CSC 445, Spring 2018, Assignment 3

Purpose: Differential Drive Kinematics

Due: 4:30pm, Thursday, March 1, 2018

Program: Differential Drive Kinematics

Create a Python script named `assignment3.py` that does the following:

1. Define a python function that implements the forward kinematics of a differential drive robot using the following equation:

$$\begin{bmatrix} {}^I\dot{x} \\ {}^I\dot{y} \\ {}^I\dot{\theta} \end{bmatrix} = \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \frac{r\dot{\phi_l}}{2} + \frac{r\dot{\phi_r}}{2} \\ 0 \\ \frac{r\dot{\phi_r}}{d} - \frac{r\dot{\phi_l}}{d} \end{bmatrix}$$

   the function should have the following parameters:

   - The pose of the robot
   - The wheel radius, r, in meters
   - The length of the axle, d, in meters
   - The velocity of the left wheel, $\dot{\phi_l}$, in radians per second
   - The velocity of the right wheel, $\dot{\phi_r}$, in radians per second
   - The time in seconds

   and should return the new robot pose in the global coordinate frame.

2. Write code that uses the function to execute commands to drive the robot in a square that has a side length of 1 meter.

   - The robot's starting pose is $[0, 0, 0]^T$
   - $d = 0.5$
   - $r = 0.25$
   - The top wheel velocity is $\pm$ 0.5 radians per second

Turning in the Assignment

Submit the `assignment3.py` file to the appropriate folder on D2L.