CPS 499/592 — *Intro to Robotics*
Spring 2023 — *Lab* 06

Assigned: 2023-04-03
Due: 2023-05-04

Overview

Demo's must be done by May 05th.

As agreed upon in class, this Lab will constitute 25% of your **Final Exam** grade.

You can demo early if your team completes the assignment and schedules a time with Dr. Stiffler, but after May 05th **@**6pm, all grades will be considered final.

The purpose of this assignment is to utilize all of the knowledge you have gained this semester programming the iRobot Create. If you have been keeping up with your lab assignments and have been building a robust iRobot Create library, this project should not take you very long.

Task 1: Docking

1. Starting from the interior of the polygon (rectangle, square, triangle, hexagon, etc) drive forward until the robot hits a wall.
2. Once the robot hits a wall, use a PID controller to follow the wall.
   - If the robot detects the "docking station" have the robot park on the dock. The robot must be actively charging in "park" to receive full credit.
   - If the robot does not detect a docking station it should follow the wall indefinitely.

Remember, **the environment can be any polygon**!!!

Task 2: Coverage

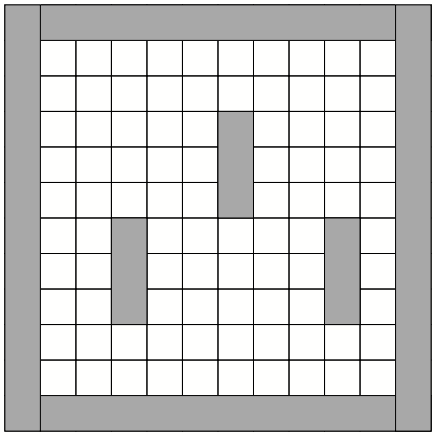
This task requires you to implement a coverage algorithm. In this scenario the dock can be anywhere within the environment. So this will require the robot to cross into the interior of the polygon.

The following should completely describe the scenario.

- The environment will be a Square.
- I will give you an exact representation. So as the example below shows, you will have a (10×10) grid. Each grid cell will be the size of the iRobot Create.

- I can choose to make any cell obstacle, prior to running your program.
- There may be no dock, in which case the robot should give an audio cue (cries miserably).

Here is a sample environment. Remember **I can choose any configuration**.



CPS 499/592 – DELIVERABLE – LAB 06

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 06.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 06

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 06

Team number: _____
Names:
_____
_____
_____
_____

Task 1: Docing (30):

- □ Wall Following component?
  - – Robot finds the polygonal boundary?
  - – PID implemented correctly?
  - – Reasonable response to right side bumps?
  - – Reasonable response to left and center bumps?
- □ Docking componenet?
  - – IR signal read correctly?
  - – Robot takes appropriate action when just the red beam is detected?
  - – Robot takes appropriate action when just the green beam is detected?
  - – Robot takes appropriate action when both beams are detected?
  - – Robot docks.
  - – Robot is actively charging once it docks.

Task 2: Coverage (30):

- □ Robot correctly reads pertinent sensors?
- □ Robot moves from cell to cell within the environment.
- □ Robot attempts to visit all reachable cells (unless it receives an IR sensor reading from the dock)
- □ Robot takes appropriate action when just the red beam is detected?
- □ Robot takes appropriate action when just the green beam is detected?
- □ Robot takes appropriate action when both beams are detected?
- □ Robot docks.
- □ Robot is actively charging once it docks.

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)
- □ Free of typos and grammatical errors?
- □ Describes docking task in detail?
- □ Describes the coverage algorithm in detail?

Other comments:

Total: