SC 627 Assignment 4 Instructions

S Deepak Mallya

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Reference

Lecture Slides titled "03-08-2022.pdf" (Find a copy in MS Teams under General $->$ Files $->$ Class Materials)

Problem Statement

Robotic Networks in Balancing

- Environment and Robot Definition
  - Number of Robots $N = 8$
  - Fixed Left Robot Position $R_1 - (0, 0)$
  - Fixed Right Robot Position $R_8 - (14, 0)$
  - Magnitude of Maximum Robot Velocity $V_{max} = 0.15m/s$
- Each Moving Robot R_i can access robot pose data for robots R_{i-1} and R_{i+1} at every instance
- At each instance (as frequently as possible) command a velocity vector (V_{x_i}, V_{y_i}) for every moving robot R_i such that the robots are balanced (equidistant from each other).
- Plot each robot's x-coordinate as a function of time

Requirements

- **Note:** Run the commands to get updated 'sc627_helper' folder
  - cd catkin_ws/src/sc627_helper
  - git pull origin master
  - cd ../..
  - catkin_make

  - source devel/setup.bash

- You'll find two new folders 'launch' and 'msg' in 'sc627_helper' folder and a few additional files in 'scripts' folder
- Create *assignment_4* folder (henceforth referred to as the folder) in 'sc627_assignments'
- The folder must contain the following files:
  - balancing.py
    This file contains your balancing script for each robot (refer to assign4_skeleton.py in sc627_helper/scripts for outline)
  - robot_path.png
    Plot of robot path for each robot
  - Plot pos_x vs. time
    Plot of robot's x-coordinate vs time (you can combine all the robots' data into one plot)
  - report.pdf
    A detailed report of your implementation

Implementation

- The expected execution is as follows -
  - roslaunch sc627_helper balancing.launch
- In the launch file 'balancing.launch' (you will find it in 'sc627_helper/launch' folder) replace the lines (Line 82, 100, 118, 136, 154, 172)
  <node pkg="sc627_helper" type="assign4_skeleton.py" name="assign4_skeleton">
  with a line that points to your 'balancing.py' script in 'sc627_assignments/assignment_4' folder. For example,
  <node pkg="sc627_assignments" type="balancing.py" name="balancing">
- In order to implement the algorithm you can use 4 topics in your balancing.py script (refer assign4_skeleton.py file in sc627_helper/scripts)
  - /odom
    Contains robot's position and velocity (in local frame) data
  - /left_odom
    Contains left robot's position and velocity (in local frame) data
  - /right_odom
    Contains right robot's position and velocity (in local frame) data
  - /cmd_vel
    Command robot's velocity

- You are also provided with a function 'velocity_convert' which you can use to convert velocities along cartesian coordinates to linear and angular velocities.
- NOTE: Kindly change the first line of each script in sc627_helper/scripts folder from 'python3' to 'python' if you are not using python3 and ensure that all the scripts are executable.

Submission

- Submission Deadline: $\mathbf{8^{th}}$ *April*, 2022 (For both Assignments 3 and 4)
- After creating the 'assignment_4' folder as described above run the following commands from the terminal
  - cd path_to_catkin_ws/src/sc627_assignments
  - git add .
  - git commit -m "assignment4_final"
    Assign this message only to the final version of your submission
  - git push -u origin master
    Verify that the folder is added to your github repository (online)
  - git log -pretty=oneline
    Copy the first string (the long one!) to the spreadsheet against your name under the appropriate column (`https://docs.google.com/spreadsheets/d/1bZN23JUzaHuUMvjP4L_9tu9Io85-VPG4_kNK7A25fTY/edit?usp=sharing`)