Ultrasonic ranging

1. Learning target

1.1 In this course, we will learn how to use pins of the Raspberry Pi Pico board.

1.2 How to use ultrasonic sensor module.

2. Preparation

Raspberry Pi Pico board *1

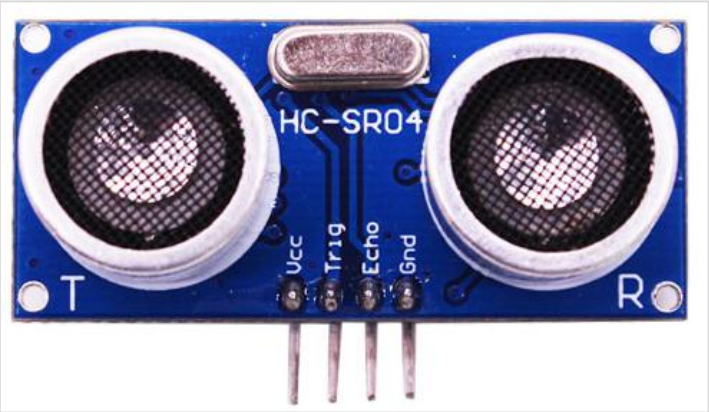
Pico sensor expansion board *1

PC *1

USB data cable *1

Ultrasonic sensor module *1

Male-to-male DuPont line *4



The ultrasonic module is a sensor that uses ultrasonic characteristics to detect the distance. It has two ultrasonic probes for transmitting and receiving ultrasonic waves. The range of measurement is 3-450 cm.

Work principle:

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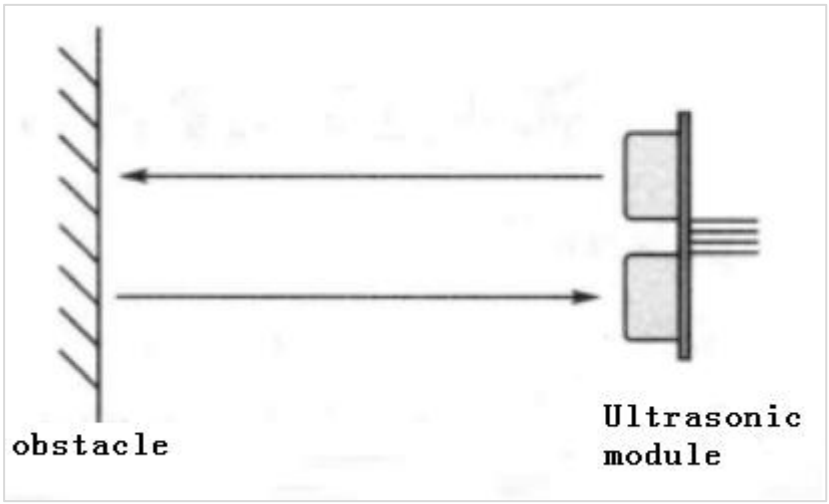
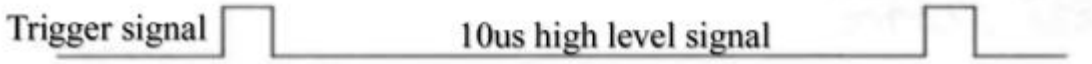
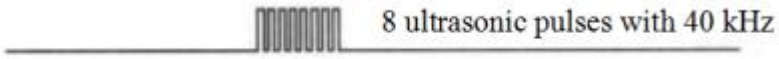


(1) You need to input a high level signal of at least 10us to the Trig pin to trigger the ranging function of the ultrasonic module.



(2) After the ranging function is triggered, the module will automatically send out 8 ultrasonic pulses with 40 kHz and automatically detect whether there is a signal return. This step is done internally by the module.

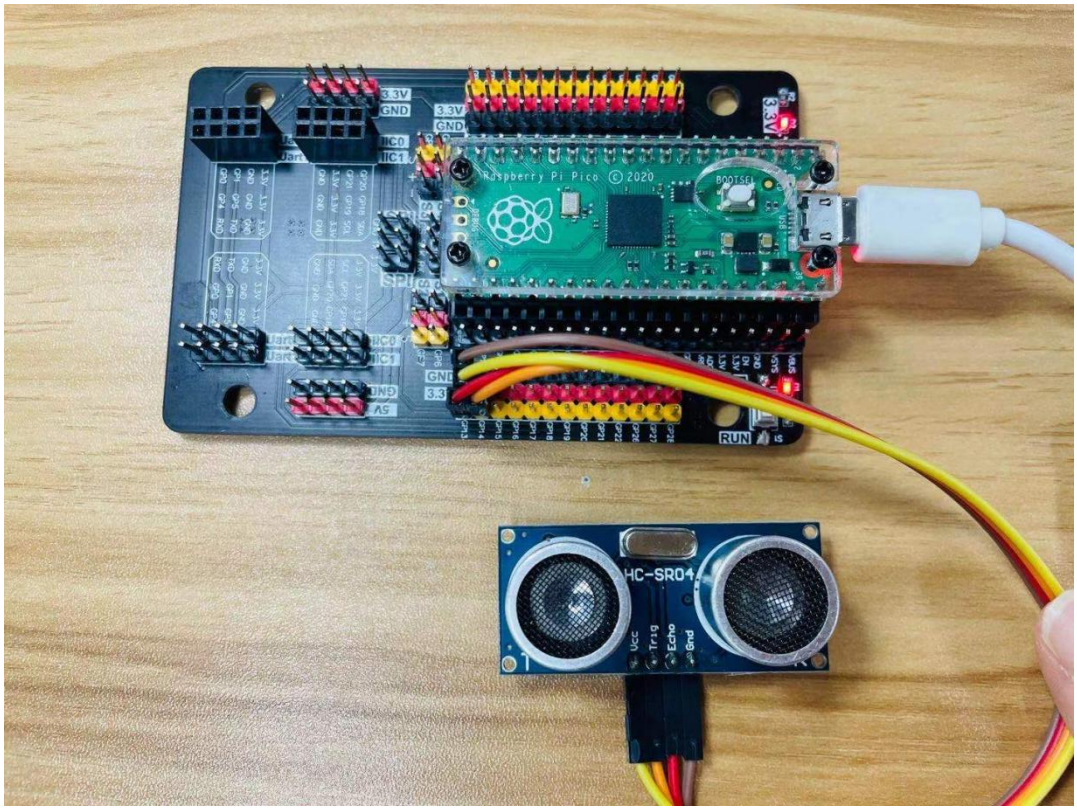


(3) When the module detects an echo signal, the ECHO pin will output a high level. The high level duration is the time from when the ultrasonic wave is sent to when it returns. You can calculate the distance by using the time function to calculate the high level duration.

Formula: Distance = High level duration * Speed of sound(340M/S)/2.

3. About wiring

Ultrasonic module	Pico sensor expansion board
Trig	GP13
Echo	GP14
VCC	5V
GND	GND



4. About code

Thonny programming

About how to using ThonnyIDE, please check the tutorials in【2.Development environment】

```
import utime
from machine import Pin
from ultrasonic import ultrasonic


Echo = Pin(13, Pin.IN)
Trig = Pin(14, Pin.OUT)

ultrasonic = ultrasonic(Trig, Echo)

while True:
    distance = ultrasonic.Distance_accurate()
    print("distance is %d cm"%(distance))
utime.sleep(.5)
```

Before running this program, you need to load ultrasonic library, please check the specific steps in【2.Development environment】

5. Phenomenon

Click the green run button  of Thonny IDE to start running the program. Click the red stop button  to stop the program. When the program is running, the shell window of Thonny IDE will print the distance value of the current environment.