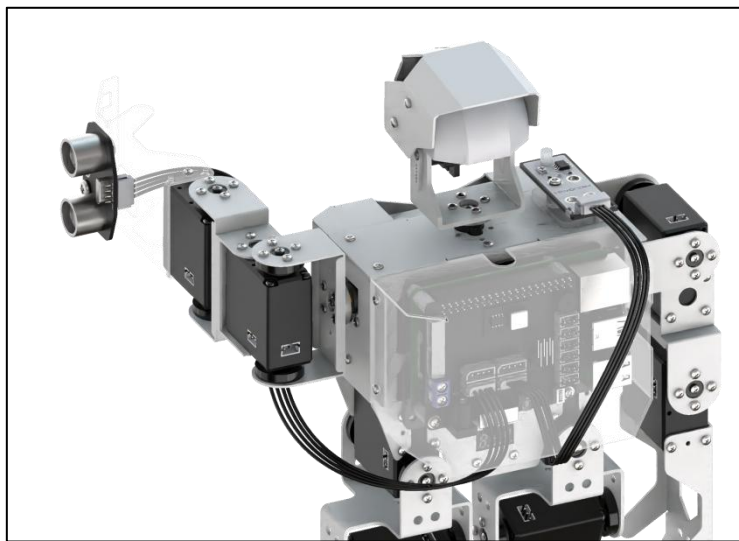# Lesson 5 Intelligent Fill Light

## 1. Getting Ready

Prepare a light and an ultrasonic sensor, and then install the light sensor on the expansion hole of robot's shoulder and install the ultrasonic sensor on the expansion hole of left arm. The installation method can refer to the file "Lesson 1 Sensor installing and wiring" under the same directory.



## 2. Working Principle

Let's look at the working principle:

When the vision recognition is started and the the external light detected by the light sensor is dark, the ultrasonic sensor emits the white light to fill light, otherwise, the ultrasonic sensor turns off the light.

The source code of the program is located in:

/home/pi/TonyPi/Extend/PhotoSensorDemo.py

```
42
43  def move():
44      global st
45
46      while True:
47          GPIO.setup(26, GPIO.IN)  #设置引脚为输入模式
48          GPIO.setup(24, GPIO.IN)
49          state = GPIO.input(24)   #读取引脚数字值
50
51          if state:
52              time.sleep(0.1)
53              if state:
54                  if st :                  #这里做一个判断，防止反复响
55                      st = 0
56                      setBuzzer(0.1)     #设置蜂鸣器响0.1秒
57                      s.setRGB(1, (255,255,255))
                          #设置超声波RGB亮白色
58                      s.setRGB(0, (255,255,255))
59          else:
60              if not st:
61                  st = 1
```
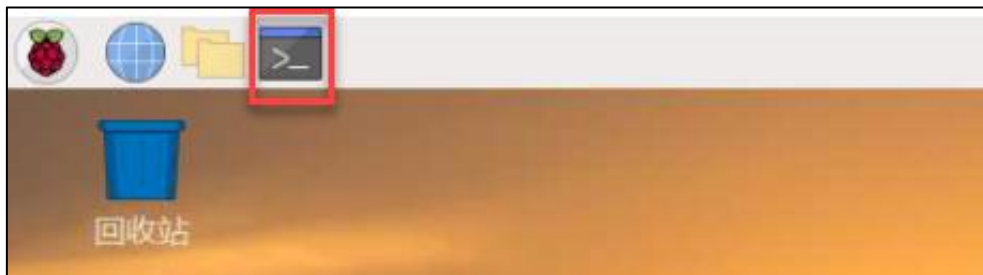
# 3. Operation Steps

ℹ The entered command must pay attention to case sensitivity and space.

1) Turn on the robot and connect to Raspberry Pi desktop with VNC.

2) Click [⌨] or press "Ctrl+Alt+T" to open LX terminal.



3) Enter "cd TonyPi/Extend/" command and press "Enter" to come to the directory of the game programmings.



pi@raspberrypi:~ $ cd TonyPi/Extend/

4) Enter "sudo python3 PhotoSensorDemo.py" command, and then press "Enter" to start the game.

```
pi@raspberrypi:~ $ cd TonyPi/Extend/
pi@raspberrypi:~/TonyPi/Extend $ sudo python3 PhotoSensorDemo.py
```

5) If want to exit the game, press "Ctrl+C" in the LX terminal. Please try multiple times if fail to exit.

# 4. Project Outcome

After the program is started, the robot raises its left hand and recognizes the label card within the visual range. When the ambient light gets dark, the buzzer will make a "Beep" sound. At the same time, the ultrasonic sensor will emit white light, which allows the robot to recognize the label card in dark environment.

# 5. Function Extension

## 5.1 Modify Fill Light

When the ambient light gets dark, the ultrasonic module will emit white light to fill light. You can modify the light color and brightness of the ultrasonic sensor, the specific operation is as follow:

1) Enter "cd TonyPi/Extend/" command and press "Enter" to come to the directory of the game programmings.

```
pi@raspberrypi:~ $ cd TonyPi/Extend/
```

2) Enter "vim PhotoSensorDemo.py" to come to the program editing interface.

```
pi@raspberrypi:~/TonyPi/Extend $ vim PhotoSensorDemo.py
```

3) Find the code in the program interface as the figure shown below.

```
 54                 if st :              #Make a judgment here to prevent repeated soun
    ding
 55                     st = 0
 56                     setBuzzer(0.1)    #set teh buzzer to sound for 0.1 second
 57                     s.setRGB(1, (255,255,255))  #Set ultrasonic RGB bright white
 58                     s.setRGB(0, (255,255,255))
 59             else:
 60             if not st:
 61                 st = 1
```

4) Press "i" on keyboard to enter the editing mode.

```
 55                     st = 0
 56                     setBuzzer(0.1)    #set teh buzzer to sound for 0.1 second
 57                     s.setRGB(1, (255,255,255))  #Set ultrasonic RGB bright white
 58                     s.setRGB(0, (255,255,255))
 59             else:
 60                 if not st:
 61                     st = 1
 62                     s.setRGB(1, (0,0,0)) #set the ultrasonic to close
 63                     s.setRGB(0, (0,0,0))
 64
 65             time.sleep(0.01)
 66
-- INSERT --                                             60,1            36%
```

5) Modify "(255,255,255)" to "(255,0,0)" (the range of three parameter is 0-255), as the figure shown below:

```
 55                     st = 0
 56                     setBuzzer(0.1)    #set teh buzzer to sound for 0.1 second
 57                     s.setRGB(1, (255,0,0))  #Set ultrasonic RGB bright Red
 58                     s.setRGB(0, (255,0,0))
 59             else:
 60                 if not st:
 61                     st = 1
 62                     s.setRGB(1, (0,0,0)) #set the ultrasonic to close
 63                     s.setRGB(0, (0,0,0))
 64
 65             time.sleep(0.01)
 66
-- INSERT --                                             59,14            36%
```

6) After modification, press "Esc" and then enter ":wq" (Please note that the colon is in front of wq). Then press "Enter" to save and exit the modified content.

```
 60                 if not st:
 61                     st = 1
 62                     s.setRGB(1, (0,0,0)) #set the ultrasonic to close
 63                     s.setRGB(0, (0,0,0))
 64
 65             time.sleep(0.01)
 66
:wq
```

7) Enter command "sudo python3 PhotoSensorDemo.py" to restart the game, and observe the effect.

## 5.2 Modify the Sound Duration

After the program starts, if the ambient light is darker, the buzzer will make "Beep" sound to prompt. The duration of the prompt sound can be modified through the program, and the specific operation steps are as follow:

1) Please refer to the steps (1) and (2) in "5.1 Modify Fill Light" to enter the program editing interface, and then find the code framed in the following figure.

```
51        if state:
52            time.sleep(0.1)
53            if state:
54                if st :          #Make a judgment here to prevent repeated sounding
55                    st = 0
56                    setBuzzer(0.1)   #set teh buzzer to sound for 0.1 second
57                    s.setRGB(1, (255,0,0))  #Set ultrasonic RGB bright Red
58                    s.setRGB(0, (255,0,0))
```

2) Refer to the step (4) in "5.1 Modify Fill Light" to modify "0.1" to "0.3", as the figure shown below.

```
54                if st :          #Make a judgment here to prevent repeated sounding
55                    st = 0
56                    setBuzzer(0.3)   #set teh buzzer to sound for 0.3 second
57                    s.setRGB(1, (255,0,0))  #Set ultrasonic RGB bright Red
58                    s.setRGB(0, (255,0,0))
59            else:
60                if not st:
```

3) Refer to the step (5) in "5.1 Modify Fill Light" to save and exit. Then enter "sudo python3 PhotoSensorDemo.py" command to restart the game, and observe the demonstration effect.

## 5.3 Adjust the Sensitivity

If the realization effect is affected by the sensitivity of light sensor, you can adjust the sensitivity by rotating the potentiometer on sensor, and the specific operation steps are as follow:

1) Find the potentiometer for adjusting the sensitivity and its position is located in the figure shown below:

2) Rotate the potentiometer with a screwdriver, and observe the status of LED1 at the same time. When LED1 is in the critical point between on and off , it means that the sensor is the most sensitive.