But what you will get from the Echo pin will be double that number because the sound wave needs to travel forward and bounce backward. So in order to get the distance in cm we need to multiply the received travel time value from the echo pin by 0.034 and divide it by 2.