ENPM 809T – Autonomous Robotics: Summer 2019

Master of Engineering Program in Robotics

Due Date Tuesday, July 23rd, 2019

Submission Information

- This assignment further explores closed-loop motor encoder control of a robot's trajectory for the purposes of localizing the robot
- This assignment contributes to the autonomy algorithms used in the Grand Challenge
- Submit response to Question #2 via email at mitchels@umd.edu
- Submit response to Question #4 via Gradescope by 5:30 pm

<u>Question #1</u> (nothing to submit)

General reminder to use your phone to record images and 30-60 second video clips throughout the course. Now that we are halfway through the course, it's time to start taking stock of the images and videos recorded up to this point, and to start laying out the timeline of your final project video.

Reminder that ***vertical videos will not be accepted*** and that final project videos must be no less than eight minutes in length and no longer than 10 minutes.

<u>Question #2</u> (nothing to submit)

The Grand Challenge will be held in the Maryland Robotics Realization Lab (RRL), located in the Engineering Annex in the middle of the AV Williams Building:

https://sites.google.com/site/roboticsrealizationlab/

The Grand Challenge is currently scheduled during the August 6th lecture period. The RRL staff have graciously made the space available during the July 30th lecture period for students of ENPM809T to use as a test run of the course.

In preparation for the Grand Challenge, please review your calendar and confirm you can attend ***both*** the July 30th and August 6th sessions in-person at the RRL. Email Dr. Mitchell at your earliest convenience directly at mitchels@umd.edu to confirm.

<u>Question #3</u> (nothing to submit)

When sending email communications from your robot to Dr. Mitchell, please send the emails to the course Gmail account only: ENPM809TS19@gmail.com

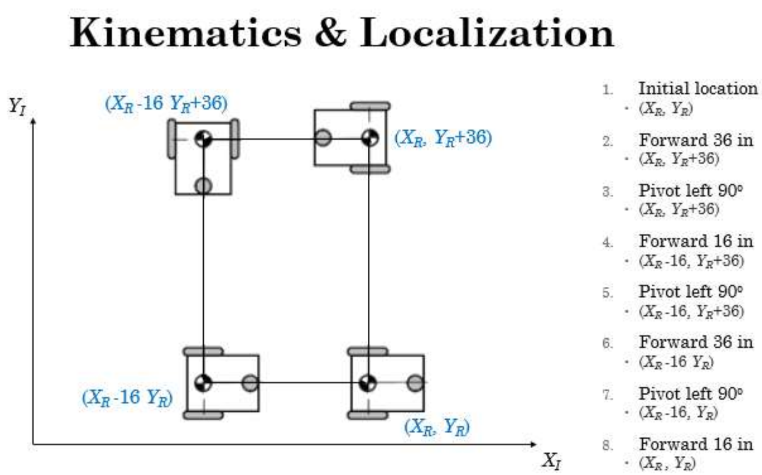
<u>Question #4</u> (15 points)

This week we continued our discussion of robot localization, including the tracking and interpretation of our robot's motor encoders to provide an estimate of the vehicle's location in a global reference frame, as well as Internet-of-Things approaches to communicate data from the robot.

Recall that for the Grand Challenge each robot must traverse the course and record/communicate the coordinates and color of each block back to the control station. In this portion of the assignment, we track the robot's trajectory as the vehicle is teleoperated, then generate a 2D map of the path traversed by the robot.

To complete this portion of the assignment:

1. Revisit the lecture notes and review Chapter 5 of the textbook. It is important to consider how the forward( ), reverse( ), pivotleft( ), and pivotright( ) functions, in conjunction with closed-loop motor encoder control, effect our ability to localize the vehicle.



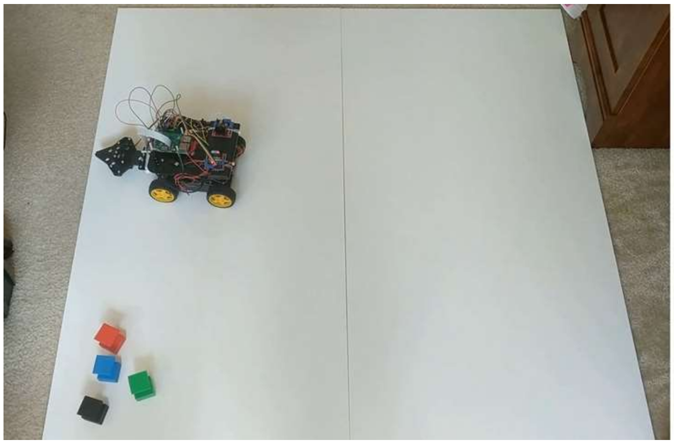
2. Complete the ***map01.py*** and ***map02.py*** In-Class Exercises from the lecture notes. Record two minimum 30 second video clips of yourself:
   a. Describing the setup and demonstrating your robot successfully traverses the path defined by the sequence of commands, then
   b. Describing the Matplotlib output(s) in comparison/contrast to the sequence of commands

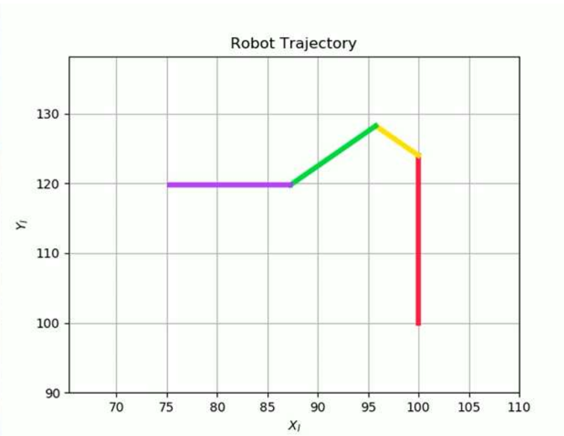
A brief example is available on the course YouTube page (note: there is **<u>no</u>** requirement to show the video and plot side-by-side):

https://youtu.be/9vI2R8hCXqc

Upload the video to your YouTube account and include a link to the video in the .pdf uploaded to Gradescope.

A comment on recording position data: the goal of the Grand Challenge is to autonomously locate blocks and transfer them to a construction zone. The robot must provide a ***crude*** map of its trajectory and the block locations, with the primary objective being to transport the blocks to the construction zone. As such, it is sufficient to effectively record the sequence of commands input by the user and use this sequence to build the map of the robot's trajectory (this of course makes assumptions about the accuracy of our closed-loop motor encoder control…). Implementation of alternative and/or more advanced techniques will be accepted, however these are not required for this course.





<u>Question #5</u> (5 points)

At the beginning of Tuesday's lecture, ***be prepared to demonstrate your robot's functionality from Question #4 of this assignment***. Dr. Mitchell will input the sequence of commands for your robot to traverse.