

Midterm

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Fig. 1. Robot with the Capture Mechanism

Abstract—In this lab practice, I present a vision-based FreeNove Robot using an OpenMV camera to accomplish position control. I employ the technique of proportional control that uses feedback from the OpenMV at every time step to correct the error. Moreover, P-Control ensures the robot moves in the direction of the desired location - which in my case, it ensures the robot circulates and stays within the area covered by the black mats - and the speed of the robot is proportional to the position of the robot in the black mats area. In this lab, I demonstrate the use of OpenMV and the technique of proportional controller to drive the robot to go around the obstacle, pick up the duck, and bring it back to the original location autonomously.

I. TIME TO COMPLETE THE TASK

20 seconds: from robot leaving to returning with the duck

II. CONCLUSION

A. How to improve your robot to perform the task faster?

A more reliable control policy. In order to achieve that, I might want to consider what information I should retrieve from the camera that will better help with determining the control policy. For example, for the Omega control, instead of getting the size of white space detected, I might consider picking a line of pixels and use that to determine the Omega value. This is a simpler method than the one I am currently using, which could have the potential to reduce the extra steps of navigation the robot takes.

B. How do you plan to release the ducks for the final?

For the current capturing mechanism, I do not have a "grabber" that holds the ducks. Therefore, my plan for releasing would be back up and turn around, so that the strip no longer pushes or touches the ducks.

C. How would you search and capture more ducks?

I would do some simple "going around" before a deck is detected and tracked. I could implement an algorithm that does something like tilting, going forwards, tilting, and going backward. The goal is to lap around the space so that the robot has a higher chance of seeing a duck.

D. What else do you plan to improve for the final?

Here are 2 things I would improve:

- **Vision:** I would do some adjustment to the placement of the OpenMV. In the current design, the OpenMV is placed at the front of the car, attached to the board, and pointing downwards at a 60 degree angle. From this experiment, I noticed the captured duck might block a big chunk of the image, thus blocking the view. As a solution, I might need to consider placing the camera higher, so it doesn't have to look at the ducks that are captured anymore.
- **Capture Mechanism:** The current design is pretty effective for capturing and pushing rubber ducks. However, it cannot capture multiple ducks since the ducks might slip away when the robot makes turns. For future improvement, I would consider making the capturing strip wider and more curved, and hopefully it can interact with more duck simultaneously.

III. LINK TO THE RECORDED VIDEO

https://drive.google.com/drive/u/0/folders/17L0642PS6uCiQZCWJ9reeEAFh_AO4AF7