UNSW, School of Computer Science and Engineering

COMP3431: Building Nodes and Runnng Turtlebots

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1 Overview

This tutorial is a chance for you to learn to create you own ROS nodes. It will also give you some experience in using a turtlebot.

2 Building & Launching Nodes

In last week's tute you should have created yourself a workspace. You should also now have some familiarity with a number of the ROS utilities such as `rosnode`, `rostopic` and `roscd`.
This week you are to continue on with the online tutorials at `http://wiki.ros.org/ROS/Tutorials/`

2.1 Beginner Tutorials

In this tute you should work your way through the rest of the beginner tutorials. The tutorials 11 & 12 and 14 & 15 are duplicates with one of each pair using C++ and the other Python. You may choose to only complete one of each pair, though you should look over any that you skip. You are than welcome to complete all of them should you wish to.

2.1.1 20. Where Next?

This tutorial is more of a discussion of things you may wish to look at. Two of the items it suggests are the RViz user guide (`http://wiki.ros.org/rviz/UserGuide`) and the turtlebot Stage simulator (`http://wiki.ros.org/turtlebot_simulator/Tutorials`). When you get the chance you should look these over.

2.2 Inermediate Tutorials

Before moving on to the turtlebots there are a couple of more advanced tutorials you should work through. In the oline tutorial is a section on intermediate tutorials. There are two of these that you should complete to help you connect to your turtlebot. Those are:

- 3. Roslaunch tips for large projects
- 4. Running ROS across multiple machines

This is because you'll need to run nodes on both the turtlebot and the desktop/laptop, and because by ros standards any project involving a real robot can be considered large. You can go through the other intermediate tutorials but there is no need to at this stage.

3 Turtlebot

Now that you are able to build your own nodes and can launch nodes over a network, its time to take the turtlebots for a test drive. First you need to select a turtlebot. There are only 5 turtlebots available in the lab so you will need to find one that isn't currently being used.
Once you have chosen your turtle you need to unplug it. Follow these steps to do so:

1. Unplug the laptop and robot base
2. Plug in the white serial cable, the socket is just above the power socket of the base
3. Turn on the robot base, the base should beep

Now you need to SSH into the turtlebot. Your login is the same zId, zPass as for the lab machines. Once on the turtlebot you need to launch the turtlebot nodes. This is most easily done using the command: '`roslaunch comp3431 turtlebot.launch`'
This launch file will launch the nodes required to connect to the base, the Kinect and the laser if it is attached.
Now if you start a terminal on the desktop and the ROS_MASTER_URI to use the robot's master you will be able to launch nodes on the desktop that connect to the robot. The command to do so is:

- `export ROS_MASTER_URI=http://<robot_name>:11311`

Now if you run '`rostopic list`' you should see all of the topics available on the robot.

3.1 Teleoperation

Now you can test drive your turtlebot by running the command: '`roslaunch turtlebot_teleop keyboard_teleop.launch`'. You can now drive the turtlebot using the keyboard.
There are a few Logitech joysticks in the lab, if you can access one you can use it to drive you turtle with the command: '`roslaunch turtlebot_teleop logitech.launch`'.

3.2 Visualization

When conected to the turtlebot start RViz, '`rosrun rviz rviz`'. Before for doing anything else check that the 'Fixed Frame' in the 'Global Options' is set to '/base_link'. This means that all visualizations should be displayed relative to the robot.
Now you should add some visualizations to RViz. You can do so by clicking the 'Add' button near the lower left of the window.
First add a 'RobotModel', you should now see a 3D view of a turtlebot. Try moving around your virtual robot by clicking and dragging insode the 3D visual pane.
Next add a LaserScan by going to the 'By topic' tab of the add visualization dialog and scrolling down to '/scan'. There should now be some white dots around the turtlebot.
Finally we'll add a DepthCloud view. This time we'll add the topic '/camera/depth_registered/sw_registered/image_rect_raw' but before adding the view use the selector to use the 'compressedDepth' transport rather than 'raw'. After a few seconds you should see a white pointcloud of the area in front of your robot. Now we can colour the pointcloud. Goto the settings for the 'DepthCloud' visualization and change the 'Color Transport Hint' to compressed. Then set the 'Color Image Topic' to '/camera/rgb/image_color'. The white pointcloud should now be replaced by a coloured cloud.

3.3 Slalom Challenge

Now that you drive the turtlebot and see things from its perspective, lets see how good you are at driving. There is a small maze at one end of the soccer field. You should be able to drive you robot through the maze sitting a the desk without once looking at the robot or crashing into the wall. Uncheck the DepthCloud visual to conserve bandwith as you should only need the laser data for this challenge.

3.4 Programming Challenge

Now that you can drive a turtlebot let's see if you can give one some "intelligence". You challenge here is to get the turtlebot to face whatever object is closest to it. For this you'll need to write a new node. It should subscribe to the '/scan' topic and use the laser scan to locate the nearest object. Then it should publish a 'geometry_msgs/Twist' message to '/cmd_vel_mux/input/navi' inorder to turn the robot towards the object.

3.5 Online Turtebot Tutorials

There are online tutorials availabe at `http://wiki.ros.org/Robots/TurtleBot` that you can choose to work through. Be aware though that there is a bug in `turtlebot_bringup minimal.lauch` when it runs on our turtles that can cause the interaction manager to shut down.

3.6 Bed Time

When you are finished using the turtlebot its time to put it to bed. The correct order for doing so is:

1. Shutdown/Kill all ROS nodes you're running on the robot
2. Disconnect the white serial cable
3. Turn off the robot base, this is often easiest accomplised by pressing the power button until it is turned on and beeps and then presing it again to turn it off
4. Plugging in both the laptop and the base
5. Checking that the LED next to the power button is pulsating orange