**[Ultrasonic sensors](http://www.engineersgarage.com/articles/ultrasonic-sensors)**

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devices that use electrical–mechanical energy transformation to measure distance from the sensor to the target object. Ultrasonic waves are longitudinal mechanical waves which travel as a sequence of compressions and rarefactions along the direction of wave propagation through the medium. Apart from distance measurement, they are also used in ultrasonic material testing (to detect cracks, air bubbles, and other flaws in the products), Object detection, position detection, ultrasonic mouse, etc.

These sensors are categorized in two types according to their working phenomenon – piezoelectric sensors and electrostatic sensors. Here we are discussing the ultrasonic sensor using the piezoelectric principle. Piezoelectric ultrasonic sensors use a piezoelectric material to generate the ultrasonic waves

Ultrasonic sensors (also known as transceivers when they both send and receive, but more generally called transducers) work on a principle similar to radar or sonar, which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively.  
Active ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object. Passive ultrasonic sensors are basically microphones that detect ultrasonic noise that is present under certain conditions.

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| Working of Ultrasonic Sensor |
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the range of the target is determined by the "time lagging" between transmitted pulse and the received "echo". Generally microwave and ultrasonic frequencies are used in RADARS

Our HC-SR04 ultrasonic sensor works similar to the  RADAR mechanism but in a simplified manner. This sensor consists of four PINS

**Pin Description of Ultrasonic Sensor**

1.Vcc------------------connect to 5V dc

2.Trigger--------------pulse input that triggers the sensor

3.Echo----------------indicates the reception of echo from the target

4.Gnd-----------------ground final

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How to Find the Range of Target in Ultrasonic Sensor

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| ULTRASONIC  pulse travels with the speed of sound 340.29 m/s = 34029 cm/s  range of target= velocity \*time ==> 34029 \* TIMER0/2                                                   ==>  17015 \* TIMER0 At 12MHz TIMER0 gets incremented for 1microsecond.         RANGE    =    17015 centimeters/seconds  \*  TIMER0 micro seconds                             =    17015 centimeters/seconds \*  TIMER0 \* (10^-6)  seconds                                                       as            (1micro second=10^-6 seconds)                                                     =    17015 centimeters/seconds \*  TIMER0 \* (10^-6)  seconds                                                                                       =    17015  \*  TIMER0     centimeters                                          (1000000)                                                           =       TIMER0\_\_\_\_\_\_\_     centimeters                                      1000000/ 17015                               =       TIMER0\_   centimeters                                       58.771                          RANGE of target  =  TIMER0\_ cm                                                                59 |

### Distance Calibration

For accurate distance measuring you may calibrate the obtained result. Here for making the displayed distance more accurate, I added 1 to the the measured distance. This constant of calibration can be find using a series of practical experiments with a ruler scale.