

CS 556: Task-Sheet for Lab 4

Wall Following (P-Controller)

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Robot ID: 20

Question:	1a Prelab	1b Prelab	1c Prelab	3.1	3.2a	3.2b	3.2c	3.2d	3.2e	Total
Points:	5	5	10	30	26	6	6	6	6	100
Score:										

Pre-lab Submission (on Canvas, Due Wednesday, 23:59 PM before lab #4):

- 1) Task-Sheet Pre-lab task (one PDF file: [TeamX_LabY_Prelab_Tasksheet.pdf](#))
- 2) Draft code (one zip folder: [TeamX_LabY_DraftCodes.zip](#))

Post-lab submission (On Canvas, Due Wednesday, 23:59 PM after lab #4) Submit in 3 separate files (do NOT zip these four together):

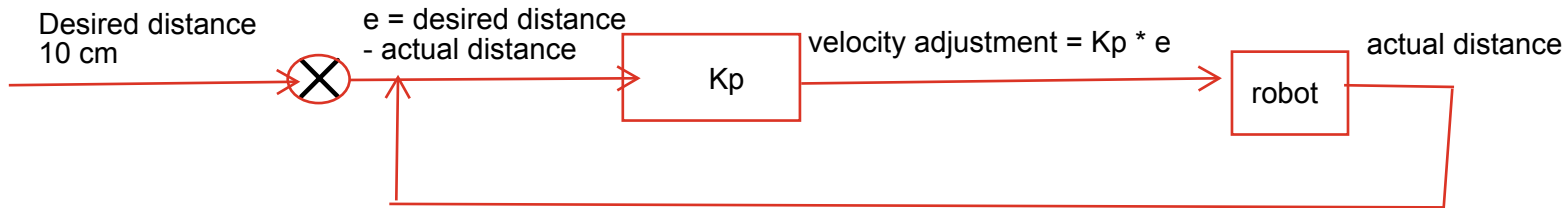
- 1) Task-Sheet tasks (one PDF file: [TeamX_LabY_Postlab_Tasksheet.pdf](#)).
- 2) Final code (one ZIP folder: [TeamX_LabY_FinalCodes.zip](#)).
- 3) Videos (one zip folder: [TeamX_LabY_Videos.zip](#)).

Lab Grading Criteria:

- Every member of the team must submit the same set of final materials for the post-lab to receive a grade.
- For the pre-lab submissions, no extensions will be offered. Failure to prepare for the lab will result in a 20% deduction from your total grade for that week's lab.
- For the post-lab submissions, late work or post-lab submissions will incur a 20% penalty per day, up to a maximum deduction of 100%.
- Lab attendance is mandatory – a missed lab will mean 0 points for you.
- Before you leave, make sure you return all robots and tools used to the front desk in the same format that you received them. If not done so, 10 points will be deducted.
- Your code must follow the industry guidelines for coding; if not done so, 10 points will be deducted. Comment out code for easy review, add new code below, and label each task with clear, descriptive comments. Ensure a modular, well-structured design with meaningful names, minimal globals, and avoid hardcoding values.

1. Prelab

- a. (5 points) Draw the block diagram for your proportional PController. Make sure to label and give units for the goal state, error, and controller output.



- b. (5 points) (Controller Architecture)

- i. Current state and how to estimate it:

The current state is the actual distance to the wall which is estimated using the sonar sensor.

- ii. Goal state:

The goal state is the desired distance we are from the wall which for this is 10 cm

- iii. Function for right wheel:

The function for the right wheel would be $V_{right} = V_{base} - (k_p * error)$

- iv. Function for left wheel:

The function for the left wheel would be $V_{left} = V_{base} + (k_p * error)$

- c. (10 points) PController Draft Code

3.1 (30 points) Final PController class submission - [25 points for working code and 5 points for comments]

3.2 PController Wall Following

- a. (26 points) Wall Following Working [Video for each test (b-d), **3 videos in total**]
- b. (6 points) List the first set of gain K_p and clamping ranges, and describe the robot's behavior.

The K_p was 0.1, and the clamping ranges were -2 to 2. The robot did a good job following the wall and was able to turn the corners and kept really close to the desired distance the whole time.

Only issue was going slightly wide when turning the corners.

- c. (6 points) List the second set of gain K_p and clamping ranges, and describe the robot's behavior.

For the second test we have the K_p at 0.5, and the clamping ranges were -3 to 3. We noticed this time the robot was a bit more jittery, and at first it looked like it made the turns better, however it spun out on the last one probably due to the clamping being too large so it lost view of the box for a second when turning too fast.

- d. (6 points) List the third set of gain K_p and clamping ranges, and describe the robot's behavior.

For the third test we had K_p at 1.0, and the clamping ranges were -1 to 1. We noticed on this last test it seemed to be a little bit more jittery than the last test which would make sense since the gain was higher so it would compensate more. Additionally it seemed to make the turns the best so far, until the last one where it got stuck on the wall, we think this has to do with the sonar reflecting off the box weird.

- e. (6 points) Best gain K_p 0.1