# HC – SR04 Ultrasonic Distance Sensor

How it works:

The HC – SR04 Ultrasonic Distance sensor consists of two ultrasonic transducers, one which acts as a transmitter, and the other a receiver. When the sensor receives a 10 µs trigger pulse from the micro-controller, it emits 8 ultrasonic pulses at 40 KHz meant to reflect off nearby objects and return to the receiving transducer. As soon as the transmitting pulses have been sent the sensor starts returning a High Echo signal back to the microcontroller. The echo signal will remain High until the receiving transducer detects the returning ultra-sonic pulses. As soon as the sensor detects the returning pulses, it switches the Echo signal to Low. The duration of time that the echo signal is High, which is the time required for the Ultrasonic pulse to go out and return, is used to calculate the distance from the sensor to the nearby object.

Schematics:
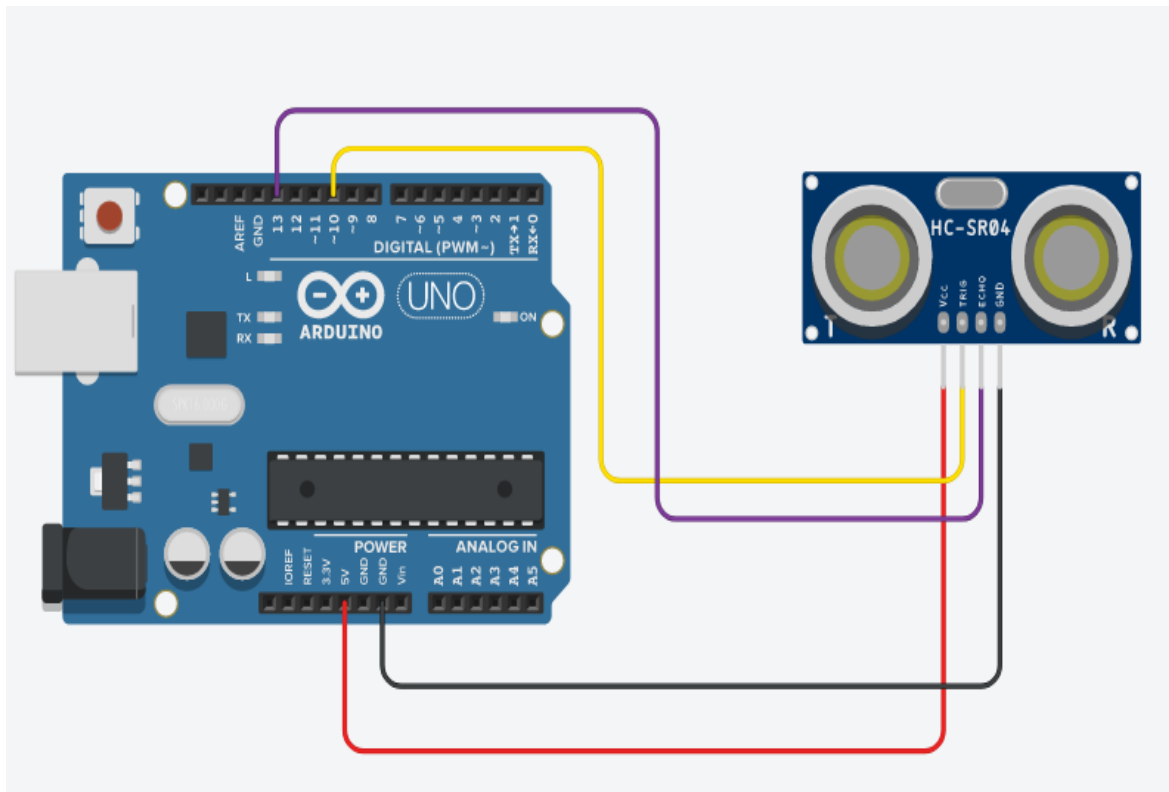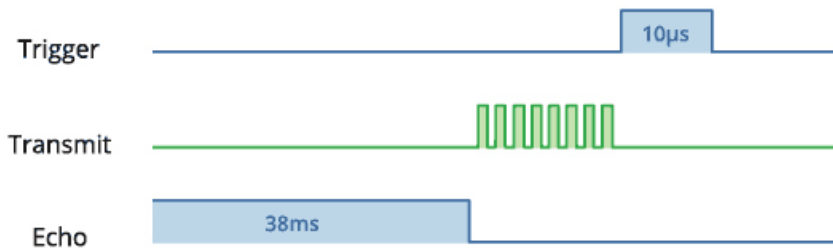
Specs:

Working voltage	DC 5V
Working current	15 mA
Max Range	400 cm, (most accurate at distance of < 200 cm)
Min Range	2 cm, (most accurate at distance of > 5 cm)
Precision	0.1-0.5 cm
Effectual Angle	+/- 15 degrees
Trigger Input signal	10 µs TTL pulse
Unit Dimensions	45x20x15 mm

Code:

```
// GLOBAL VARIABLES & DECLARATIONS
#define trigPin 10                           // DEFINE PIN 10 AS trigPin
#define echoPin 13                           // DEFINE PIN 13 AS echoPin
float duration,distance;                     // DECLARE DURATION AND DISTANCE

// SET UP LOOP
void setup() {
  Serial.begin(9600);                        // START SERIAL MONITOR
  pinMode(trigPin,OUTPUT);                   // ASSIGN trigPin AS AN OUPUT
  pinMode(echoPin,INPUT);                    // ASSIGN echoPin AS AN INPUT
}                                            // END SETUP

// MAIN LOOP
void loop() {                                // NECESSARY SYNTAX
  digitalWrite(trigPin,LOW);                 // LOW SIGNAL TO CLEAR trigPin
  delayMicroseconds(2);                      // DURATION OF CLEARING SIGNAL
  digitalWrite(trigPin,HIGH);                // TRIGGER SIGNAL FROM trigPin
  delayMicroseconds(10);                     // DURATION OF TRIGGER SIGNAL
  digitalWrite(trigPin,LOW);                 // END TRIGGER SIGNAL

// CALCULATE DISTANCE
  duration = pulseIn(echoPin,HIGH);          // READ & RECORD DURATION OF ECHO SIGNAL
  distance = (duration/2)* 0.0343;           // CALCULATE DISTANCE

// PRINTING TO SERIAL MONITOR
  Serial.print("Distance = ");               // PRINT DISTANCE TO SERIAL
  if (distance >= 400 || distance <= 2) {    // SPECIFY DISTNACE RANGE
     Serial.println("Out of range");         // OUT OF RANGE ERROR MESSAGE
     }                                       // END IF

  else {                                     // IF DISTNACE IS IN RANGE
    Serial.print(distance);                  // PRINT DISTANCE
    Serial.println(" cm");                   // ADD "...cm" TO DISTANCE
    delay(500);                              // 500 MICROSECOND SECOND DELAY
    }                                        // END ELSE
    delay(500);                              // 500 MICROSECOND SECOND DELAY
}                                            // END MAIN LOOP
```

Useful links:

The following links provide more information on codes, and specs for the distance sensor.
- Website: https://lastminuteengineers.com/arduino-sr04-ultrasonic-sensor-tutorial/
- YouTube Video: https://www.youtube.com/watch?v=6F1B_N6LuKw