HC-SR04 Ultrasonic Sensor Module

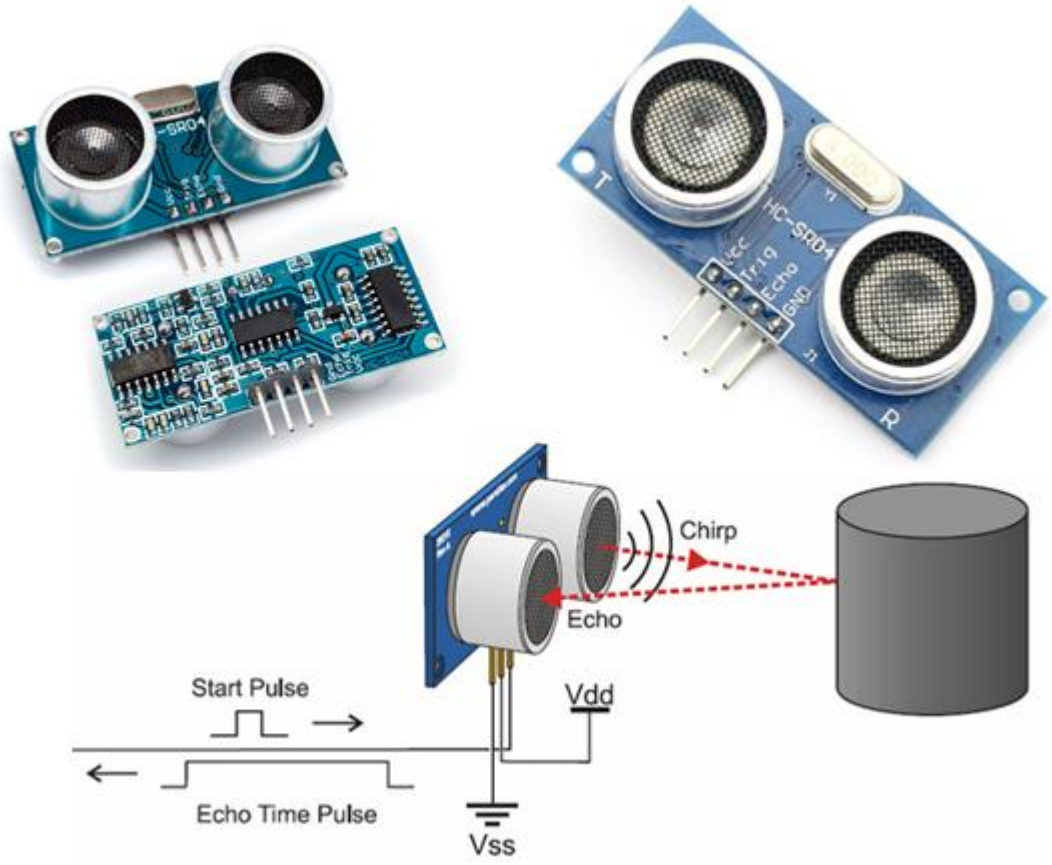
HC-SR04 Ultrasonic Sensor is a very affordable proximity/distance sensor that has been used mainly for object avoidance in various robotics projects. It has also been used in turret applications, water level sensing, and even as a parking sensor.

SKU: SSR1012

Brief Data:

- Power Supply: 3.3~5 VDC
- Quiescent Current : <2mA
- Working Current: 2.8mA @ 5V
- Effective Angle: <15°
- Ranging Distance : 2cm – 400 cm or 1″ – 13ft
- Connector: 4-pins header with 2.54mm pitch.
- Dimension: 45mm x 20mm x 15mm
- Weight 8.5g.

HC-SR04 Ultrasonic Sensor Module



User Guide: Ultrasonic Sensor V1.0

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1.0 Introduction:

Ultrasonic is an excellent way of figuring outwhat's in the immediate vicinity of your Arduino.The basics of using ultrasound are likethis: you shoot out a sound, wait to hear itecho back, and if you have your timing right,you'll know if anything is out there and howfar away it is. This is called echolocation and it'show bats and dolphins find objects in the darkand underwater, though they use lower frequencies thanyou can use with your Arduino.Figure-1 show the working principal of ultrasonic ranging concept.

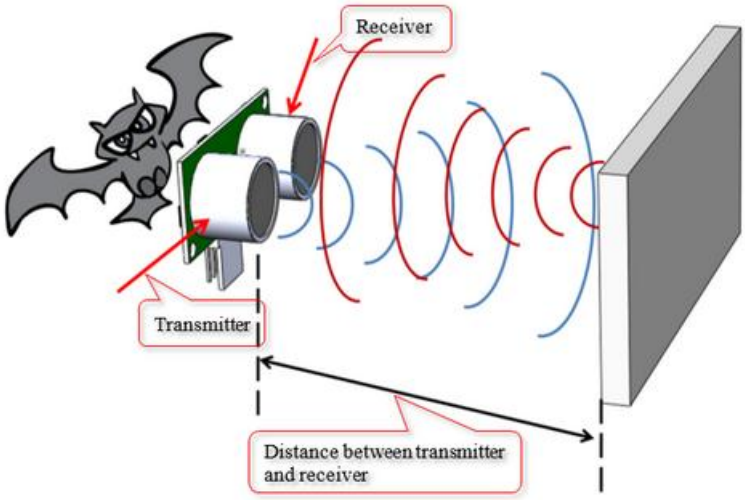


Figure-1

HC-SR04 Ultrasonic Sensor is a very affordable proximity/distance sensor that has been used mainly for object avoidance in various robotics projects. It has also been used in turret applications, water level sensing, and even as a parking sensor.

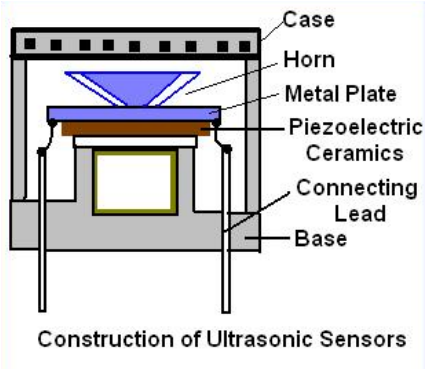
This module is the second generation of the popular HC-SR04 Low Cost Ultrasonic Sensor. Unlike the first generation HC-SR04 that can only operate between 4.8V~5V DC, this new version has wider input voltage range, allow it to work with controller operates on 3.3V.HC-SR04 ultrasonic sensor provides a very low-cost and easy method of distance measurement. It measures distance using sonar, an ultrasonic (well above human hearing) pulse (~40KHz) is transmitted from the unit and distance-to-target is determined by measuring the time required for the echo return. This sensor offers excellent range accuracy and stable readings in an easy-to-use package. An on board 2.54mm pitch pin header allows the sensor to be plugged into a solderless breadboard for easy prototyping.

2.0: Module Specification

Electrical Parameters	**Value**
Operating Voltage	3.3Vdc ~ 5Vdc
Quiescent Current	<2mA
Operating Current	15mA
Operating Frequency	40KHz
Operating Range	2cm ~ 400cm (1in ~ 13ft)
Sensitivity	-65dB min
Sound Pressure	112dB
Effective Angle	15°
Connector	4-pins header with 2.54mm pitch
Dimension	45mm x 20mm x 15mm
Weight	9g

2.1: Sensor Element Construction

Piezoelectric crystals are used for sensor elements. Piezoelectric crystals will oscillate at high frequencies when electric energy is applied to it. The Piezoelectric crystals will generate electrical signal when ultrasound wave hit the sensor surface in reverse.



Construction of Ultrasonic Sensors

3.0: Ultrasonic Real Application

3.1 Car Parking Reverse Sensors

The main purpose is the distance range detection, which is widely used parking sensor for car. The sensor is used forcalculating the distance, or direction of an object from the time it takes for a soundwave to travel to the object and echo back. The effective detective range is 0.3m ~ 3.0m. Refer to Figure-2.

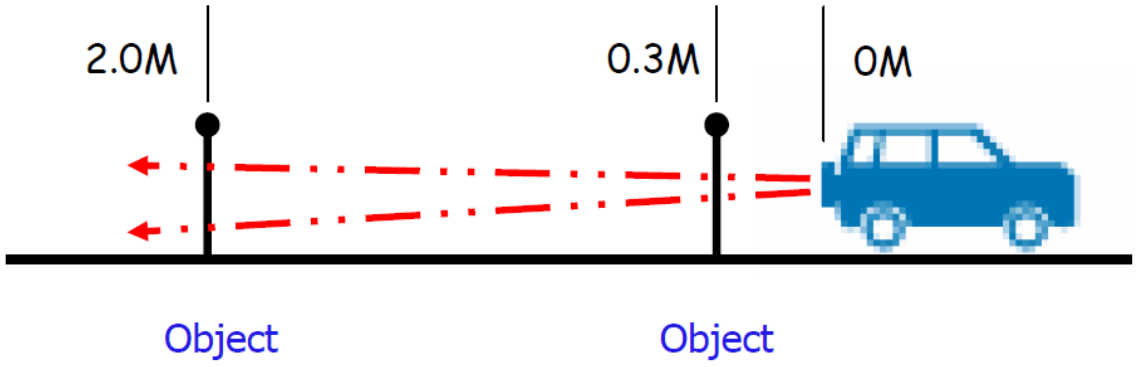


Figure-2.

3.2: Liquid Level Detection

Ultrasonic sensors are widely used forliquid level detection. In such cases,place a pipe on top of the sensor head as shown Figure-3. By detecting the liquid level inside thepipe, a wavy surface or bubbles which can disturb stable reading can be prevented.

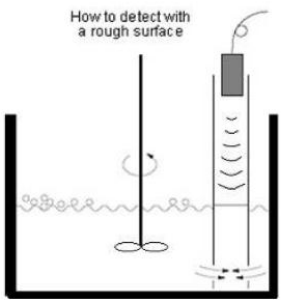
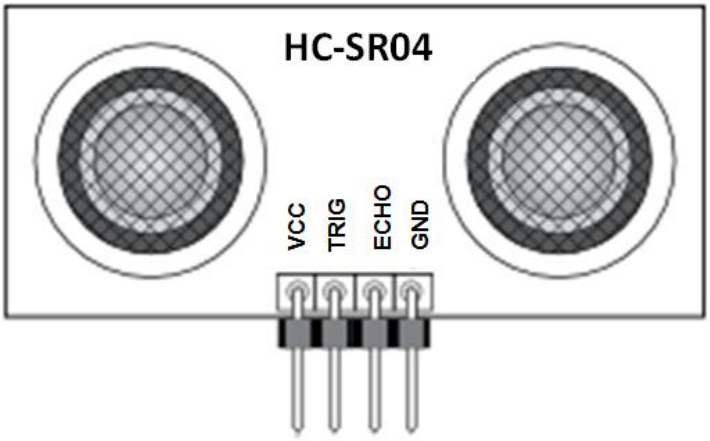


Figure-3.

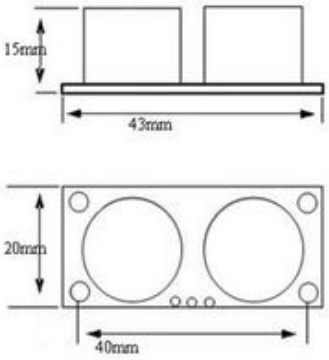
4.0: Pins Assignment and Dimension

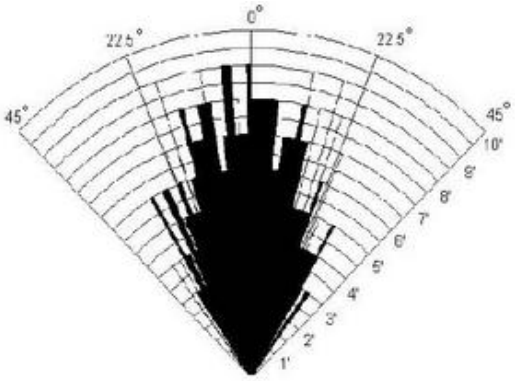
4.1 Pin Assignment



VCC	3.3v ~ 5V
TRIG	Triggering Input Pin. 10uS TTL Pulses
ECHO	TTL Logic Output Pin. Proportional to distance
GND	Ground Pin

4.2 Mechanical Dimension





Practical test of performance,
Best in 30 degree angle

4.3 Timing Diagram

The timing diagram, Figure-4 is shown below. You only need to supply a short 10uS pulse to “Trigger Input” pin to start the ranging.The module will send out 8-cycles burst of ultrasound at 40KHz and raise its “Echo” pin, refer to Figure-5. The echo is a distance object that is pulse width and the range in proportion. You can calculate the range through the time interval between sending trigger signal and receiving echo signal.

Formula: uS / 58 = centimeters or uS / 148 =inch

or: the range = high level time * sound velocity (340m/s) / 2;

Suggest to use over 60ms measurement cycle, in order to prevent trigger signal to the echo signal.

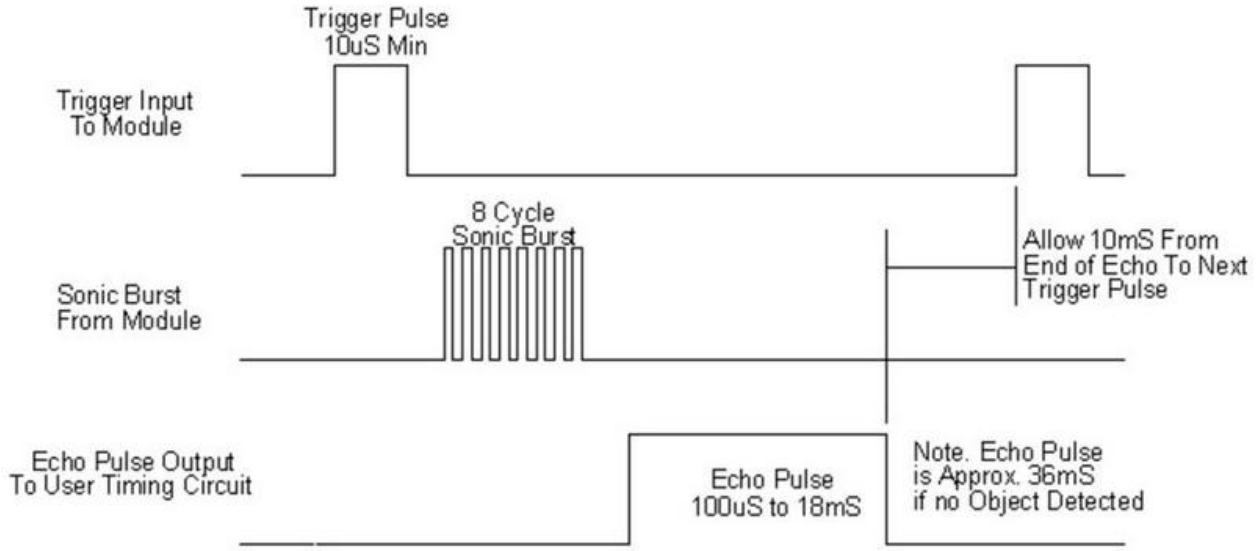


Figure-4: Timing Diagram

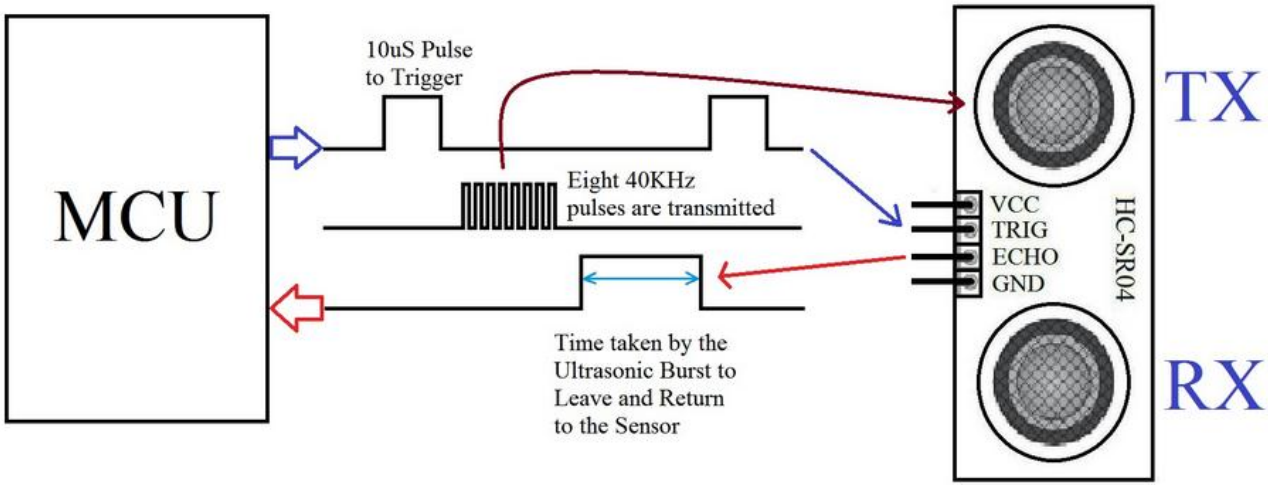
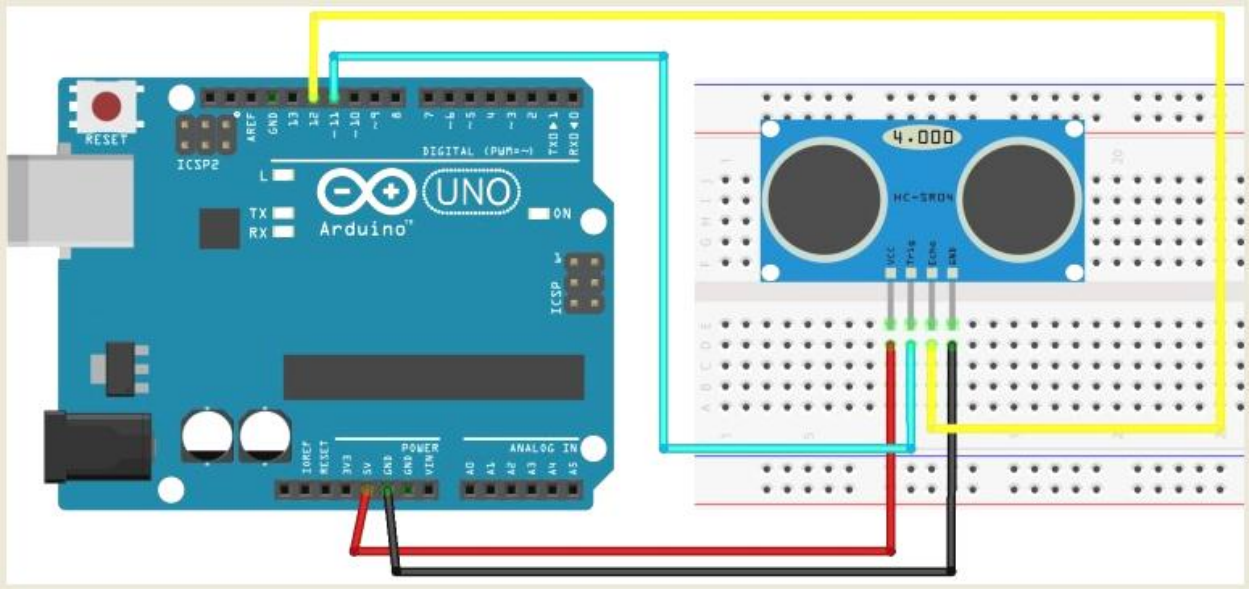


Figure-5: Microcontroller Interfacing

Please make sure the surface of object to be detected should have at least 0.5m^2areafor better performance.

4.4 Arduino Application Examples

Connect the circuit to Arduino as shown in below:



Ultrasonic Sensor HC-SR04	Arduino
VCC	5V
Trig	Pin 11
Echo	Pin 12
GND	GND

Upload the below sketch to Arduino Board. Open up the Serial monitor and place some object in front of the sensor module and observe the distance displayed.

```
/*================================================================================

//  Author      : Handson Technology
//  Project     : HC-SR04 Ultrasonic Sensor with Arduino Uno
//  Description : HC-SR04 Distance Measure with Arduino and display
//                on Serial Monitor.
//  Source-Code : HC-SR04.ino
//================================================================================
*/

int trig=11;
int echo=12;
int duration;
float distance;
float meter;
void setup()
{
  Serial.begin(9600);
  pinMode(trig, OUTPUT);
```

```
  digitalWrite(trig, LOW);
  delayMicroseconds(2);
  pinMode(echo, INPUT);
  delay(6000);
  Serial.println("Distance:");
}
void loop()
{
  digitalWrite(trig, HIGH);
  delayMicroseconds(10);
  digitalWrite(trig, LOW);

  duration = pulseIn(echo, HIGH);

  if(duration>=38000){
      Serial.print("Out range");
      }

  else{
      distance = duration/58;
      Serial.print(distance);
      Serial.print("cm");
      meter=distance/100;
      Serial.print("\t");
      Serial.print(meter);
      Serial.println("m");
      }
  delay(1000);
}
```

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- Warranty does not cover freight cost for both ways.

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