Color interaction

1. Introduction to gameplay

```
How to play:
1) First close the large program;
2) Start a command line window as the anti-decryption server and keep running.
cd ~/dofbot_ws/ # Enter the workspace
catkin_make # compile
source devel/setup.bash # Update system environment
roslaunch dofbot_info dofbot_server.launch # Start the server node
3) The gameplay path of luring a snake out of its hole:
dofbot_ws/src/dofbot_snake_follow/scripts/lead the snake out of its hole.ipynb
```

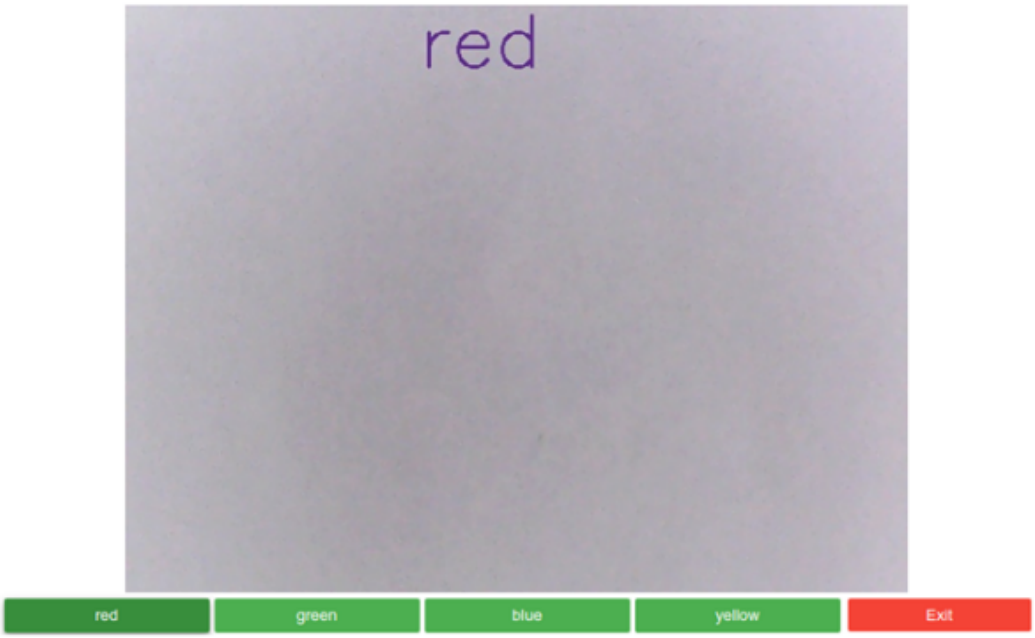
(1) Start the code block and display the interface as shown in the figure. Click the color button to select a color at will. The selected color is displayed in the middle above the image.

(2) When the selected color appears in the field of view, the robot arm will estimate the location of the block based on its area in the image.

(3) When the area becomes smaller, the robotic arm drives forward until the front end completes the grasping action. When the area becomes larger, it retreats and shakes its head in fear.

(4) If the color that appears on the screen is not the selected color, the robot arm moves back and shakes its head.

Note: Use the color block here to control the robotic arm back and forth, and then slowly move away to trigger it. This case requires multiple attempts



2. Code design

- Use polygon approximation method to obtain the area of color objects in the field of view

```
for i, cnt in enumerate(contours):
     # Calculate the moments of a polygon
     mm = cv.moments(cnt)
     cx = mm['m10'] / mm['m00']
     cy = mm['m01'] / mm['m00']
     # Calculate the area of the contour
     area = cv.contourArea(cnt)
```

- Obtain the current pose through the correct solution

```
def get_Posture(self):
     '''
     Publish joint angles and obtain positions
     '''
     self.read_joint()
     # Wait for the server to start
     self.client.wait_for_service()
     #Create message package
     request = kinemaricsRequest()
     ... ...
```

- Estimate location based on area size

```
# Estimate the position of the camera based on the block
distance = 27.05 * math.pow(area, -0.51) - 0.2
# Estimate the position of the block in the base coordinate system
target_dist = distance + self.Posture[1]
```

- Use the inverse solution to find the angle that each joint needs to rotate.

```
def snake_run(self, point_y):
     '''
     Issue a position request and obtain the joint rotation angle
     '''
     pass
```

- Anti-solution design

When we are playing the game of luring the snake out of the hole, we need to control the end posture of the robotic arm and always face the front. When obtaining the inverse solution, we can just write the end posture of the robotic arm.

```
/////////////// Lure the snake out of its hole ///////////////
if (request.tar_z >= 0.2) {
        x=request.tar_x;
        y=request.tar_y;
        z=request.tar_z;
        Roll= -90;
}
Code path dofbot_ws/src/dofbot_info/src/dofbot_server.cpp
```

For detailed codes, please view snake_ctrl.py;snake_move.py;snake_target.py in the /root/dofbot_ws/src/dofbot_snake_follow/scripts directory