ENPM 809T – Autonomous Robotics: Summer 2019

Master of Engineering Program in Robotics

Due Date Tuesday, July 16th, 2019

Submission Information

- This assignment explores closed-loop motor encoder control of a robot's trajectory for the purposes of localizing the robot within its environment
- Submit response to Question #2 via email by 5:30 pm
- Submit response to Question #3 via Gradescope by 5:30 pm

Question #1 (nothing to submit)

General reminder to use your phone to record images and 30-60 second video clips throughout 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 final project videos must be no less than eight minutes in length and no longer than 10 minutes.

Question #2 (submit email to Dr. Mitchell)

In the spirit of the Grand Challenge, where a robot has been launched and delivered onto the surface of Mars, during Tuesday's lecture we will discuss Internet-of-Things applications for the purposes of receiving information from our robots. In preparation for Tuesday, create a new Gmail account:

https://support.google.com/mail/answer/56256?hl=en

This dummy account will be used for the sole purpose of receiving the messages and data autonomously transmitted from your robot during the Grand Challenge. As such, ***do not create a username or password that is used by your other accounts*** as this information could be viewed by the public.

Once the dummy account is created, email Dr. Mitchell at mitchels@umd.edu from the account. Be sure to include your name in the message so Dr. Mitchell can track account ownership.

Question #3 (20 points)

The primary focus of this week's lecture was the tracking and interpretation of our robot's motor encoders to provide an estimate of the robot's location in a global reference frame.

To complete this portion of the assignment:

1. Revisit the lecture notes and ensure the encoder feedback from the ***encodercontrol01.py – 04.py*** scripts behaves as expected. It is important to work through each step to ensure proper closed-loop motor control.

2. Complete the final In-Class Exercise from the lecture notes (see below). Record a minimum 30 second video clip of yourself describing the setup and demonstrating your robot successfully traverses a **straight** line across a user-defined distance. Note: ***this video should be recorded with your cell phone, iPad, etc***. A brief example is available on the course YouTube page:

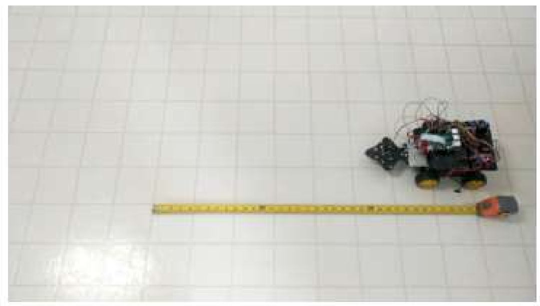
   https://www.youtube.com/watch?v=an3v2KewWww

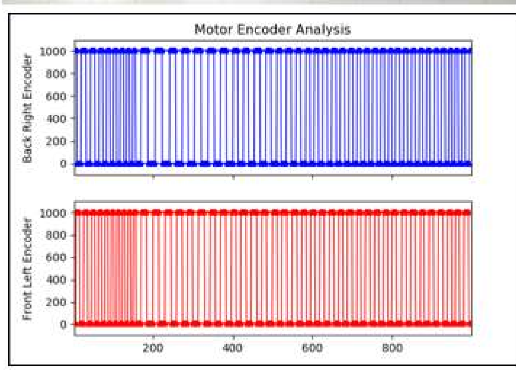
   Upload the video to your YouTube account and include a link to the video in the .pdf uploaded to Gradescope. Also include in the .pdf a screenshot(s) of your Matplotlib plot(s) of the encoder states, along with 2-3 sentences describing the encoder data. Note: ***students must use subplots***!

In-Class Exercise

- Create new Python script ***encodercontrol05.py***
- Script must:
  1. Drive robot in straight line for a user-defined distance
  2. Record encoder data from both encoders
- Open & subplot all data in Matplotlib

$$\left(\frac{1\, wheel\ rev}{2\pi(0.0325) meter}\right)(x\ meters) = \#\, wheel\ rev$$





3. Update your Python script(s) as required to track encoder counts for the reverse( ), pivotleft( ), and pivotright( ) functions. In similar fashion to item #2 above, record a minimum 30 second video clip of yourself describing the setup and demonstrating your robot successfully traverses (a) a **straight** line when driving in reverse, and (b) the proper angles when pivoting left and right, for a user-defined distance/angle in each case. Upload the video to your YouTube account and include a link to the video in the .pdf uploaded to Gradescope.

Question #4 (5 points)

At the beginning of Tuesday's lecture, ***be prepared to demonstrate your robot's functionality from Question #3 of this assignment***. Dr. Mitchell will define the required distances/angles for your robot to traverse.