

Homework 4

16-311: Introduction to Robotics

2018

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1 Learning Objectives

1. Expand thoughts on encoders.
2. Collect intuition about PID control.
3. Present ideas based on Moore's Law.
4. Introduce path planning.

2 Encoders

An optical encoder relies on a slotted disc and fixed sensor that counts the gaps or lines on the disc as they spin past it. Design a new disc or additional component that

could be used to determine direction, as well as rotational displacement. Provide an image and a one-sentence explanation of the design.

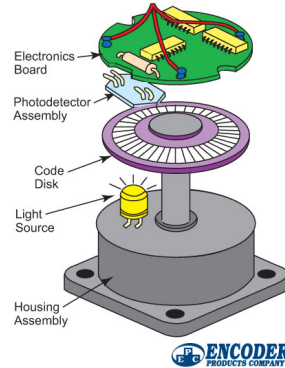


Figure 1: Encoder diagram from Encoder Products Company.

3 PID

Here is a basic MATLAB PID visualization function <http://www.cs.cmu.edu/afs/cs.cmu.edu/academic/class/16311/www/current/hw/hw4/pidFun.m>. Your goal is to fill the pool so that the temperature of the water is 100 degrees when the pool reaches the fill point (the water will turn green when this happens). Only adjust the K_p , K_i and K_d input terms to do this. Refer to the Control Slides for a few methods for tuning a PID controller. Please take a screenshot of the final pool and list which values you used for K_p , K_i and K_d . Write 1 to 2 sentences about how you tuned these gains.

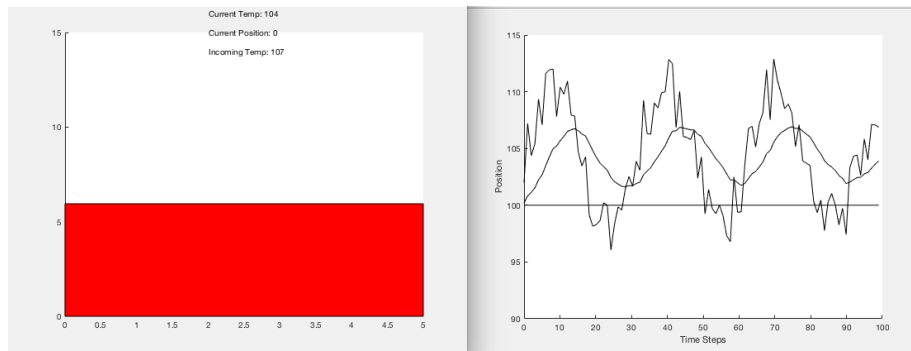


Figure 2: Sample image. This pool is too hot as is.

4 Moore's Law

Moore's Law, which is an observation of the approximate doubling of transistor density every two years has been applied to many different trends including costs of production, hard drive density, fiber-optic capacity and pixels per dollar. Find a resource on 'singularity' as it applies to artificial intelligence (Wikipedia, for starters: https://en.wikipedia.org/wiki/Technological_singularity). Do you think that such a time will ever come? If so, will it be in our lifetime? There are no right or wrong answers here, please just provide some discussion on this idea (2 to 4 sentences).

5 Path Planning

In the images below, which is the best path? Explain your selection(s) in at least two sentences.

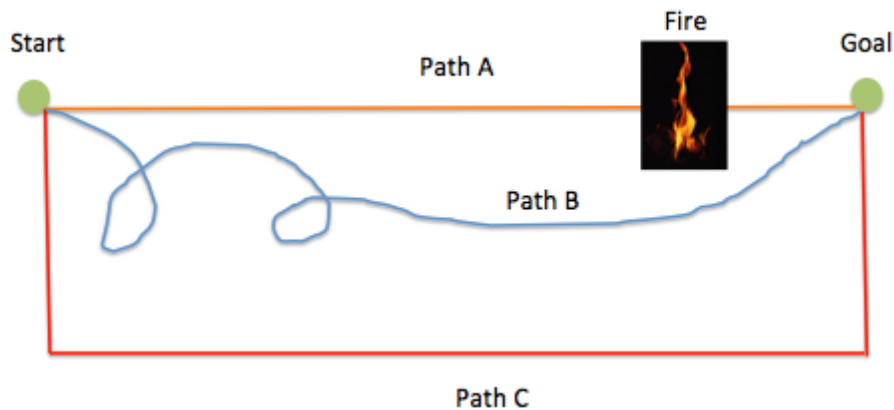


Figure 3: Sample paths.

6 What To Submit

Submissions are due on Autolab by the date specified in the Syllabus.

1. A .pdf file with the written answers to Section 2, 3, 4 and 5.