ENPM 809T – Autonomous Robotics: Spring 2023

Master of Engineering Program in Robotics

Due Date	Friday, April 7th, 2023
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 #1 via Gradescope by 11:59 pm

Question #0.1 (nothing to submit)

Reminder that the project video constitutes the largest portion of your project grade for ENPM809T this semester. Be sure to continue recording 30-60 second clips to document the build and testing of your vehicle this semester!

Question #1 (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. As discussed in lecture, this will require you to implement a control loop in your code. Note: ***this video should be recorded with your cell phone, iPad, etc***. A brief example is available on the course YouTube page:

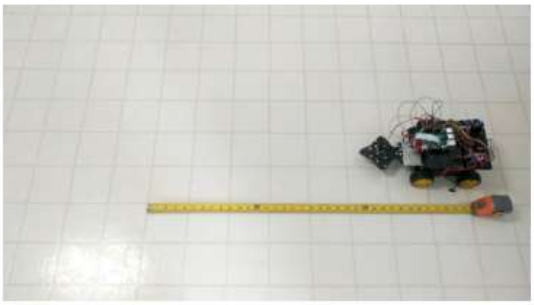
   https://www.youtube.com/watch?v=an3v2KewWww

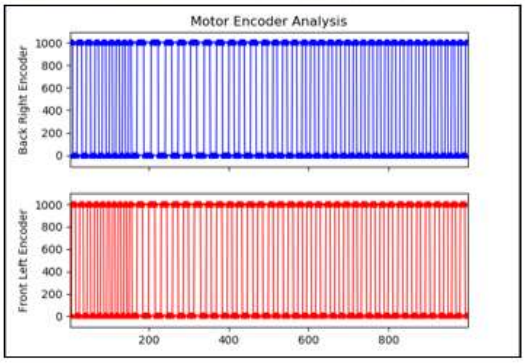
   Upload the video to your YouTube account and include a link to the video in the .pdf uploaded to Gradescope. Also include in the .pdf a screenshot(s) of your Matplotlib plot(s) of the encoder states, along with 2-3 sentences describing the encoder data. Note: ***students must use subplots***! Be sure to indicate which platform your team is using (Baron or Pirate) in your submission.

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.

For this assignment, **do not use any information/data from the IMU**. Use only the encoders to control the trajectory of the vehicle. (We will incorporate the IMU in subsequent sections of the course).