

Part 2

Lesson

9

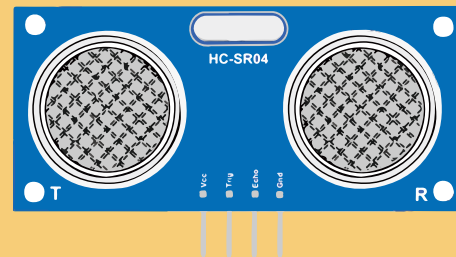
Ultrasonic Sensor Module

Overview

The ultrasonic sensor is great for all kinds of projects that need distance measurements or avoiding obstacles for example. The HC-SR04 is inexpensive and easy to use since we will be using a Library specifically designed for these sensor.

Component Required:

- (1) x Elegoo Uno R3
- (1) x Ultrasonic sensor module
- (4) x F-M wires (Female to Male DuPont wires)



Component Introduction

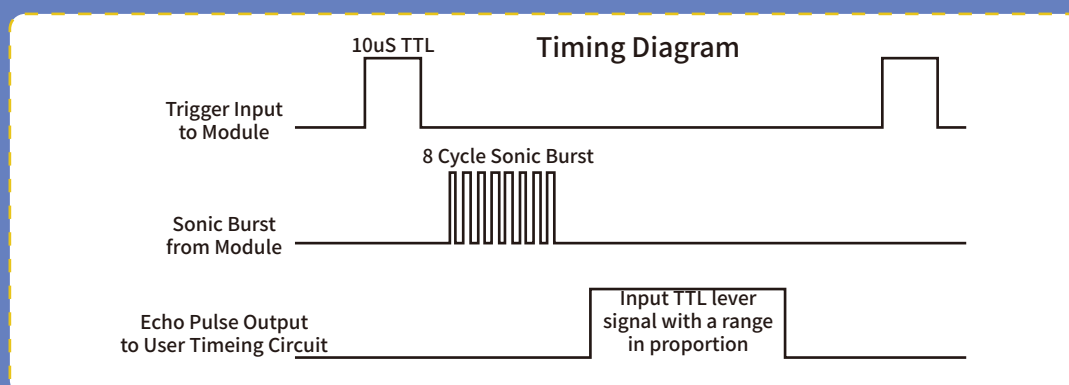
Ultrasonic sensor

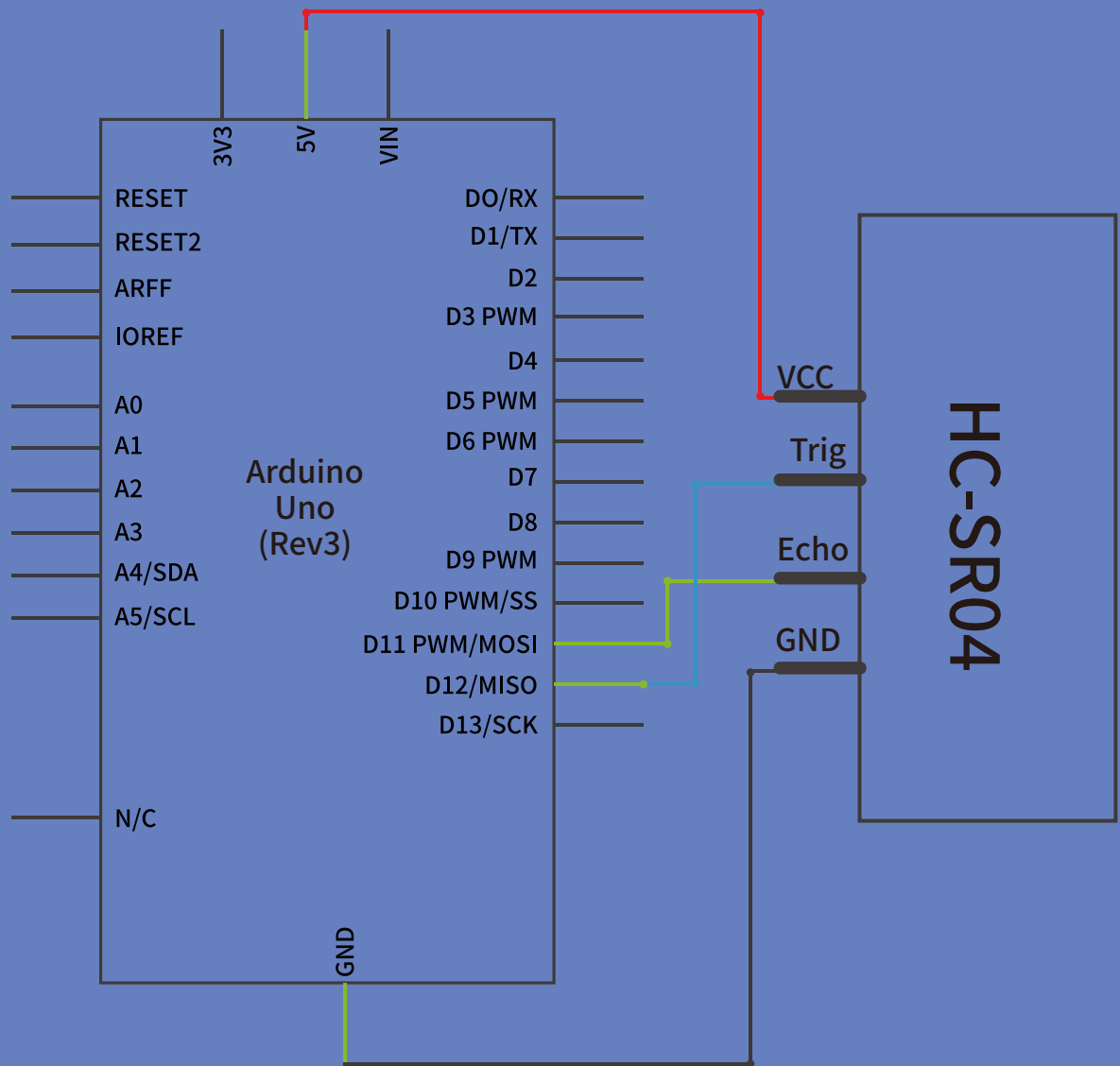
Ultrasonic sensor module HC-SR04 provides 2cm-400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:

- (1) Using IO trigger for at least 10us high level signal,
- (2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
- (3) IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.

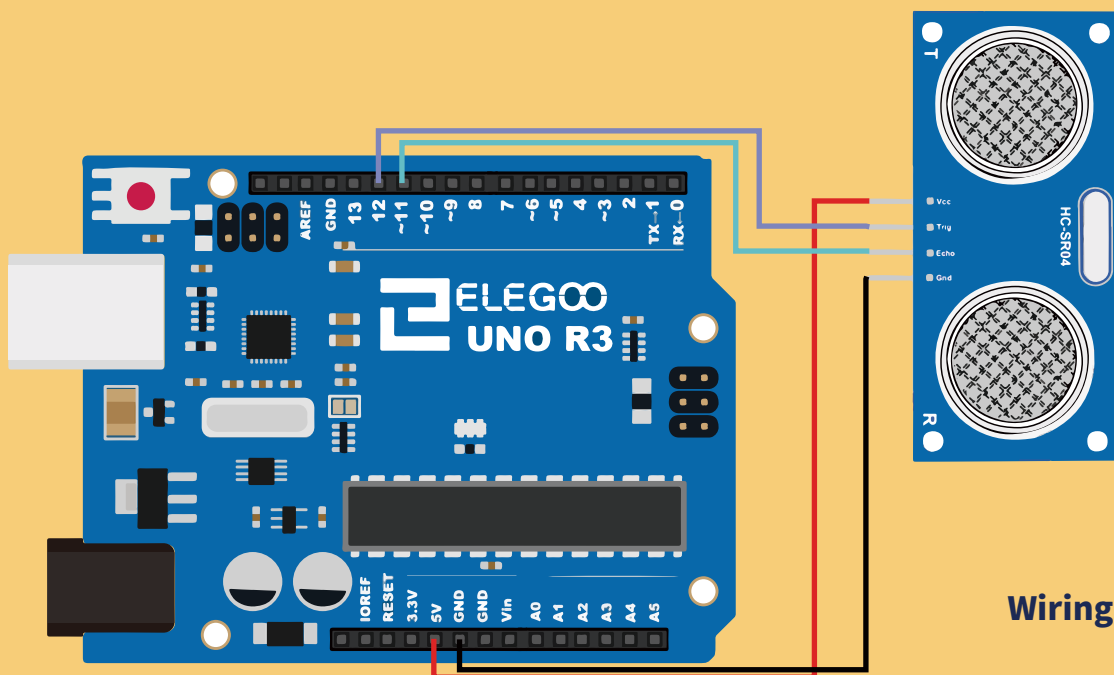
Test distance = (high level time × velocity of sound (340m/s) / 2

The Timing diagram is shown below. You only need to supply a short 10us pulse to the trigger input to start the ranging, and then the module will send out an 8 cycle burst of ultrasound at 40 kHz and raise its echo. The Echo pulse width is proportional to the distance of the object, or range. You can calculate through the time interval between sending trigger signal and receiving echo signal. Formula: $\text{us} / 58 = \text{centimeters}$ or $\text{us} / 148 = \text{inch}$; or:
the range = high level time * velocity (340M/S) / 2; we suggest to use over 60ms measurement cycle, in order to prevent trigger signal to the echo signal.





Connection Schematic



Wiring diagram

Code

Using a Library designed for these sensors will make our code short and simple. We include the library at the beginning of our code, and then by using simple commands we can control the behavior of the sensor.

After wiring, please open the program in the code folder-SR04_Example and click UPLOAD to upload the program. See Lesson 5 for details about program uploading if there are any errors.

Before you can run this, make sure that you have installed the **<HC-SR04>** library or re-install it, if necessary. Otherwise, your code won't work.

```
long a;
```

`long()`

[Conversion]

Description

Long keyword indicates a long integer data, which is a basic data type in programming language. It is the abbreviation of long int. it is a signed long integer by default, which contains 4 bytes, and the value range is: $-2^{31} \sim (2^{31}-1)$

Syntax

`long(x)`

`(long)x` (C-style type conversion)

Parameters

x: a value. Allowed data types: any type.

Returns

Data type: long.

Open the monitor then you can see the data as blow:

Click the Serial Monitor button to turn on the serial monitor. The basics about the serial monitor are introduced in details in Lesson 4 of part 2.

