**任务书**

**(Task 1.3) Pilot into “resident ROV” docking station**

We operate on the HSV image, extract the red part to obtain a binary image, use the minimum circumscribed circle to find the red button’s center, and determine the left or right movement based on the offset between the button’s center and the lens center. The actual distance from the camera to the object is calculated by camera focal length, the ratio of the length of the object to be measured to the distance between the object and the lens, and other known parameters, combined with the number of pixels of (?) in the docking station.……

*自动入站：*

*对HSV图像进行操作，提取红色部分获得二值化图像，利用最小外接圆找到其中心，并根据该中心与镜头中心偏移决定向左/右移动。通过已知的摄像头焦距、待测物体距离与长度比等参数，结合站点（某杆？）的像素个数得到摄像头到该物体的实际距离（未完待续……*

**(Task 2.4) Monitor and protect seagrass habitat**

Solution: We operate on the image with only 8\*8 grids obtained after specific image processing. We estimate the length A and width B of a grid based on the total pixel length/8 and width/8. After that, the program start from the (A/2, B/2) position (i.e., the center of the grid in the upper left corner) and traverse the center of all grids to count the number of green grids by telling the different shade of color of grayscale image.

Introduction of robot visual function

The robot can get a grayscale image after image processing, traverse all the grids in the step of the pixel length of a grid, and calculate the number of green grids.

Mission specifics

For image processing, we use grayscale image to distinguish deep color (blue background and green grids) from light color(blank grid). Then we use morphological opening to remove tiny noise, and use color judgment to remove the edge parts of the grayscale image, leaving 8\*8 grids. To make sure a certain grid is green, we draw 9 pixels from the center of the grid. If 7 pixels out of 9 are green, we consider that grid as a green one.

**Challenges & Troubleshooting**

**(Task 1.3) Pilot into “resident ROV” docking station**

Challenges: We find it difficult to estimate the size of the red button in the docking station. There was a significant deviation between the calculated value and the actual value, which could lead to errors in calculating the distance between the robot and the button.

Troubleshooting:

We use HSV image to recognize red color and adjust parameters based on the actual button color captured, and the button is extracted based on its color (based on the *findContours* function of opencv, only the outer contour is detected and all contour information points are retained). Then, the minimum circumscribed circle of the button’s image is drawn, and we use the minEnclosingCircle function of opencv to find the center and radius of the contour of the button.