Assignment 2

Sayan Basu Roy (sayan@iiitd.ac.in)

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Question 1.

Consider the kinematic model of a uni-cycle robot

$$\dot{x} = v\cos\theta,\ x(0) = 0 \tag{1}$$

$$\dot{y} = v\sin\theta,\ y(0) = 0 \tag{2}$$

$$\dot{\theta} = \omega,\ \theta(0) = 0 \tag{3}$$

where $\Big(x(t), y(t), \theta(t)\Big)$ denote the pose of the robot and $\Big(v(t), \omega(t)\Big)$ denote the input velocity (linear and angular) of the robot. Here the time $t \in [0, \infty)$. Design a feedback controller such that the robot periodically visits the coordinates $(1,0)$, $(0,1)$, $(-1,0)$ and $(0,-1)$ while the instantaneous linear velocity at these coordinates is to be kept at 2 unit.

What you have to submit :

1> Simulink file/ code in Matlab/Python or any other programming language of your choice

2> Plot of time evolution of the following variables for the designed controller during the time-span $t \in [0, 15]$ seconds.

a> x-vs-t,

b> y-vs-t

c> θ-vs-t.

d> x-vs-y

The plots along with remark (if any) should be included in a single pdf file. You can create a single .zip file which include the code and the pdf.

(There is additional 10 marks for implementing the same task using a turtlebot in ROS and Gazebo, where with the help of ROS nodes you should access the current pose of the robot and provide input velocities to the robot. You have to submit a gazebo animation video along with the written code for getting the additional marks.The deadline for this is separate as indicated in the google classroom.)