

## Lesson 10 Ultrasonic Sensor Module

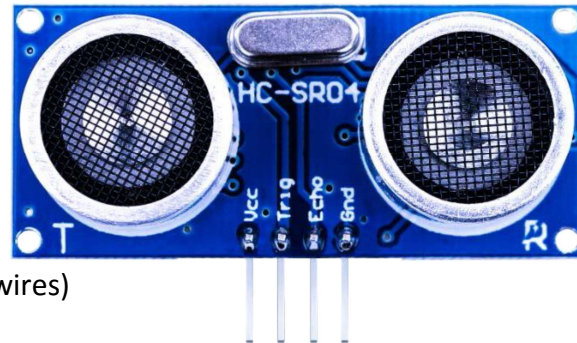
### Overview

Ultrasonic sensor is great for all kind of projects that need distance measurements, avoiding obstacles as examples.

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

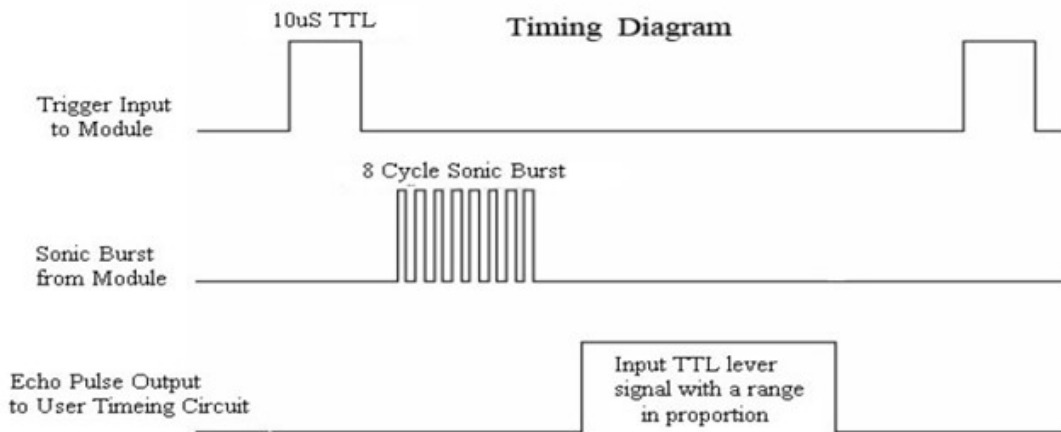
#### Ultrasonic sensor

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 turning.

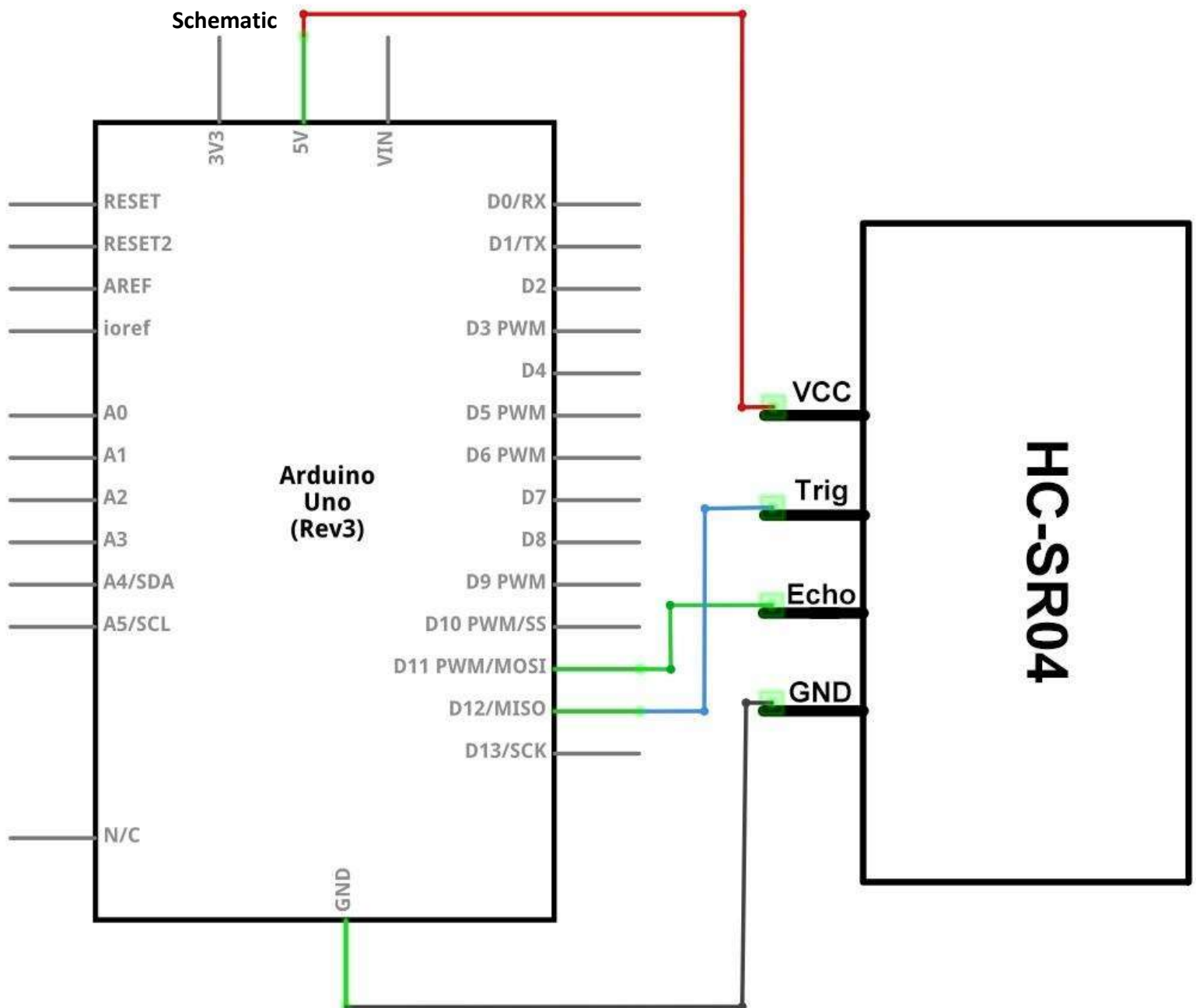
Test distance = (high level time × velocity of sound (340m/s) / 2

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 is a distance object that is pulse width and the range in proportion .You can calculate the range through the time interval between sending trigger signal and receiving echo signal. Formula:  $us / 58 = \text{centimeters}$  or  $us / 148 = \text{inch}$ ; 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.

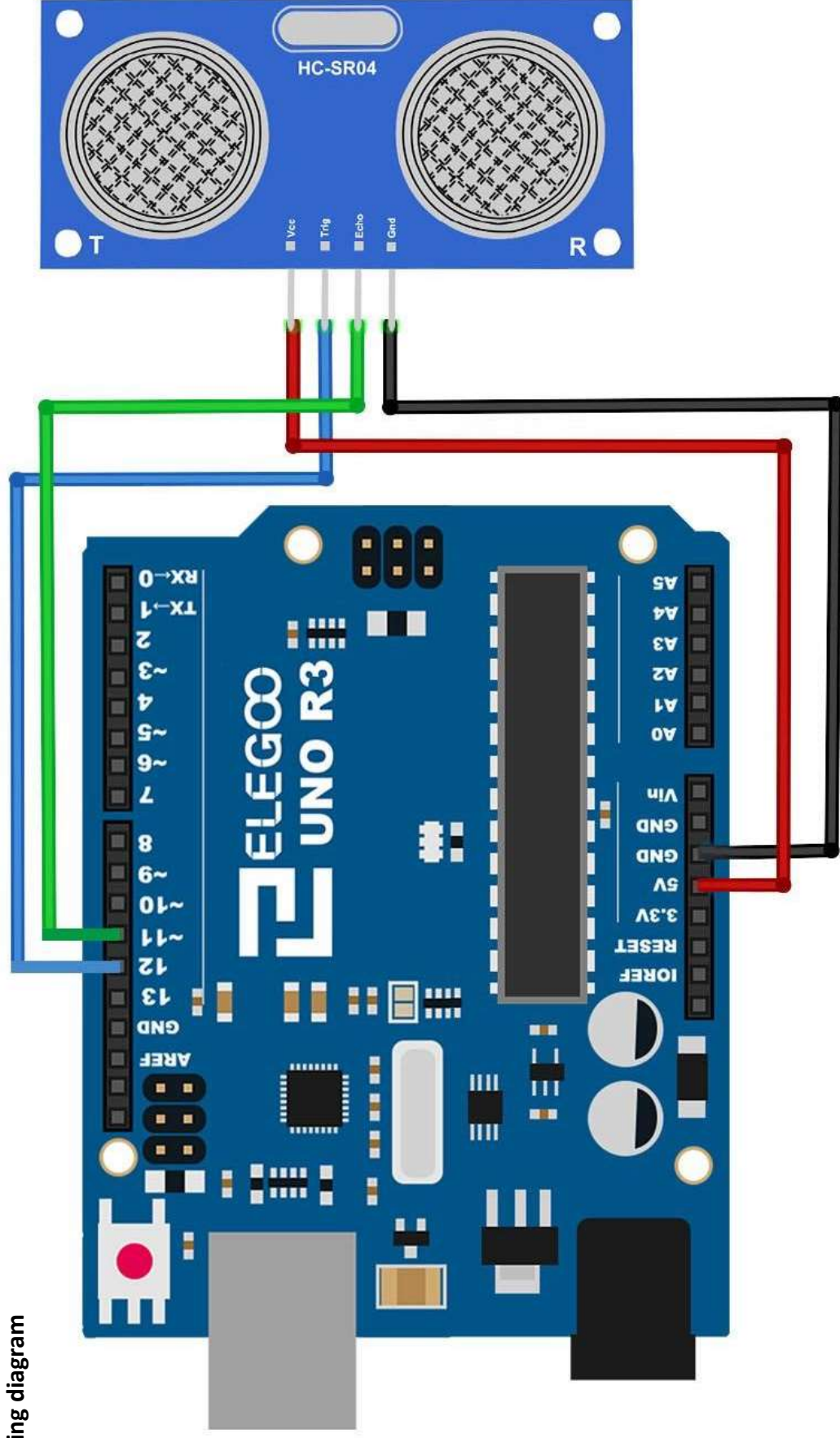


## Connection

### Schematic



Wiring diagram



## Code

Using a Library designed for these sensors will make our code short and simple.

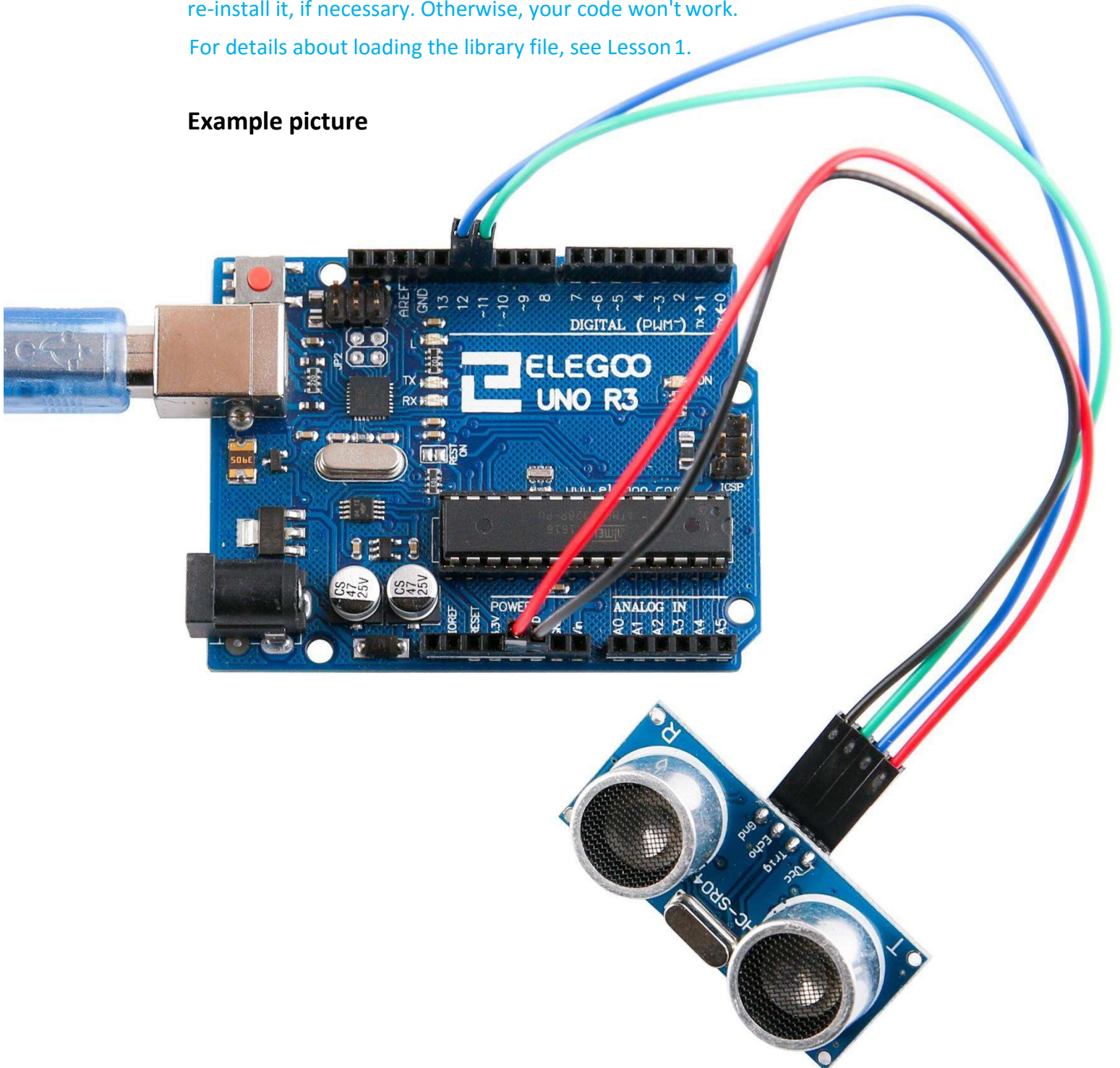
We include the library at the beginning of our code, and then by using simple commands we can control the behavior of the sensor.

After wiring, please open the program in the code folder- Lesson 10 Ultrasonic Sensor Module and click UPLOAD to upload the program. See Lesson 2 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.

For details about loading the library file, see Lesson 1.

## Example picture



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 1](#).

