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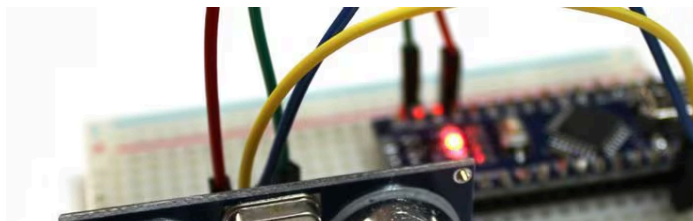


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Ultrasonic Sensors: How They Work (and How to Use Them with Arduino)

4 Apr 2018



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All About Ultrasonic Sensors & How They Work with Arduino

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Jeremy S. Cook has a BSME from Clemson University, and worked for 10 years in manufacturing automation. He now writes for a variety...

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How Does an Ultrasonic Sensor Work?

Ultrasonic sensors work by emitting sound waves at a frequency too high for humans to hear. They then wait for the sound to be reflected back, calculating distance based on the time required. This is similar to how radar measures the time it takes a radio wave to return after hitting an object.

While some sensors use a separate sound emitter and receiver, it's also possible to combine these into one package device, having an ultrasonic element alternate between emitting and receiving signals. This type of sensor can be manufactured in a smaller package than with separate elements, which is convenient for applications where size is at a premium.

While radar and ultrasonic sensors can be used for some of the same purposes, sound-based sensors are readily

In-depth comparison

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distance from your sensor, this can be calculated based on this formula:

$$\text{Distance} = \frac{1}{2} T \times C$$

(T = Time and C = the speed of sound)

At 20°C (68°F), the speed of sound is 343 meters/second (1125 feet/second), but this varies depending on temperature and humidity.

Specially adapted ultrasonic sensors can also be used underwater. The speed of sound, however, is 4.3 times as fast in water as in air, so this calculation must be adjusted significantly.

What are Ultrasonic Sensors Used For?

So where can we use these sensors? Robot navigation comes to mind, as well as factory automation. Water-level sensing is another good use, and can be accomplished by positioning one sensor above a water surface. Another aquatic application is to use these sensors to “see” the bottom of a body of water

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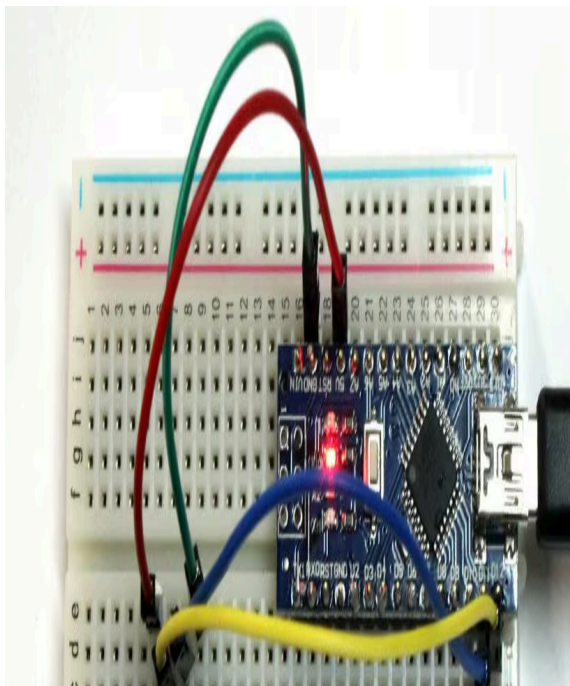
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relations between the two.

Flowrate accuracy can be increased by using data from multiple ultrasonic elements, giving results accurate to within a fraction of a percent.

Incorporating Ultrasonic Sensors into Arduino Projects



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Gather the components (Arduino, HC-SR04, wires, and breadboard) and go into the Arduino IDE and install the “NewPing” sensor library.

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Once installed, there will be a number of new example sketches you can choose from.

Open up the “NewPing3Sensors” sketch.

Attach pins from your Arduino to the HC-SR04, as defined in the program, adding ground and 5V from the Arduino.

Send the program to your dev board, and then open up a serial monitor at 115200 baud. You’ll see a distance reading when you put something in front of it. Note that it reads “0” when it doesn’t properly read a distance.

Try experimenting with different shapes and materials to see what works and

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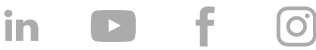


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