# ARDUINO ULTRASONIC RANGE DETECTION SENSOR (HC-SR04)

I am investigating a number of different sensor alternatives to determine cost/benefit as measured against my needs.  The device I evaluated in this case is as the title above reads, I purchased it from a distributor in China: www.elechouse.com.

## OVERVIEW

This device is used to measure the distance from an object.  It can detect objects that are within a a range of 2cm – 450cm (.78" – 14' 9").  The device uses two digital pins to communicate the distance found.

With a Vcc and GND pin, the four pinned device is programmed by writing to the trigger pin in a certain way and then timing the duration of the input from the echo pin.
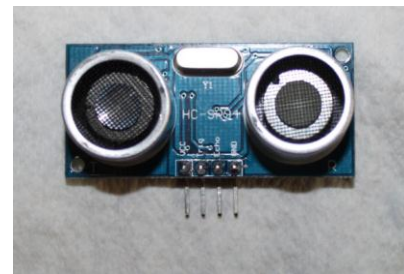
## CONNECTING TO ARDUINO

Our testing was done by connecting the device to the Arduino Mega 2560.  I chose to map the trigger pin to PWM/Digital pin 8, and the echo pin to PWM/Digital pin 9.
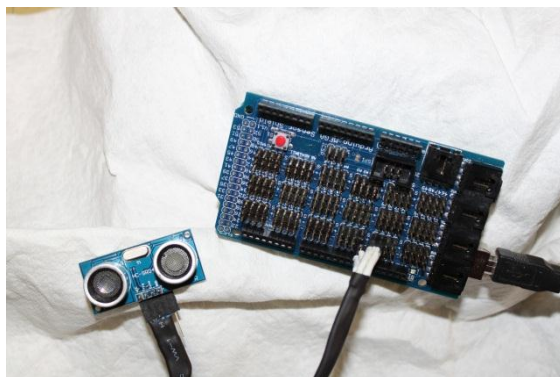
*[plug] I have found working with these guys so pleasant that I am trying to write a short note along with some code about the parts I try so that others can have an even more pleasurable experience. [\plug]*

That's about it for the hardware.  Now on to the tough stuff!   Software.

# SOFTWARE

Our application is going to sample the device every tenth of a second and print out the distance calculated in centimeters and inches.

This code was based on using a PING))). The two are not the same as the PING))) only has one digital pin.

```
/* HC-SR04 Sensor

   This sketch reads a device ultrasonic rangefinder and returns the
   distance to the closest object in range. To do this, it sends a pulse
   to the sensor to initiate a reading, then listens for a pulse
   to return.  The length of the returning pulse is proportional to
   the distance of the object from the sensor.

   The circuit:
       * +V connection of thj device attached to +5V
       * GND connection of the device attached to ground
       * SIG connection of the device attached to digital pin 7

   http://www.arduino.cc/en/Tutorial/Ping

   created 3 Nov 2008
   by David A. Mellis
   modified 30 Jun 2009
   by Tom Igoe

   This example code is in the public domain.

 */

// this constant won't change.  It's the pin number
// of the sensor's input and output:
const int triggerPin = 8;
const int echoPin = 9;

void setup() {
  // initialize serial communication. We are going to watch our progress in the
monitor
  Serial.begin(9600);
}

void loop()
{
  // establish variables for duration of the ping,
  // and the distance result in inches and centimeters:
  long duration, inches, cm;

  // The device is triggered by a HIGH pulse of 2 or more microseconds.
  // Give a short LOW pulse beforehand to ensure a clean HIGH pulse:
  pinMode(triggerPin, OUTPUT);
  digitalWrite(triggerPin, LOW);
  delayMicroseconds(2);
  digitalWrite(triggerPin, HIGH);
  delayMicroseconds(5);
  digitalWrite(triggerPin, LOW);
```

```
  // The echo pin is used to read the signal from the device: a HIGH
  // pulse whose duration is the time (in microseconds) from the sending
  // of the ping to the reception of its echo off of an object.
  pinMode(echoPin, INPUT);
  duration = pulseIn(echoPin, HIGH);

  // convert the time into a distance
  inches = microsecondsToInches(duration);
  cm = microsecondsToCentimeters(duration);

  Serial.print(inches);
  Serial.print("in, ");
  Serial.print(cm);
  Serial.print("cm");
  Serial.println();

  delay(100);
}

long microsecondsToInches(long microseconds)
{
  // ***  THIS NEEDS TO BE CHECKED FOR THE HC-SR04  ***
  return microseconds / 74 / 2;
}

long microsecondsToCentimeters(long microseconds)
{

  // ***  THIS NEEDS TO BE CHECKED FOR THE HC-SR04  ***
  return microseconds / 29 / 2;
}
```