CSCE 274 – Robotics Design and Applications – Fall 2019

Project 3 (10% over the final grade)

Assigned: October 24, 2019
Due: November 14, 2019

The purpose of this assignment is to give you some additional experience with PID control.

Instructions

Please read carefully the following tasks and program the robot accordingly. *You should do this assignment in the groups that have been assigned*.

The instructions on how to use the robot and how to submit the project assignment is on the webpage of the class, at the following links

https://drive.google.com/file/d/1Z4sSVl08r5S98r2kKA0xmwTWbPnh8d63/view

https://drive.google.com/file/d/1JRj0926o3-jKDnJP5l_T_xM4pE0sSSgy/view?usp=sharing

Tasks

Task 1. Augment the robot interface[1] written in Project 1 and Project 2 to include the infrared distance sensor, which has maximum range of a few inches.

Task 2. Write a program that

a. Initializes the robot, by setting it in *passive* and *safe* mode.
b. If the robot is stopped, once the *clean/power* button is pressed (already done in Project 1), initializes a **wall following** behavior. The wall following behavior on the Create robots should use a **PD controller**. 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. In the "Description" section of your report, be sure to describe the process you used to select the set point and the gains.
   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 is following. Be sure to describe the decisions you made to handle these cases in the report. In the "Evaluation" section of your report, please motivate 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.
c. If the robot is moving, when the clean/power button is pressed, stop the robot wherever it is (already done in Project 1).
d. Note that the program should continue listening for button presses, both in b. and c. cases, until the program is terminated.

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1 *Interface* here refers to the general concept of Application Programming Interface (API), which is a set of programming instructions (that can be in classes or methods) that can be used to build your own application – i.e., that in Task 2. An example in Python that uses classes can be found in https://python.swaroopch.com/oop.html.

Comments

Your programs will be evaluated based on both their functionality and their coding style. In the notes for iRobot Create 2 you can find an informal style guide to help give you an idea of what is expected together with the coding style that you should follow.

Evaluation

The solution will be evaluated according to the following.

Task 2. functionality (10):

- Proper reading and interpretation of the infrared sensor.

Task 2. functionality (60):

- Overall behavior (30)
  - Moves parallel to wall?
  - Minimal oscillation?
  - Reasonable response to right side bumps?
  - Reasonable response to left and center bumps?
  - Follows left turns in the wall?
  - Follows right turns in the wall?
- PD control (30)
  - P computed correctly?
  - D computed correctly?
  - Action computed from P, I, and D correctly?

Style (20):

- No duplication of executable code?
- No magic numbers?
- Names match functionality?
- Adequate comments?
- Comments match code?
- Consistent formatting?

Documentation (10):

- Report is complete and clear?
- Required sections exist?
- Free of typos and grammatical errors?