Lesson 11 HC-SR04 Ultrasonic Sensor Module

Introduction

In this lesson, you will learn how to use a HC-SR04 Ultrasonic Sensor to distance easurements,which is great for all kind of projects that need distance easurements,avoiding obstacles as examples.

Hardware Required

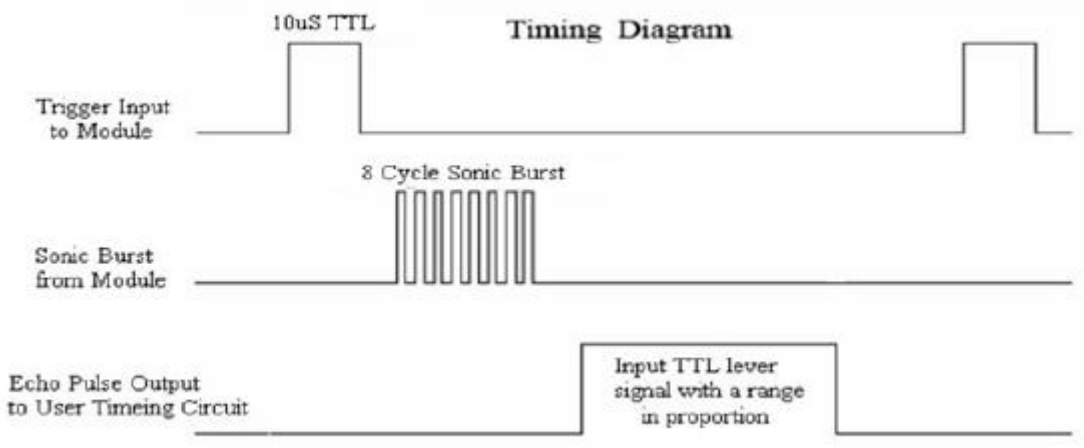
- ✓ 1 * RexQualis UNO R3
- ✓ 1 * Ultrasonic Sensor Module
- ✓ 4 * F-M Jumper Wires

Principle

HC-SR04 Ultrasonic Sensor Module

Ultrasonic Sensor emits an ultrasound at 40 000 Hz which travels through the air and if there is an object or obstacle on its path It will bounce back to the module. Considering the travel time and the speed of the sound you can calculate the distance.

In order to generate the ultrasound you need to set the Trig on a High State for 10us. That will send out an 8 cycle sonic burst which will travel at the speed sound and it will be received in the Echo pin. The Echo pin will output the time in microseconds the sound wave traveled.



Test distance = (high level time × velocity of sound (340m/s) /2

For example, if the object is 10 cm away from the sensor, and the speed of the sound is 340 m/s or 0.034 cm/μs the sound wave will need to travel about 294 u seconds. But what you will get from the Echo pin will be double that number because the sound wave needs to travel forward and bounce backward. So in order to get the distance in cm we need to multiply the received travel time value from the echo pin by 0.034 and divide it by 2.

Code interpretation

```
#include "SR04.h"

#define TRIG_PIN 12   //Pin   to Arduino Digital Pin 12

#define ECHO_PIN 11   //Pin   to Arduino Digital Pin 11

SR04 sr04 = SR04(ECHO_PIN,TRIG_PIN);//defines variables

long a;


void setup() {

    Serial.begin(9600);//starts the serial commuications

    delay(1000);
```

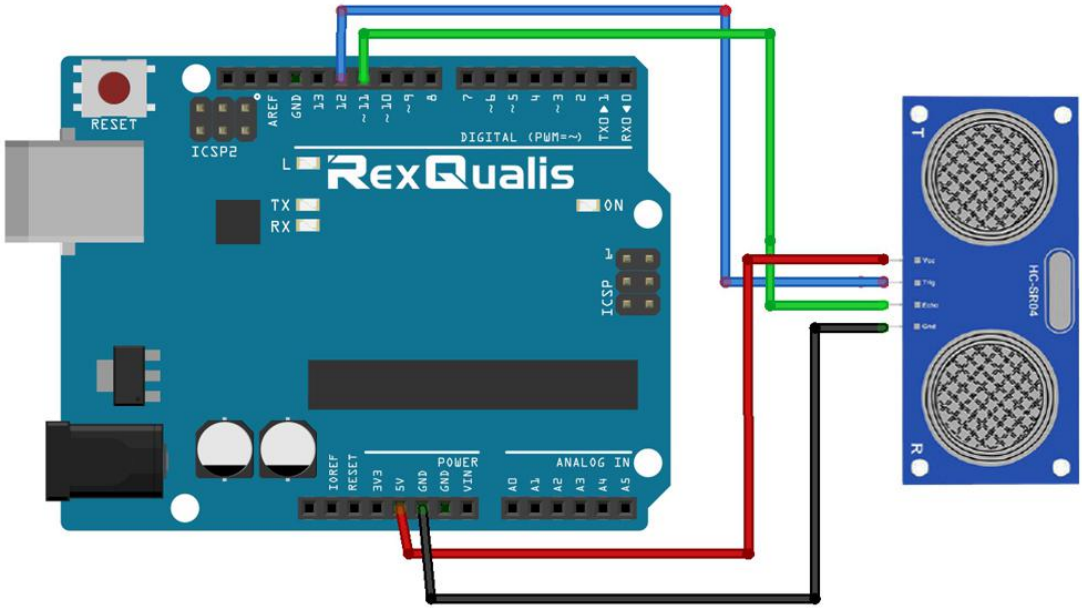
```
}


void loop() {
    a=sr04.Distance();
    Serial.print(a);
    Serial.println("cm");//prints the distance on the Serial Monitor
    delay(1000);
}
```

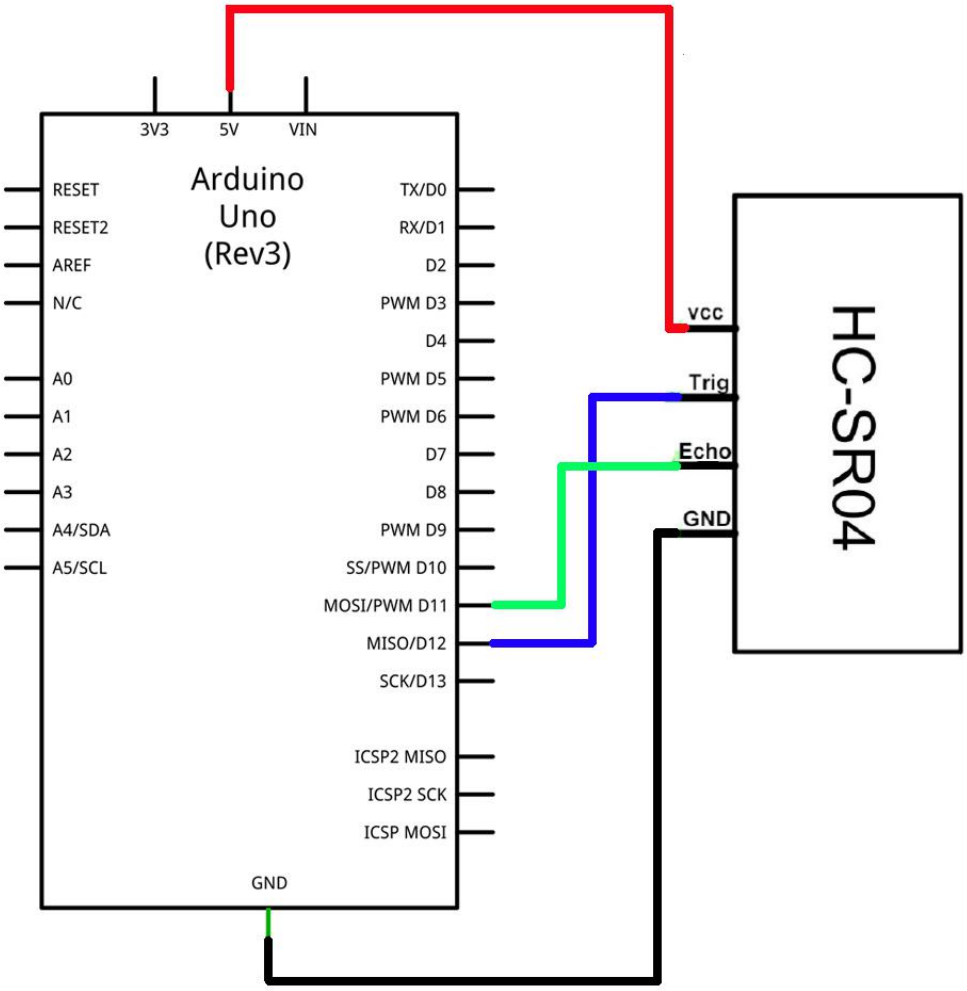
Experimental Procedures

Step 1:Build the circuit

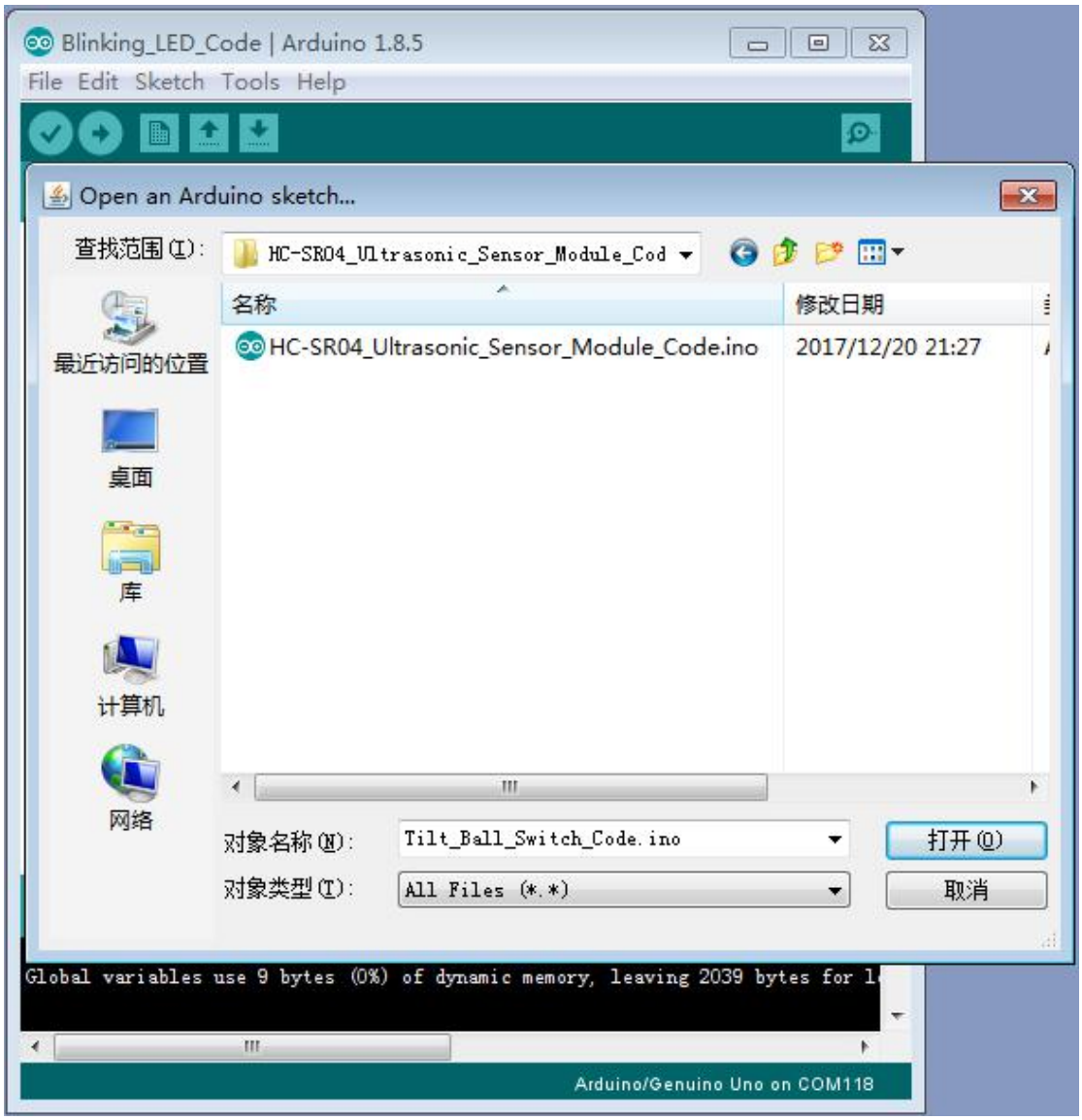
The HC-SR04 Ultrasonic Module has 4 pins, Ground, VCC, Trig and Echo. The Ground and the VCC pins of the module needs to be connected to the Ground and the 5 volts pins on the Arduino Board respectively and the trig and echo pins to any Digital I/O pin on the Arduino Board.



Schematic Diagram

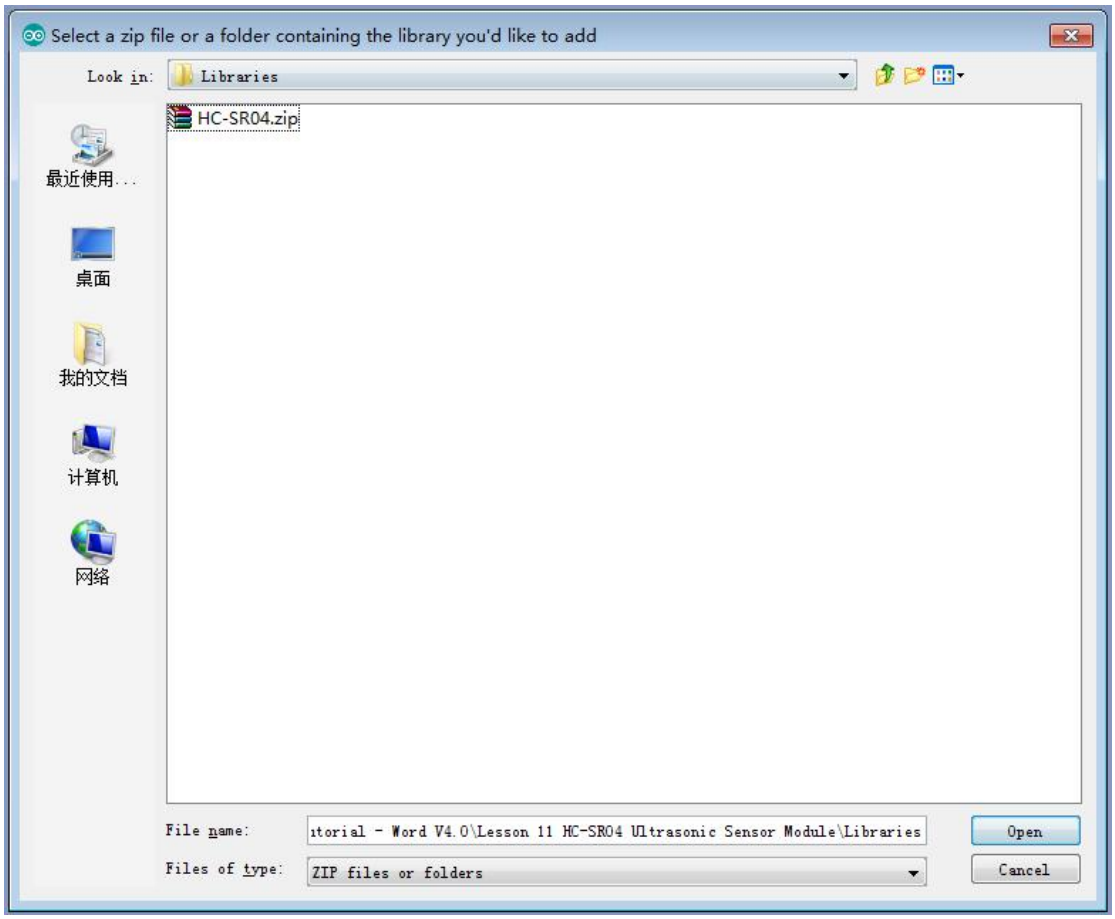


Step 2:Open the code:HC-SR04_Ultrasonic_Sensor_Module_Code



Step 3:Attach Arduino UNO R3 board to your computer via USB cable and check that the 'Board Type' and 'Serial Port' are set correctly.

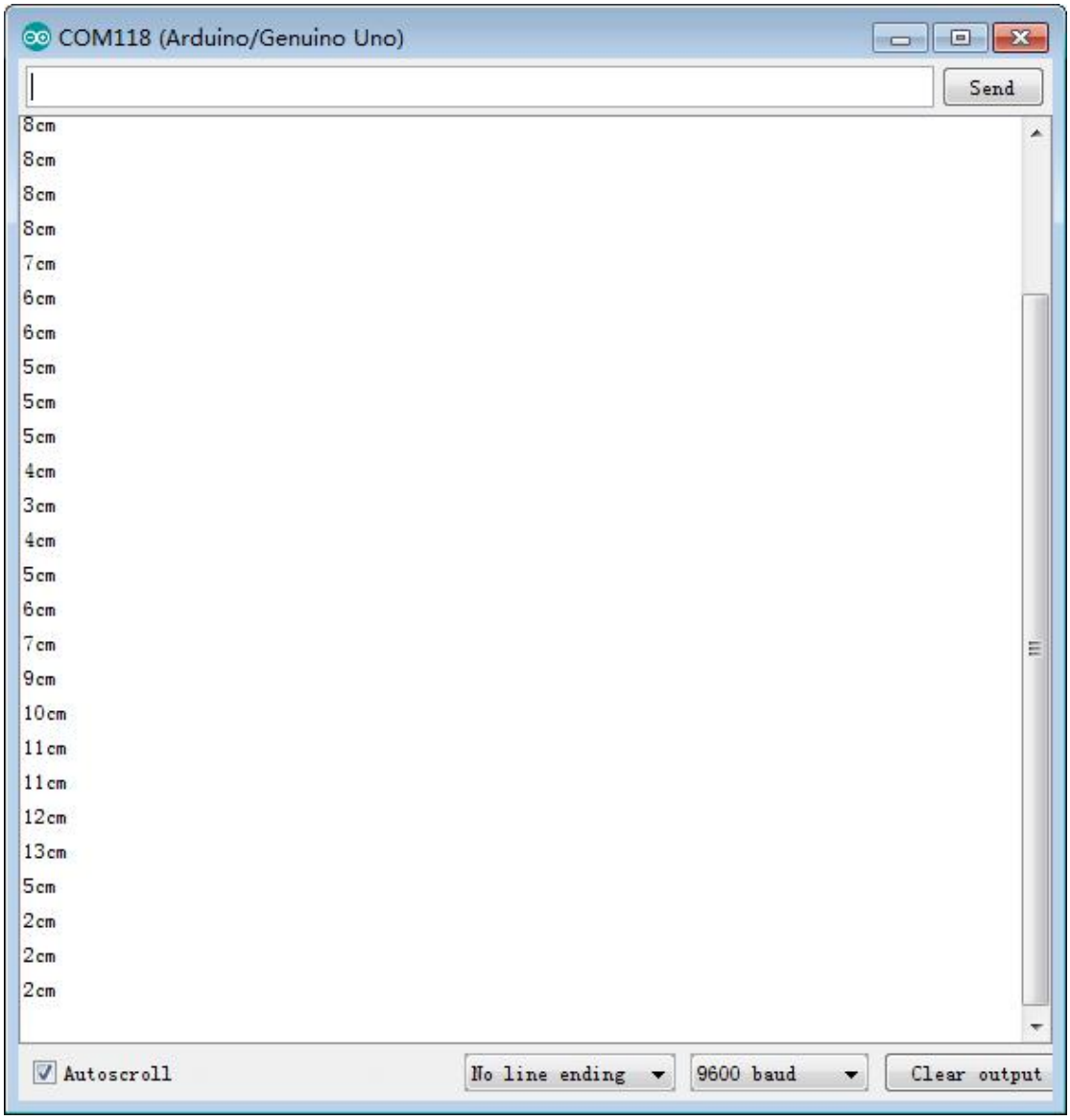
Step 4:Load the Library:HC-SR04



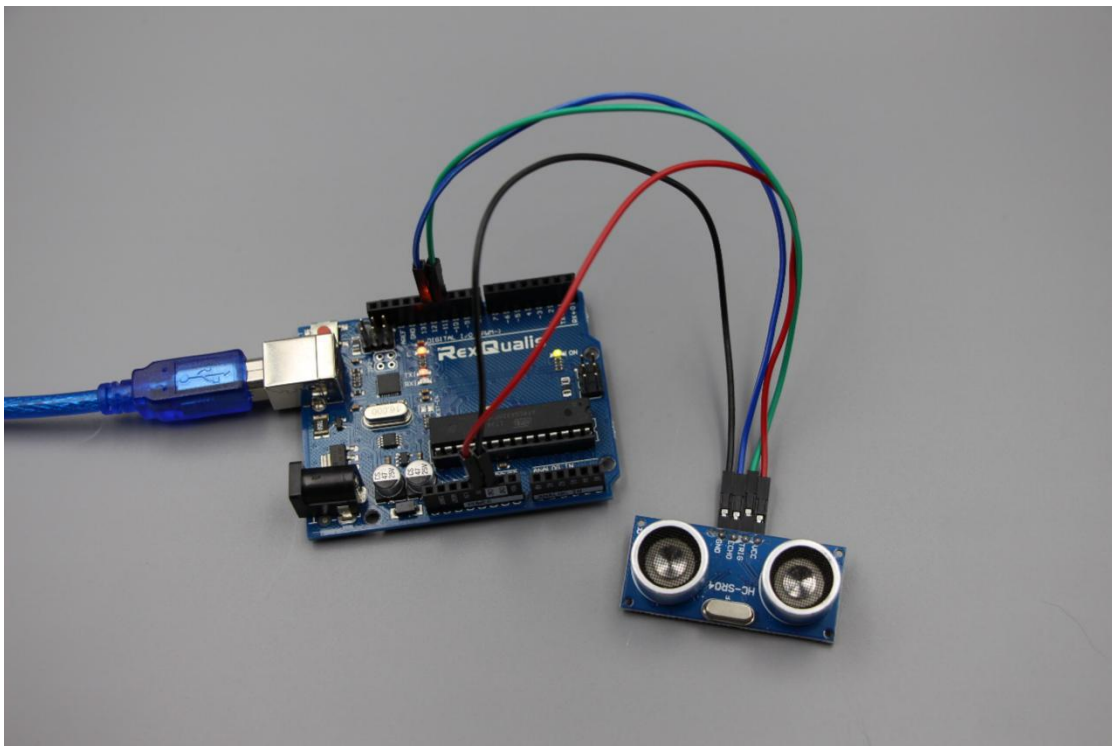
Step 5:Upload the code to the RexQualis UNO R3 board.

Step 6:Open the Serial Monitor then you can see the data as blow:

(How to use the Serial Monitor is introduced in details in Lesson 0 Preface)



Then, You can test the distance between the ultrasound module and the wall by moving the ultrasound module,and it will show on the monitor.



You can see the video of the experiment results on YouTube: https://youtu.be/jBk20gTGm_A

If it isn’t working, make sure you have assembled the circuit correctly, verified and uploaded the code to your board.For how to upload the code and install the library, check Lesson 0 Preface.