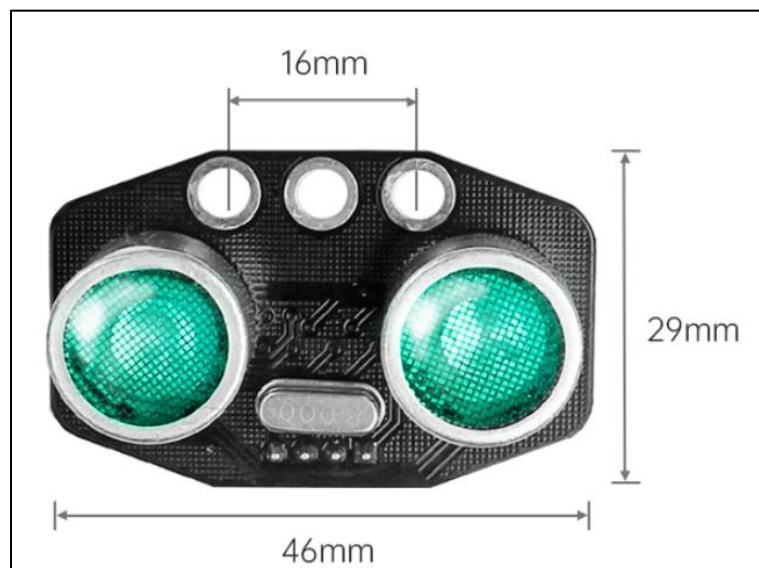


## Lesson 2 Ultrasonic Detection and Digital Tube Display

### 1. Project Principle

In this lesson, ultrasonic sensor will be used to detect object and the detection result will be displayed on digital tube.

The used glowing ultrasonic ranging module integrates ultrasonic transmitting circuits, ultrasonic receiving circuits, digital processing circuits, etc. inside the ranging chip. The module adopts IIC communication interface, and can read the measured distance through IIC communication.



Ultrasonic sensors have two main components: the transmitter and the receiver.

The module will automatically send eight 40khz square waves and detect if there are signals are sent back. If there are signals back, output a high level. Then the duration time is time when the ultrasonic waves are sent and returns.

Measured distance(L) =(high level time\* the speed of time(340M/S))/2.

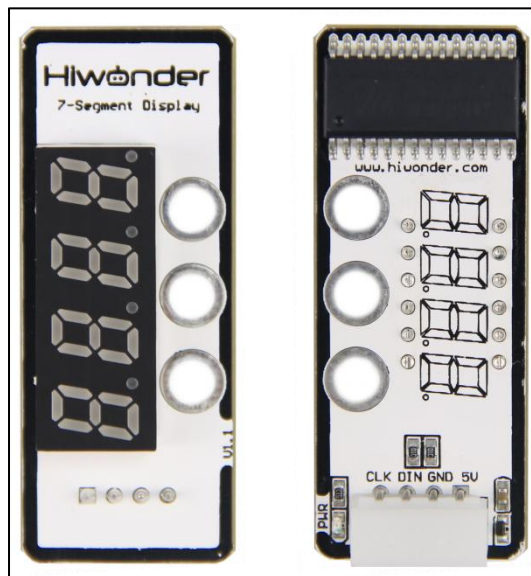
The ultrasonic probes integrates two RGB lights, not only can adjust the light

brightness, but also through the red (R), green (G), blue (B) three color channel changes and their superposition on each other to achieve colorful color changes.

The digital tube has a 4-digit red LED for displaying numbers, decimal points and some special characters. This module is compact and easy to use, you can apply this module in robotics projects for displaying sensor values such as speed, time, fraction, temperature, distance, etc.

Firstly, import corresponding libraries and initialize ultrasonic sensor, buzzer, servo and digital tube module.

Then set the distance measurement conditions, three threshold intervals are set in program. Different intervals will be distinguished with different colors.



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## 2. Preparation

### 2.1 Hardware

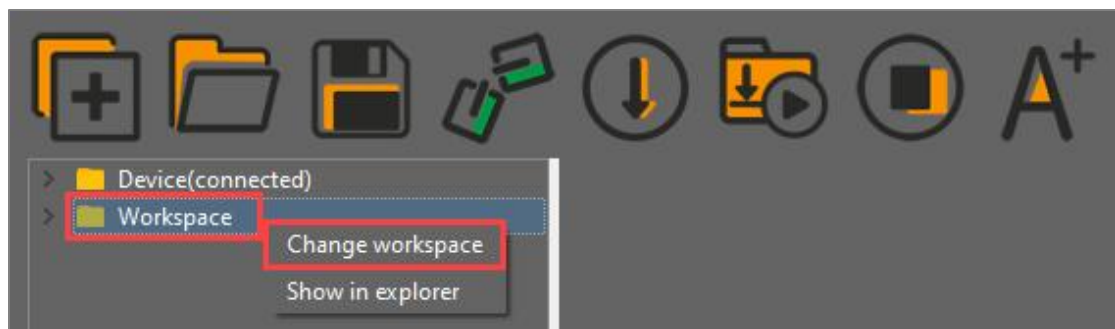
Please assemble the ultrasonic sensor to the corresponding position on MaxArm according to the tutorial in folder “Lesson 1 Sensor Assembly” under the same directory.

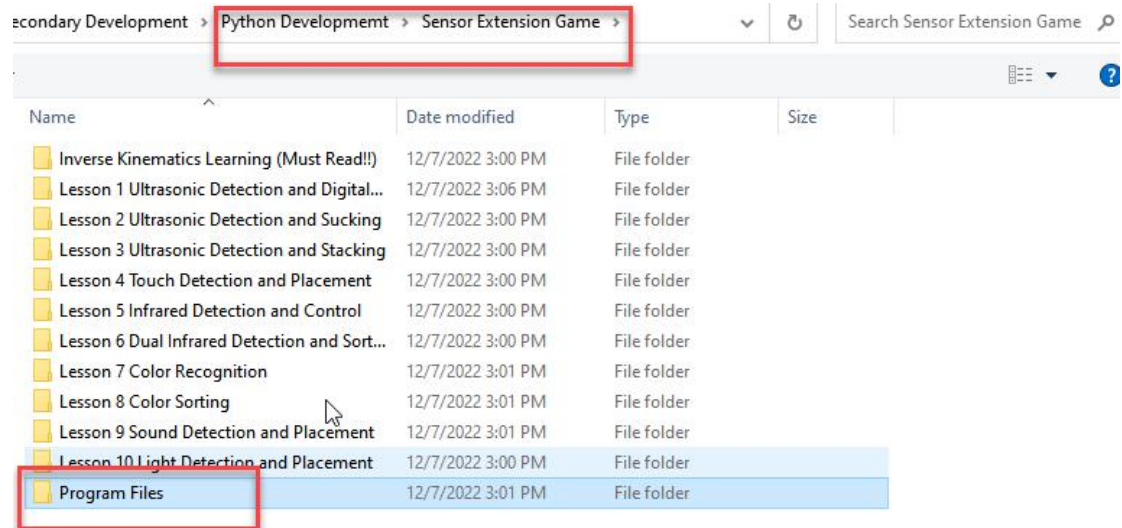
### 2.2 Software

Please connect MaxArm to Python editor according to the tutorial in folder “4. Underlying Program Learning/Python Development/Lesson 1 Set Development Environment”.

## 3. Program Download

- 1) After connecting, change the path of Workspace to “6. Secondary Development / Python Development/Sensor-extension Game”, and select “Program Files”.





- 2) Click the folder "Ultrasonic Detection and Digital Tube Display", and then select all the program files in the folder.



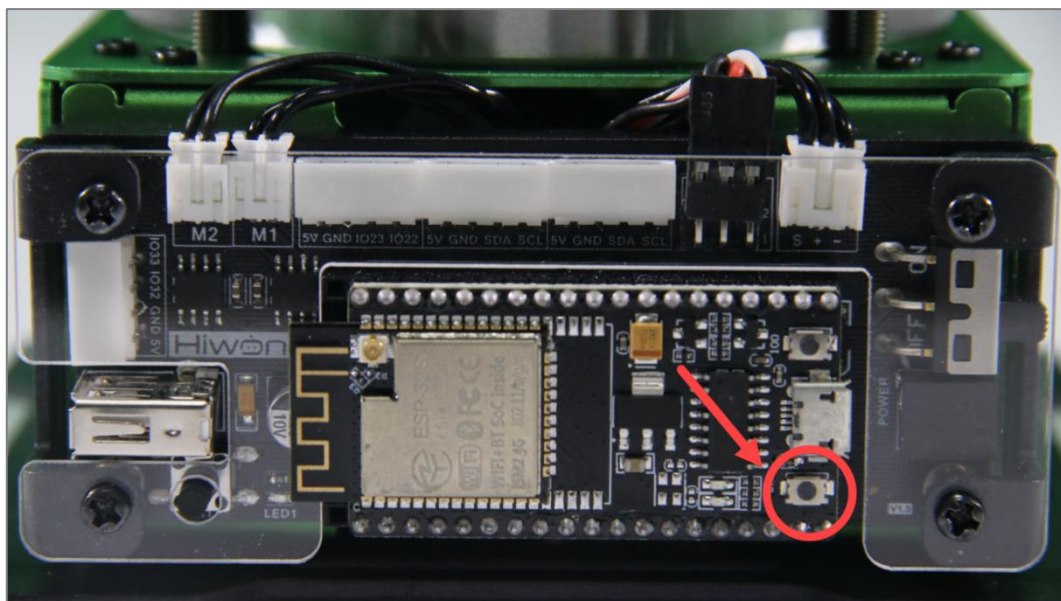
- 3) Then right click to download all the program files to the controller.



- 4) When the terminal prints the prompt as shown in the image below, it means download completed.

```
>>>
Downloading files
Start downloading TM1640.py.....
TM1640.py Download ok !
>>>
Start downloading Ultrasonic.py.....
Ultrasonic.py Download ok !
>>>
Start downloading main.py.....
main.py Download ok !
>>>
```

- 5) After downloading, click on the reset icon or press the reset button on ESP32 controller to run program.



## 4. Project Outcome

Place a block or other objects in front of ultrasonic sensor, and then the corresponding distance will be displayed on digital tube. If the distance



between sensor and object is less than 50cm, red light is on. If the distant is between 50cm and 100cm, green light is on. When the distance is farther than 100cm, blue light is on.

## 5. Program Instruction

### 5.1 Import library file

The path of program file: "6. Secondary Development/Sensor-extension Game/Python Development/ Ultrasonic Detection and Digital Tube Display/main.py"

Before the program is executed, I2C protocol, ultrasonic sensor, buzzer, PWM servo, bus servo, air pump and other related Python function libraries are imported.

```
1  import time
2  import TM1640
3  from machine import Pin, I2C
4  from Buzzer import Buzzer
5  from espmax import ESPMax
6  from PWMServo import PWMServo
7  from BusServo import BusServo
8  from Ultrasonic import ULTRASONIC
9  from RobotControl import RobotControl
10 from SuctionNozzle import SuctionNozzle
```

### 5.2 Ultrasonic detection

The variables is set to read the distance measured by ultrasonic sensor.

```
36  while True:
37      Distance = hwsr06.getDistance() # 3
38      print("Distance =", Distance, "mm")
```

### 5.3 LED Display

Display the distance value on digital tube.

39

```
tm.tube_display_int(Distance)
```

## 5.4 Light Color Setting

If the distance between sensor and object is less than 50cm, green light is on.

If the distance is between 50cm and 100cm, red light is on.

When the distance is farther than 100cm, blue light is on.

```
40 if Distance <= 50:
41     hwsr06.setRGBValue(bytes([0,255,0, 0,255,0]))
42 elif 50 < Distance and Distance <= 100: #
43     hwsr06.setRGBValue(bytes([255,0,0, 255,0,0]))
44 elif 100 < Distance:
45     hwsr06.setRGBValue(bytes([0,0,255, 0,0,255]))
46     time.sleep(0.2)
47
```