Independent football exercise

1. Purpose of the experiment

This tutorial will teach you how to locate a ground target ball through visual recognition and use motion planning algorithms to control the robot dog to perform controlled movements.

2. Main source code path

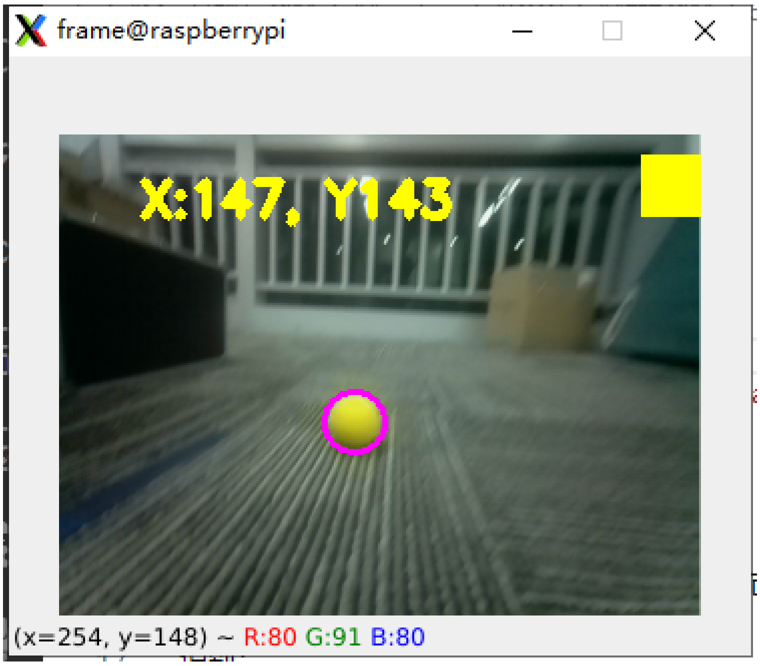
First end the large program and then enter the terminal

```
cd ~/home/pi/DOGZILLA_Lite_class/6.AI Visual Interaction Course/12.Football Sport
python3 play_football.py
```

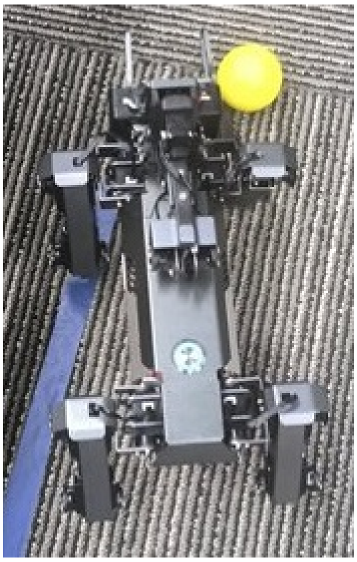
3. Experimental Phenomenon

After running the source code, by placing the ball within the range that the robot dog can identify, you can let the robot dog track the ball and then kick the ball. The yellow ball is recognized by default, and you can switch the color of a building block by pressing the button in the upper right corner of the screen.

Identification:



Playing football:



result:

4. Main source code analysis

```
while 1:
    ret, frame = cap.read()
    frame_ = cv2.GaussianBlur(frame,(5,5),0)
    hsv = cv2.cvtColor(frame,cv2.COLOR_BGR2HSV)
    mask = cv2.inRange(hsv,color_lower,color_upper)
    mask = cv2.erode(mask,None,iterations=2)
    mask = cv2.dilate(mask,None,iterations=2)
    mask = cv2.GaussianBlur(mask,(3,3),0)
    cnts =
cv2.findContours(mask.copy(),cv2.RETR_EXTERNAL,cv2.CHAIN_APPROX_SIMPLE)[-2]


    if g_mode == 1:
        if len(cnts) > 0:
            cnt = max (cnts, key = cv2.contourArea)
            (color_x,color_y),color_radius = cv2.minEnclosingCircle(cnt)
            if color_radius > 10:
                cv2.circle(frame,(int(color_x),int(color_y)),int(color_radius),
(255,0,255),2)


                X_track_PID.SystemOutput = color_x - obj_error #X 因为球要在右足方向
上  Because the ball needs to be in the right foot direction
                X_track_PID.SetStepSignal(X_Middle_error)
                X_track_PID.SetInertiaTime(0.01, 0.1)
                x_real_value = int(X_track_PID.SystemOutput)
                x_real_value = limit_fun(x_real_value ,-18,18)

                g_dog.move('y',x_real_value)


                if color_y > 225 or color_y ==0 :
                    g_dog.move('x',0)
                else :
                    g_dog.move('x',10)

            #停止定点，进行踢球运动 Stop stationary and start playing soccer
            if color_y > 225 :
                if abs(color_x -obj_error -160)<25:###6
                    step = step+1
                else :
                    step = 0
                if step > 5:
                    g_dog.stop()
                    g_mode = 2 #进入踢球运动 Enter the sport of football
        else:
            color_x = 0
            color_y = 0
            g_dog.stop()

        #print([color_x,color_y])
        cv2.putText(frame, "X:%d, Y%d" % (int(color_x), int(color_y)), (40,40),
cv2.FONT_HERSHEY_SIMPLEX, 0.8, (0,255,255), 3)
        t_start = time.time()
        fps = 0

    elif g_mode == 2: #踢球运动  Football sports

        g_dog.translation(['x'],[-10])
        time.sleep(0.5)
        g_dog.attitude(['p'],[0])
        time.sleep(0.5)

        g_dog.motor_speed(200) #加快运动速度 Accelerate the speed of movement
        time.sleep(0.2)
        g_dog.motor(four_leg,[7.18, 31.65, -0.12, -32.35, 55.49, -0.82, 4.35,
39.18, 1.76, 4.82, 39.8, 0.12])#收 Close
        time.sleep(0.2)
        g_dog.motor(four_leg,[7.18, 31.65, 1.06, 46.71, -22.31, -0.59, 4.35,
38.55, 1.76, 4.82, 39.18, 0.12])#伸 extend
        time.sleep(0.2)
        g_dog.motor(four_leg,[7.18, 31.65, 1.06, 50.0, -54.94, -0.82, 4.35,
38.55, 1.76, 5.29, 39.18, 0.12])#踢 kick
        time.sleep(0.2)
        g_dog.motor(four_leg,[5.29, 31.65, -0.35, 5.76, 31.65, 0.35, 2.94, 39.18, -0.35, 3.88, 39.18, 0.12])#收回 retract
        time.sleep(1)


        g_dog.translation(['x'],[0])#恢复追踪目标的姿态 Restore the posture of the tracked target
        time.sleep(0.2)
        g_dog.attitude(['p'],[15])
        time.sleep(0.2)

        g_dog.pace('slow') #恢复寻找目标的速度 Restore the speed of searching for targets
        time.sleep(0.2)

        step = 0
        g_mode = 1
```

The above code is the main process of a kicking motion by identifying the ball of the target color.