Lesson 4 AprilTag Tracking

Note: The servo on robotic hand has been set with corresponding ID and limited angle before delivery. If the ID and the limited angle change due to other operations, please refer to the tutorial in "5.Appendix/8.Servo Debugging Method" to adjust.

1. Getting Ready

1) This lesson can be started after the robotic hands are assembled. The specific assembly method refers to "Advanced Lesson/ Vision Gripping Lesson/ Lesson 1 Robotic Hands Assembly".

2. Working Principle

The working principle of this this lesson is as follow:

The color is recognized through Lab color space firstly. Then convert RGB color into Lab color space, and proceed with binarization, dilation and erosion to obtain the contour of the target color. Then frame the color with rectangle to realize the color recognition.

Next, call the action group that has been set and let the robot pick up the object.

Then, control the robot's head in motion to search AprilTag within the visual range. The screen is processed by positioning, image segmentation and contour finding first. After the contour is positioned, quadrilateral detection is performed. Through the acquisition of the four corner points, the straight line is fitted to form a closed loop, and the identification and position acquisition of AprilTag are completed.

The source code of the program is located in:

/home/pi/TonyPi/Extend/ApriltagTrack.py

```python
16     #开合手掌放置apriltag区域
17
18    if sys.version_info.major == 2:
19        print('Please run this program with python3!')
20        sys.exit(0)
21
22    debug = False
23    tag_id = None
24    action_finish = False
25    CentreX = 320
26    servo1, servo2 = 920, 1500
27    objective_x, objective_y = 0, 0
28    color, color_x, color_y, angle = None, 0, 0, 0
29
30    lab_data = None
31    def load_config():
32        global lab_data
33
34        lab_data = yaml_handle.get_yaml_data(yaml_handle.lab_file_path)
35
36    range_rgb = {
37        'red': (0, 0, 255),
38        'blue': (255, 0, 0),
39        'green': (0, 255, 0),
40        'black': (0, 0, 0),
41        'white': (255, 255, 255),
42        'None': (255, 255, 255)}
43
44    # 初始位置
45    def initMove():
46        Board.setPWMServoPulse(1, servo1, 1000)
47        Board.setPWMServoPulse(2, servo2, 1000)
48        Board.setBusServoPulse(17, 500, 1000)
49        Board.setBusServoPulse(18, 500, 1000)
50
51    def right_splay():
52        Board.setBusServoPulse(17, 240, 1000)
53        time.sleep(1)
54
55    def right_grasp():
56        Board.setBusServoPulse(17, 500, 1000)
57        time.sleep(1)
58
```
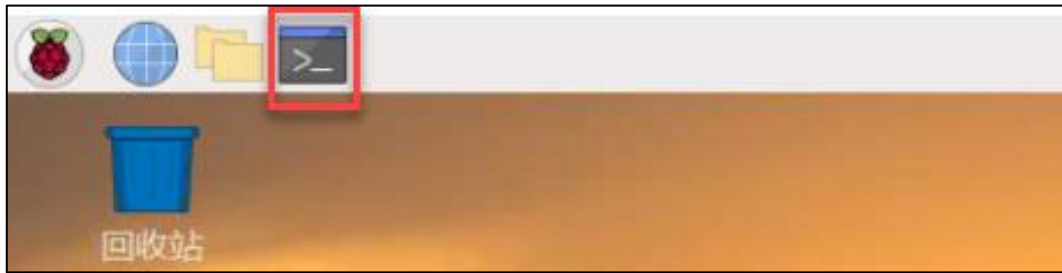
3. Operation Steps

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

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

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

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

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

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 starting the game, TonyPi Pro will detect the object within the visual range. When one of colored blocks is recognized, TonyPi Pro will pick up the block, and then move to the AprilTag and put it down.