Home Work 4

Mobile Robotics 2015 - ShanghaiTech University

1 Calculate Odometry (35%)

1.1 Preparation

Follow the preperation steps from hw2 using the following file: `wget` http://robotics.shanghaitech.edu.cn/sites/default/files/files/hw4_files.tgz

1.2 Task

Your input is the topic `/joint_states` of type `sensor_msgs/JointState`. This gives you the accumulated `wheel_left_joint` and `wheel_right_joint` wheel rotations (in radians).

You are also given the appropriate dimensions:

- Wheel base = 230 mm (length between the center of the wheels)
- Wheel radius = 35 mm

Complete the node "hw_4_wheel_to_motion/" to publish the motion of this differential drive robot. The motion is the transform from the previous robot frame to the current robot frame. The output topic should be `/motion` of type `geometry_msgs/PoseStamped`. Fill in the header (frame_id = "base_link") and the pose information.

At least for every 3rd line of code that you write, add one line of comments (starting with "//"), describing what your code does.

In the very first line, add a comment (starts with //) and the following information: Your name (Chinese and Pinyin), your student id and your email. Also include the course name and the number of the homework (number 4).

Read up on forward kinematic models on the slides and in the text book AMR chapter 3. Be careful: in the book on also on the the slide (which is from the book) the odometry is calculated in the global refernce frame. But your task is to calculate the motion of the robot in the frame of the robot at the previous time step. The math is actually a little easier then!

2 Calculate 3D pose estimate (60%)

2.1 Task

Complete the node "hw_4_motion_to_odom/": Similar to HW2, calculate the 3D pose estimate using your motion estimates. Use the tf data-structures provided by ROS for the calculation! The input for this node is the output of your node from task 1.

Publish the robot pose on topic `/pose` of type `geometry_msgs/PoseStamped`.

Also publish the path of the robot (topic `/path` , type `nav_msgs/Path`) - you may get some hints on how to do this from the hw2 package `pose2d_to_3d`.

Finally, also publish the tf using a ROS transform broadcaster. The transform should express the robot pose: the robot frame wrt. a frame called "odom".

Make sure to fill in the correct header for data that you publish.

At least for every 3rd line of code that you write, add one line of comments (starting with "//"), describing what your code does. In the very first line, add a comment (starts with //) and the following

information: Your name (Chinese and Pinyin), your student id and your email. Also include the course name and the number of the homework (number 4).

From the bagfile "hw4_joints.bag" (located in "hw_4_wheel_to_motion"), record a bag called "odom.bag" with the following topics: `/pose /tf` . Make sure to restart all nodes, start the recording and only then start the replay to collect all data in paused mode. After two seconds all nodes should have connected to the replay node - then unpause the replay. Make sure you get the correct amount of messages in your recording (one or two fewer messages than in the original bagfile).

Also create a screen shot ("rviz.png") showing both terminals and rviz displaying the complete path and the tf "tree" from the bagfile.

3 Submission (5%)

Commit everything to your git (see HW 2) in a subfolder called hw4.

The following files are important:

- Everything that was in the original archive - The code must compile and be the code you used to create the odom.bag file!
- "odom.bag" created by you!
- "rviz.png": the screen-shot from rviz.

Be sure to add all files to git, to commit properly and the push the changes to the server. Once you are done send me the hash of your commit (find out with git log) in the e-mail.

Send the e-mail to soerensch@shanghaitech.edu.cn by Friday, Jan 15, 2016, 10:00 pm. The subject of the e-mail should have the follow format: `[Mobile Robotics][Homework 4][Pinyin Name]`

If you do not follow the guidlines in this section (subject name) you will loose the 5%!