Lesson 2 Ultrasonic Detection and Suction

1. Working Principle

Ultrasonic sensors is a sensor that converts ultrasonic signals into other energy signals (usually electrical signals). There are two probes on ultrasonic sensor for receiving and transmitting ultrasound.

Firstly, import the corresponding library and initialize ultrasonic sensor, buzzer, servo and action groups.

Next, the object is detected by ultrasonic sensor and the measured distance is read by I2C protocol. After determining the distance, MaxArm will perform the corresponding action based on the determined result.

Then, execute the functions for controlling action group, starting buzzer and air pump to suck the object to the side.

The path to the program of the source code is “6. Secondary Development /Sensor-extension Game/Python Development/Program Files/Ultrasonic Detection and Suction/main.py”.

2. Preparation

1.1 Hardware

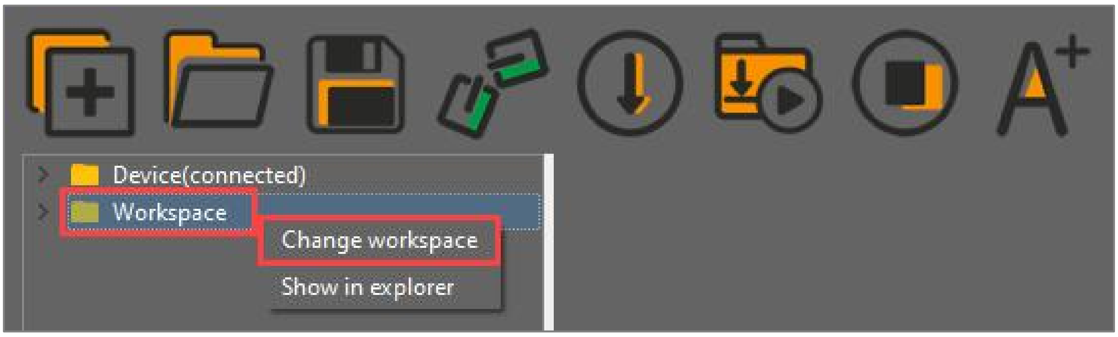
Please assemble the ultrasonic sensor to the corresponding position on MaxArm according to the tutorial in folder “Lesson 1 Sensor Assembly” under the same directory.

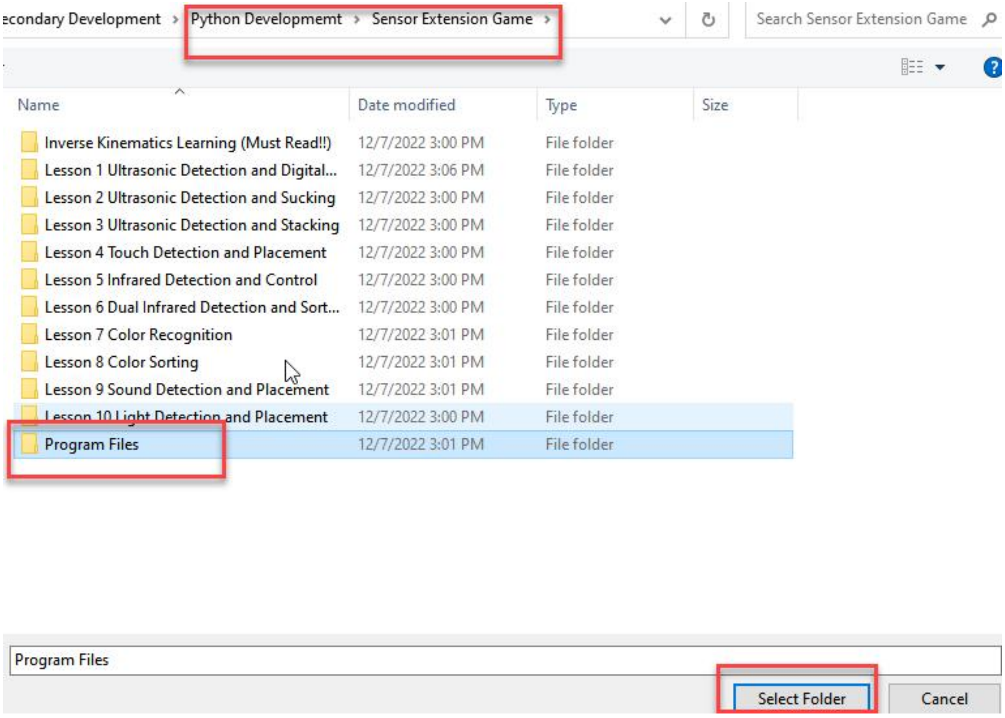
1.2 Software

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

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

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Name	Date modified	Type	Size
Inverse Kinematics Learning (Must Read!!)	12/7/2022 3:00 PM	File folder	
Lesson 1 Ultrasonic Detection and Digital...	12/7/2022 3:06 PM	File folder	
Lesson 2 Ultrasonic Detection and Sucking	12/7/2022 3:00 PM	File folder	
Lesson 3 Ultrasonic Detection and Stacking	12/7/2022 3:00 PM	File folder	
Lesson 4 Touch Detection and Placement	12/7/2022 3:00 PM	File folder	
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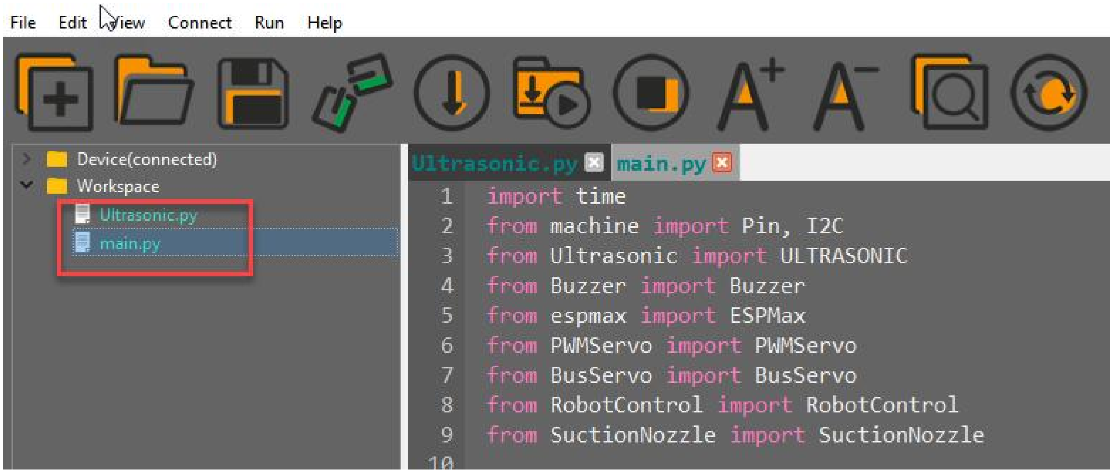
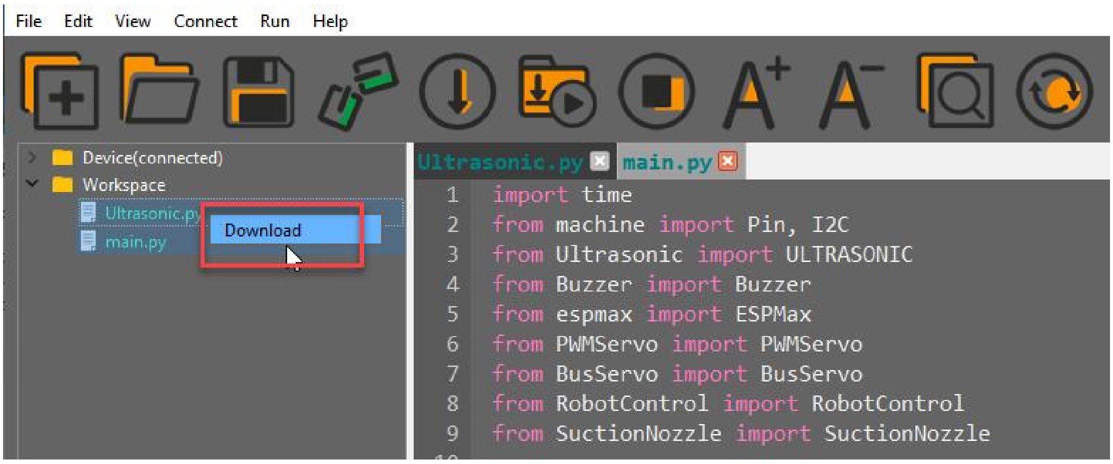
Program Files

1) Click the folder “Ultrasonic Detection and Suction”, and then select all the program files in the folder.

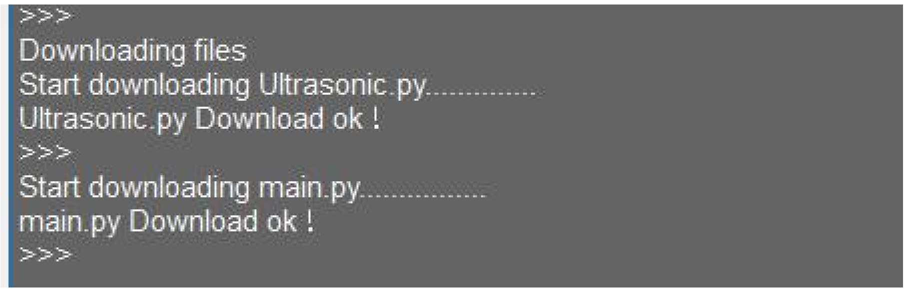


```
import time
from machine import Pin, I2C
from Ultrasonic import ULTRASONIC
from Buzzer import Buzzer
from espmax import ESPMax
from PWMServo import PWMServo
from BusServo import BusServo
from RobotControl import RobotControl
from SuctionNozzle import SuctionNozzle
```

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

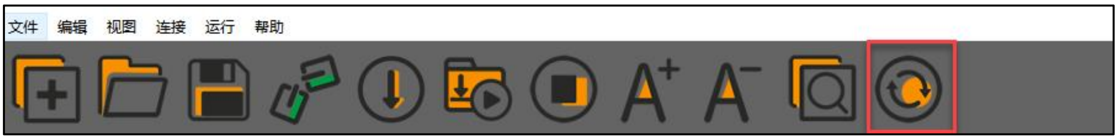


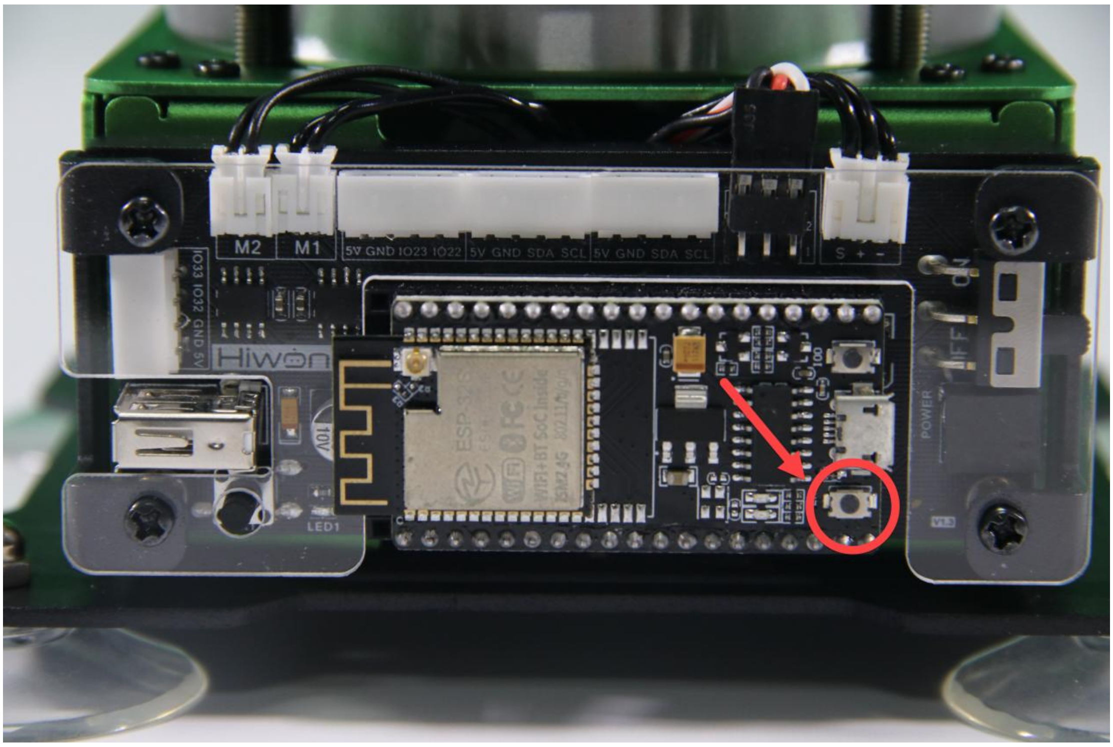
When the terminal prints the prompt as shown in the image below, it means download completed.



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

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





4. Project Outcome

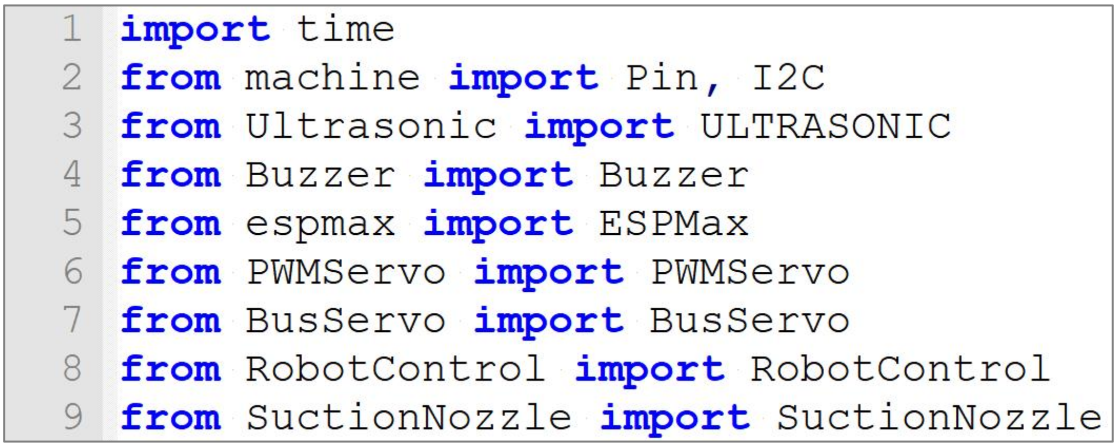
After the object is detected by ultrasonic sensor, the buzzer will make “Di” sound, and the robotic arm will move to the object. Then suck and place the object to the right. After the air pump stops, MaxArm will return to the initial posture.

5. Program Instruction

5.1 Import library file

Before carrying out detection and suction, the I2C protocol, ultrasonic sensor, buzzer, PWM servo, bus servo, air pump and other related Python function libraries are imported.

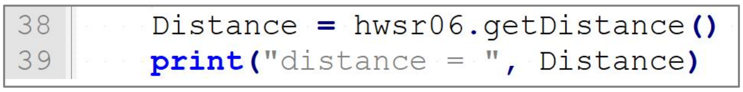
The path to the program of the source code is “6. Secondary Development /Python Development/Sensor-extension Game/Sensor Programs/ Ultrasonic Detection and Suction/mian.py”



```python
import time
from machine import Pin, I2C
from Ultrasonic import ULTRASONIC
from Buzzer import Buzzer
from espmax import ESPMax
from PWMServo import PWMServo
from BusServo import BusServo
from RobotControl import RobotControl
from SuctionNozzle import SuctionNozzle
```

5.2 Ultrasonic detection

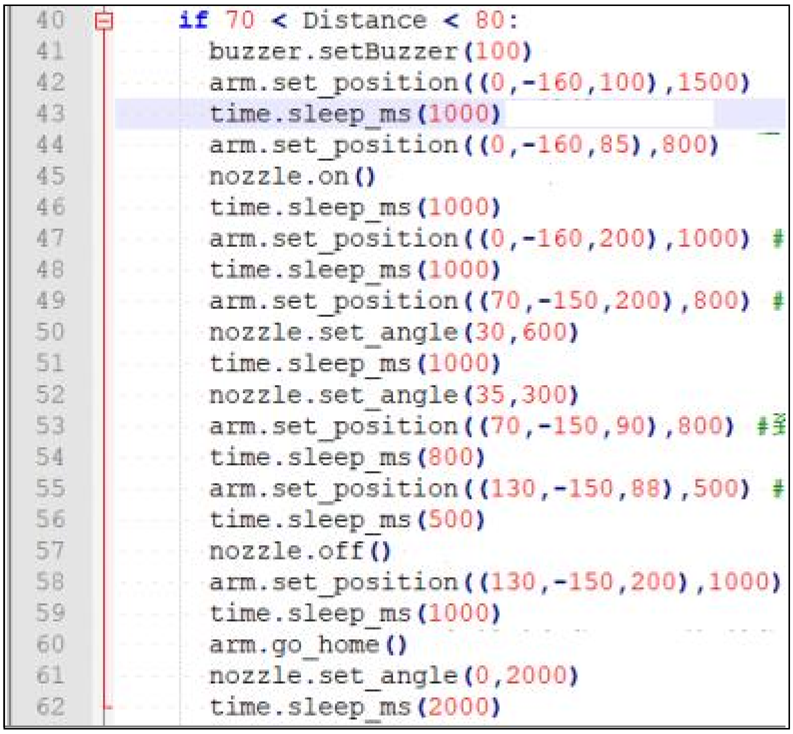
The distance is measured by suing hwsr06.getDistance() function, and then use print() function to print out the measured distance.



```python
    Distance = hwsr06.getDistance()
    print("distance = ", Distance)
```

5.3 Control robotic arm

Determine the distance of the front object first. If the object is between 60 and 80mm, MaxArm will perform the corresponding action.



```
    if 70 < Distance < 80:
        buzzer.setBuzzer(100)
        arm.set_position((0,-160,100),1500)
        time.sleep_ms(1000)
        arm.set_position((0,-160,85),800)
        nozzle.on()
        time.sleep_ms(1000)
        arm.set_position((0,-160,200),1000) #
        time.sleep_ms(1000)
        arm.set_position((70,-150,200),800) #
        nozzle.set_angle(30,600)
        time.sleep_ms(1000)
        nozzle.set_angle(35,300)
        arm.set_position((70,-150,90),800) #到
        time.sleep_ms(800)
        arm.set_position((130,-150,88),500) #
        time.sleep_ms(500)
        nozzle.off()
        arm.set_position((130,-150,200),1000)
        time.sleep_ms(1000)
        arm.go_home()
        nozzle.set_angle(0,2000)
        time.sleep_ms(2000)
```

Use the buzzer.setBuzze() function to control buzzer. Take the code “buzzer.setBuzzer(100)” as example:

The first parameter “(0，-160，100)” is the position of the suction nozzle on x, y and z axes.

The second parameter “1500” is the running time and the unit is ms.

Use the nozzle.set_angle() function to control the rotation of the suction nozzle. Take the code “nozzle.set_angle(30,600)” as example:

The first parameter “30” is the angle of PWM servo.

The second parameter “600” is the running time and the unit is ms.