Lesson 3 Lab sheet- AI for Mobile Robots

Intelligent mobile robotics

**Creating a ROS package containing publisher and subscriber nodes**

Aims

* Create a ROS package
* Create a simple publisher node using python
* Create a node that subscribe to the publisher node
* Compile the created ROS package

To achieve the aims do the following steps:

## Create a ROS package

* First in the ‘code Editor’ check the folders that you have. Find the ‘catkin\_ws’folder, catkin work space.
* Which folders are in ‘catkin\_ws’?
* Open a web shell and go to ‘catkin\_ws/src’ folder by following command:

**$cd catkin\_ws/src/**

* When you are in the ‘src’ folder run the following command to create a new ROS package called ‘my\_package’:

**$catkin\_create\_pkg my\_pakage rospy**

This will create a package that’s depend on rospy. rospy is a python module for ROS.

* what changes did happen in side ‘catkin\_ws/src ‘ folder?

## Write a python code to create a publisher node

Right click on the ‘src’ folder in the package folder that you want to put your publisher node, i.e. ‘my\_package/src’, and create a new file. Call it talker.py

* Get the python code for a simple publisher here:  [talker.py](https://raw.github.com/ros/ros_tutorials/kinetic-devel/rospy_tutorials/001_talker_listener/talker.py)

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| [1](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_1) #!/usr/bin/env python  [2](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_2) # license removed for brevity  [3](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_3) import rospy  [4](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_4) from std\_msgs.msg import String  [5](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_5)  [6](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_6) def talker():  [7](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_7) pub = rospy.Publisher('chatter', String, queue\_size=10)  [8](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_8) rospy.init\_node('talker', anonymous=True)  [9](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_9) rate = rospy.Rate(10) # 10hz  [10](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_10) while not rospy.is\_shutdown():  [11](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_11) hello\_str = "hello world %s" % rospy.get\_time()  [12](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_12) rospy.loginfo(hello\_str)  [13](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_13) pub.publish(hello\_str)  [14](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_14) rate.sleep()  [15](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_15)  [16](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_16) if \_\_name\_\_ == '\_\_main\_\_':  [17](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_17) try:  [18](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_18) talker()  [19](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_19) except rospy.ROSInterruptException:  [20](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c82832e0d612370fe9886563f0b7f5433f6caee1_20) pass |

Different parts of the code have been described in [1].

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| [7](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-0d784dd4f9d2b50d6bfc6dbddf4a45b58f61bbe1_7) pub = rospy.Publisher('chatter', String, queue\_size=10)  [8](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-0d784dd4f9d2b50d6bfc6dbddf4a45b58f61bbe1_8) rospy.init\_node('talker', anonymous=True) |

pub = rospy.Publisher("chatter", String, queue\_size=10) declares that we have a ‘chatter’ topic that the node can publish messages with the type of String. (String is the class std\_msgs.msg.String).

rospy.init\_node(NAME, ...) tells rospy the name of the node. In rospy.init\_node('talker', anonymous=True)the node’s name is talker.

* Have a look on [1] and find what does ‘anonymous=True’ mean?
* What about the following lines:

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| [10](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c119a947845452aa2f89a85d4fb37e402941b0e1_10) while not rospy.is\_shutdown():  [11](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c119a947845452aa2f89a85d4fb37e402941b0e1_11) hello\_str = "hello world %s" % rospy.get\_time()  [12](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c119a947845452aa2f89a85d4fb37e402941b0e1_12) rospy.loginfo(hello\_str)  [13](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c119a947845452aa2f89a85d4fb37e402941b0e1_13) pub.publish(hello\_str)  [14](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-c119a947845452aa2f89a85d4fb37e402941b0e1_14) rate.sleep() |

* In a shell window navigate to the folder that the python code, i.e. talker.py, exists. Then using following commend to make it executable python code:

*$chmod +x talker.py*

## Write a python code for subscriber node

Right click on the ‘src’ folder in the package folder that you want to put your publisher node, i.e. ‘my\_package/src’, and create another new file called lestener.py.

Copy the python code for the subscriber node using this link: [listener.py](https://raw.github.com/ros/ros_tutorials/kinetic-devel/rospy_tutorials/001_talker_listener/listener.py) and past it in your newly created file, i.e. listener.py.

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| [1](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_1) #!/usr/bin/env python  [2](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_2) import rospy  [3](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_3) from std\_msgs.msg import String  [4](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_4)  [5](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_5) def callback(data):  [6](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_6) rospy.loginfo(rospy.get\_caller\_id() + "I heard %s", data.data)  [7](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_7)  [8](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_8) def listener():  [9](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_9)  [10](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_10) # In ROS, nodes are uniquely named. If two nodes with the same  [11](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_11) # name are launched, the previous one is kicked off. The  [12](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_12) # anonymous=True flag means that rospy will choose a unique  [13](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_13) # name for our 'listener' node so that multiple listeners can  [14](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_14) # run simultaneously.  [15](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_15) rospy.init\_node('listener', anonymous=True)  [16](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_16)  [17](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_17) rospy.Subscriber("chatter", String, callback)  [18](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_18)  [19](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_19) # spin() simply keeps python from exiting until this node is stopped  [20](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_20) rospy.spin()  [21](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_21)  [22](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_22) if \_\_name\_\_ == '\_\_main\_\_':  [23](http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29#rospy_tutorials.2FTutorials.2FWritingPublisherSubscriber.CA-56fb82d4681d7880a3d3a97f7af70cfe17618f86_23) listener() |

## Compile the package (Building publisher and subscriber nodes)

As we have newly added two python codes to the package, i.e. my\_pcakage, we need to compile ROS package using catkin as a build system. To compile the package go to catkin work space, i.e. ‘catkin\_ws’ folder, in a web shell by running the following commands:

**$ cd /catkin\_ws**

**$ catkin\_make**

Run ROS master using **‘$roscore’** command

Start both nodes with following comments:

**$ python talker.py**

**$ python listener.py.**

Note that in addition to directly use python to run a python code in a package, you could use ‘rosrun [package name] [executable name]’ to run your executable (python) code. (you need to run ‘catkin\_make’ to help the ros to know your package before running the package using rusrun.

**$ rosrun my\_package talker.py**

1. Using the comments learned in week 2 to see the active nodes and topic. Show the message which is in the topic using commands in a new web shell.
2. Create new publisher and subscriber nodes, i.e. talker2.py and listener2.py, that could publish/subscribe another type of data, i.e. int32. The other standard ROS message types have been described here: <http://wiki.ros.org/std_msgs>. You could use following python code:

from std\_msgs.msg import Int32

Add a counter to your publisher node, i.e. talker2.py, to count and send the counter results to the topic.

Note that you should use a new name (for example 'chatter2') for the topic in the talker2.py:

pub = rospy.Publisher('chatter2', Int32, queue\_size=10)

1. Change the first subscriber code, i.e. listener.py, to subscribe to the new talker node in addition to the initial one.

Put the out put screen shot on Discussion board.

Reference:

[1] Writing a Simple Publisher and Subscriber (Python)

<http://wiki.ros.org/ROS/Tutorials/WritingPublisherSubscriber%28python%29>

[2] Creating a ROS Package

<http://wiki.ros.org/ROS/Tutorials/CreatingPackage>

[3] ROS Robotics By Example

By [Carol Fairchild](https://www.google.co.uk/search?hl=en&sxsrf=ALeKk03do47uK-yGYAeDO_ZHmwEOua1l_g:1612727144425&q=inauthor:%22Carol+Fairchild%22&tbm=bks), [Dr. Thomas L. Harman](https://www.google.co.uk/search?hl=en&sxsrf=ALeKk03do47uK-yGYAeDO_ZHmwEOua1l_g:1612727144425&q=inauthor:%22Dr.+Thomas+L.+Harman%22&tbm=bks)

The pdf of the book is available on DMU library:

[https://dmu.summon.serialssolutions.com/?s.q=ROS+Robotics+By+Example&s.cmd=#!/search?ho=t&l=en-UK&q=ROS%20by%20example](https://dmu.summon.serialssolutions.com/?s.q=ROS+Robotics+By+Example&s.cmd=)