
CPS 499/592 — Intro to Robotics
Spring 2023 — Lab 05

Assigned: 2023-04-03

Due: 2023-04-26

OVERVIEW

The purpose of this assignment is two-fold:

1. To ensure that you are comfortable using the software suite to program the iRobot Create2.
 - The code can be found at https://github.com/DrRobotN1ck/Create2_Library
2. To code more “advanced” functionality than what has been asked of you up to this point.

TASK 1: GETTING TO THE WALL

Do not assume a specific environment for this lab.
The instructor reserves the right to reconfigure the environment however they want.

From a design standpoint, you can assume that the robot is placed *somewhere* within the environment. Your robot should do the following:

- On button press, drive until it encounters a wall.
- On button press, orient itself parallel to the wall *before* starting its wall following behavior.

TASK 2: WALL FOLLOWING

This task has you implement a *wall following* behavior on the Create robots (I recommend trying a naïve PID controller).

1. The Create has a single infrared distance sensor near its front right corner. The maximum range of this sensor is just a few inches.
2. The goal of your controller should be to keep this sensor value at a given set point. Choose the set point and the controller gains to keep the robot moving parallel to a straight wall, without drifting away, bumping the wall frequently, or oscillating noticeably.

REPORT CONSIDERATIONS

The following *Hints* assume you implemented a naïve PID controller. If you made any alternative design decisions, the expectation is that you have just as much, if not more, detail in your document.

In the “Description” section of your report, be sure to describe the process you used to select the set point and the gains. You do *not* need to list the specific values for the set point and gains in your report, because these values will be immediately obvious from your code. (Right?)

In addition to the controller, your program should also be able to notice and respond appropriately to bumping into obstacles, and to both left and right turns in the wall it’s following. Be sure to describe the decisions you made to handle these cases in the report.

In the “Reflection” section of your report, please tell me whether you would recommend PID control to someone else that wanted to complete this task and give a *substantive argument explaining why or why not*.

CPS 499/592 – DELIVERABLE – LAB 05

I will be accepting one document for the deliverable. Below are the details regarding this document.

Filetype: pdf **if it is not a pdf ... 5 points will be deducted**

Filename: Lab 05.pdf

The header of the document should look like the following example:

Team Members: Nicholas Stiffler, Student1 (YYYY), Student2 (ZZZZ)
Course: CPS 499/592
Assignment: Lab 05

There are 2 major components to the deliverable:

1. Python Code

All of the code that you used needs to be included in the submission in a folder called “code”.

2. Report

This component requires you do the following:

- Write a brief report about the project describing the steps your team took to accomplish each task. Assume each task will require a *minimum* of a half-page of explanation in the report.
 - What challenges did you face?
 - What did not work as you had anticipated?
 - What did your team do to overcome these challenges?
 - If you had more time what would you do differently to improve the code?
 - etc.

Below is the grading rubric I will use when evaluating your submission.

- The deliverable should be an archive (.zip, .tgz., etc) that contains the following
 - A pdf file for the report.
 - A “code” directory that contains all of the code you used for the assignment.
- The demo requires a time, scheduled either outside of class or on a designated lab day where you will show Dr. Stiffler that your project works, and he will ask questions about your design decisions, etc.
- **Your submission will not be graded without demoing the project.**

CPS 499/592 – COVER SHEET – LAB 05

Task 1 (20):

- ☐ Drives until it hits a wall?
- ☐ Orientates itself along the wall?

Team number: _____

Names:

Task 2 (40):

- ☐ Moves parallel to the wall?
- ☐ Minimal oscillation?
- ☐ Reasonable response to right side bumps? left bumps? center bumps?
- ☐ Follows left turns in the wall?
- ☐ Follows right turns in the wall?

Style (20):

The following refers to your code, which should be submitted **as part of your Team's deliverable document**.

- ☐ One function per command?
- ☐ No duplication of executable code?
- ☐ No magic numbers?
- ☐ Names match functionality?
- ☐ Adequate comments?
- ☐ Comments match code?
- ☐ Consistent formatting?

Documentation (20):

- ☐ Report is complete and clear?
- ☐ Required sections exist? (report and code)
- ☐ Describes calibration process?
- ☐ Argues either for/against PID control for this task?

Other comments:

Total: