CSC 445, Spring 2018, Assignment 4

Purpose: Feedback Control

Due: 4:30pm, Friday, March 9, 2018

Program: Move to a point

Create a Python script named `assignment4.py` that does the following:

1. The following equations define a control law to move a differential drive robot from the current pose $[x, y, \theta]$ to a desired point $[x_d, y_d]$:

$$v = k_v \sqrt{(x_d - x)^2 + (y_d - y)^2}$$
$$\omega = \text{atan2}(y_d - y, x_d - x) - \theta$$

   where k_v is a proportional gain. Define a python function named `controller` that computes control inputs based on the previous equations. Note: be careful when subtracting angles so that the result is in the range $(-\pi, \pi]$.

2. The following pseudocode moves the robot to within 1 centimeter of a goal location:

```
d = 0.5 # distance between the wheels
r = 0.25 # radius of the wheels
dt = 0.5 # execute a command every half second
pose = [0, 0, 0]
goal = [1, 1]
while (the robot is greater than 1 centimeter from the goal point):
    # compute the control inputs
    v, omega = controller(pose, goal, kv)

    # transform v and omega into left and right wheel velocities

    # scale the wheel velocities if either is greater than the maximum
    # wheel velocity (use plus/minus 0.5 rad/s)

    # compute the new pose based on the solution to assignment 3
    pose = differential_drive(pose, r, d, phi_dot_l, phi_dot_r, dt)
```

   Write code that that moves the robot from the pose $[0, 0, 0]^T$ to the point $[1, 1]$ four times: (1) $k_v = 0.01$, (2) $k_v = 0.1$, (3) $k_v = 0.5$, and (4) $k_v = 0.99$

3. Print the time each trial took to complete.

4. Plot the path for each trial on the same figure.

Turning in the Assignment

Submit the `assignment4.py` file to the appropriate folder on D2L.