

ECE588 Project Assignment 1

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Winter 2022

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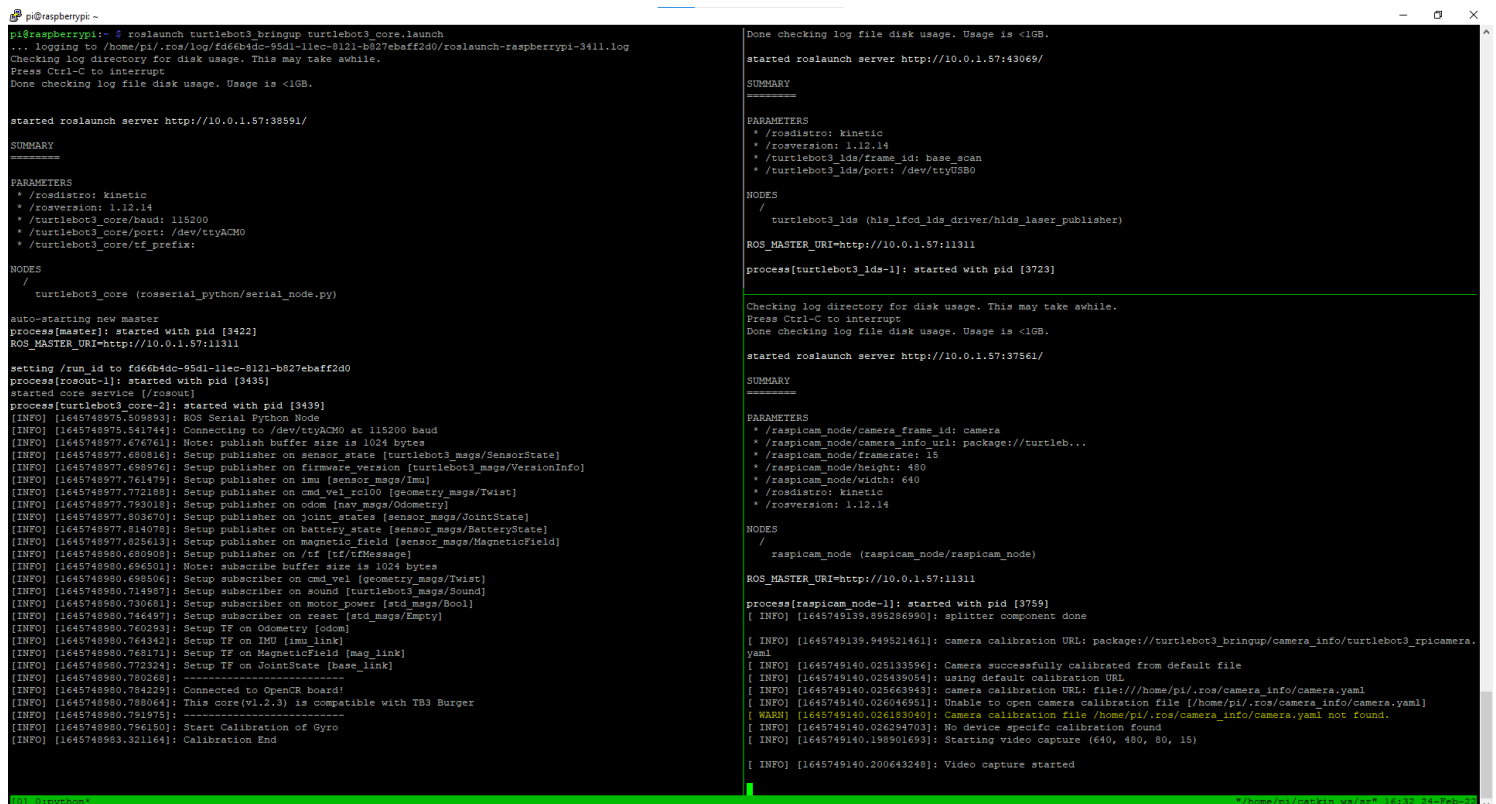
Kay Batt

Brandon Hagans

Introduction

Please note that our group bought our own Turtlebot and connected to it rather than the simulation or Turtlebot from the lab.

Below is how we started ROS on the TurtleBot using SSH. Note that we used tmux in order to run multiple sessions in a single window.



```
pi@raspberrypi:~$ roslaunch turtlebot3_bringup turtlebot3_core.launch
... logging to /home/pi/.ros/log/fd66b4dc-95d1-11ec-8121-b027ebaff2d0/roslaunch-raspberrypi-3411.log
Checking log directory for disk usage. This may take awhile.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://10.0.1.57:38591/

SUMMARY
=====

PARAMETERS
* /roslaunch: kinetic
* /rosversion: 1.12.14
* /turtlebot3_core/ baud: 115200
* /turtlebot3_core/ port: /dev/ttyACM0
* /turtlebot3_core/ tf_prefix:

NODES
/
  turtlebot3_core (roscpp/python/serial_node.py)

auto-starting new master
process[master]: started with pid [3422]
ROS_MASTER_URI=http://10.0.1.57:11311

setting /run_id to fd66b4dc-95d1-11ec-8121-b027ebaff2d0
process[roscout-1]: started with pid [3435]
started core service [/roscout]
process[turtlebot3_core-2]: started with pid [3439]
[INFO] [1645748975.508893]: ROS Serial Python Node
[INFO] [1645748975.541744]: Connecting to /dev/ttyACM0 at 115200 baud
[INFO] [1645748977.676761]: Note: publish buffer size is 1024 bytes
[INFO] [1645748977.680816]: Setup publisher on sensor_state [turtlebot3_msgs/SensorState]
[INFO] [1645748977.689576]: Setup publisher on firmware_version [turtlebot3_msgs/VersionInfo]
[INFO] [1645748977.761479]: Setup publisher on imu [sensor_msgs/Imu]
[INFO] [1645748977.772188]: Setup publisher on cmd_vel [geometry_msgs/Twist]
[INFO] [1645748977.793018]: Setup publisher on odom [nav_msgs/Odometry]
[INFO] [1645748977.803870]: Setup publisher on joint_states [sensor_msgs/JointState]
[INFO] [1645748977.814078]: Setup publisher on battery_state [sensor_msgs/BatteryState]
[INFO] [1645748977.825613]: Setup publisher on magnetic_field [sensor_msgs/MagneticField]
[INFO] [1645748980.680908]: Setup publisher on tf [tf/tfMessage]
[INFO] [1645748980.686001]: Note: subscribe buffer size is 1024 bytes
[INFO] [1645748980.698506]: Setup subscriber on cmd_vel [geometry_msgs/Twist]
[INFO] [1645748980.714987]: Setup subscriber on sound [turtlebot3_msgs/Sound]
[INFO] [1645748980.730681]: Setup subscriber on motor_power [std_msgs/Bool]
[INFO] [1645748980.744497]: Setup subscriber on reset [std_msgs/Empty]
[INFO] [1645748980.760353]: Setup TF on Odometry [odom]
[INFO] [1645748980.764342]: Setup TF on IMU [imu_link]
[INFO] [1645748980.768171]: Setup TF on MagneticField [mag_link]
[INFO] [1645748980.772324]: Setup TF on JointState [base_link]
[INFO] [1645748980.782229]: Connected to OpenCR board!
[INFO] [1645748980.780064]: This core(v1.2.3) is compatible with TB3 Burger
[INFO] [1645748980.791975]: -----
[INFO] [1645748980.796150]: Start Calibration of Gyro
[INFO] [1645748983.321164]: Calibration End

Done checking log file disk usage. Usage is <1GB.
started roslaunch server http://10.0.1.57:43069/

SUMMARY
=====

PARAMETERS
* /roslaunch: kinetic
* /rosversion: 1.12.14
* /turtlebot3_lds/frame_id: base_scan
* /turtlebot3_lds/port: /dev/ttyUSB0

NODES
/
  turtlebot3_lds (hls_lfcd_lds_driver/hlds_laser_publisher)

ROS_MASTER_URI=http://10.0.1.57:11311

process[turtlebot3_lds-1]: started with pid [3723]

Checking log directory for disk usage. This may take awhile.
Press Ctrl-C to interrupt
Done checking log file disk usage. Usage is <1GB.

started roslaunch server http://10.0.1.57:37561/

SUMMARY
=====

PARAMETERS
* /raspicam_node/camera_frame_id: camera
* /raspicam_node/camera_info_url: package://turtleb...
* /raspicam_node/framerate: 15
* /raspicam_node/height: 480
* /raspicam_node/width: 640
* /roslaunch: kinetic
* /rosversion: 1.12.14

NODES
/
  raspicam_node (raspicam_node/raspicam_node)

ROS_MASTER_URI=http://10.0.1.57:11311

process[raspicam_node-1]: started with pid [3759]
[ INFO] [1645749139.895286990]: splitter component done
[ INFO] [1645749139.949521461]: camera calibration URL: package://turtlebot3_bringup/camera_info/turtlebot3_rpcamera.yaml
[ INFO] [1645749140.025133596]: Camera successfully calibrated from default file
[ INFO] [1645749140.025439054]: using default calibration URL
[ INFO] [1645749140.025663943]: camera calibration URL: file:///home/pi/.ros/camera_info/camera.yaml
[ INFO] [1645749140.026046951]: Unable to open camera calibration file [/home/pi/.ros/camera_info/camera.yaml]
[ WARN] [1645749140.026183040]: Camera calibration file /home/pi/.ros/camera_info/camera.yaml not found.
[ INFO] [1645749140.026294703]: No device specific calibration found
[ INFO] [1645749140.195901693]: Starting video capture (640, 480, 30, 15)
[ INFO] [1645749140.200643248]: Video capture started
```

The following sections show how we pulled information on the various ROS topics.

Connect to Turtle Bot

```
ip_TurtleBot = '10.0.1.57';
ip_Matlab = '10.0.1.54';

setenv('ROS_MASTER_URI', strcat('http://', ip_TurtleBot, ':11311'))
```

```
setenv('ROS_IP', ip_Matlab)
```

```
rosinit(ip_TurtleBot)
```

The value of the ROS_IP environment variable, 10.0.1.54, will be used to set the advertised address for the ROS node
Initializing global node /matlab_global_node_67359 with NodeURI http://10.0.1.54:57211/

```
ans = datetime  
24-Feb-2022 19:25:07
```

Echoing Ros Topics

```
datetime
```

```
ans = datetime  
24-Feb-2022 19:25:07
```

/cmd_vel

```
rostopic info /cmd_vel
```

Type: geometry_msgs/Twist

Publishers:

Subscribers:

* /turtlebot3_core (http://10.0.1.57:45775/)

```
%msg_vel = rostopic("echo", "/cmd_vel")
```

Since there are no publishers for the velocity, there is no message content to display. This is why the line 'msg_vel = rostopic("echo", "/cmd_vel")' is commented, since it will run forever waiting for data.

/scan

```
rostopic info /scan
```

Type: sensor_msgs/LaserScan

Publishers:

* /turtlebot3_lds (http://10.0.1.57:42047/)

Subscribers:

* /matlab_global_node_22226 (http://10.0.1.57:50091/)

```
msg_scan = rostopic("echo", "/scan")
```

```
msg_scan =
```

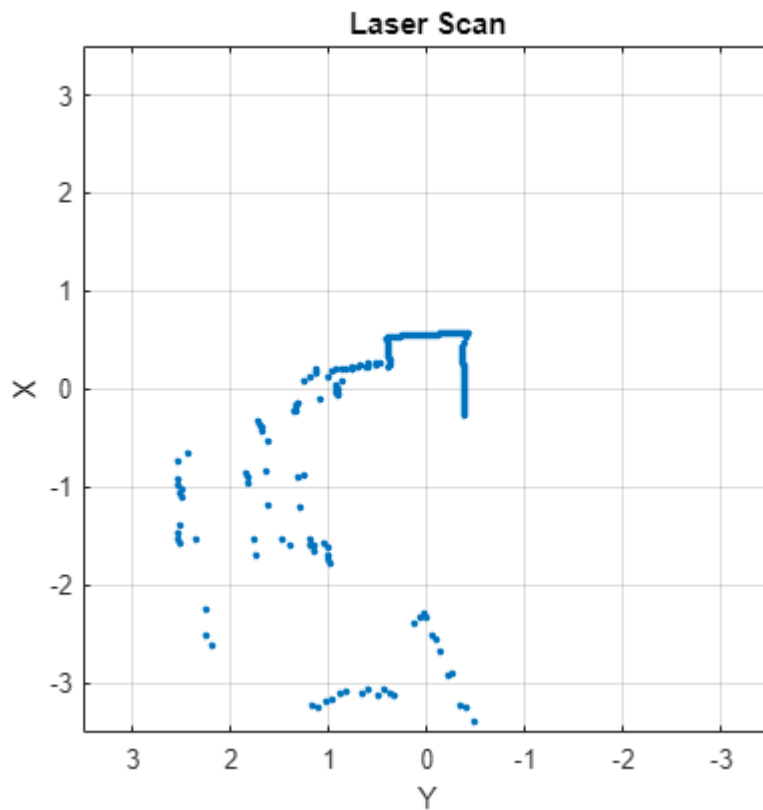
ROS LaserScan message with properties:

```
    MessageType: 'sensor_msgs/LaserScan'  
      Header: [1x1 Header]  
    AngleMin: 0  
    AngleMax: 6.2657  
AngleIncrement: 0.0175  
TimeIncrement: 2.9900e-05  
    ScanTime: 0  
    RangeMin: 0.1200  
    RangeMax: 3.5000
```

Ranges: [360×1 single]
Intensities: [360×1 single]

Use showdetails to show the contents of the message

```
laser_sub = rossubscriber('/scan');  
scan_data = receive(laser_sub);  
plot(scan_data);
```



/raspicam_node/image/compressed

```
rostopic info /raspicam_node/image/compressed
```

Type: sensor_msgs/CompressedImage

Publishers:

* /raspicam_node (http://10.0.1.57:43265/)

Subscribers:

```
msg_camera = rostopic("echo", "/raspicam_node/image/compressed")
```

msg_camera =

ROS CompressedImage message with properties:

MessageType: 'sensor_msgs/CompressedImage'

Header: [1×1 Header]

Format: 'jpg'

Data: [103770×1 uint8]

Use showdetails to show the contents of the message

```
TurtleBot_Topic.picam = '/raspicam_node/image/compressed';  
image_sub = rosubsubscriber(TurtleBot_Topic.picam);  
image_compressed = receive(image_sub);  
  
image_compressed.Format = 'bgr8; jpeg compressed bgr8';  
figure  
imshow(readImage(image_compressed))
```



/imu

```
rostopic info /imu
```

Type: sensor_msgs/Imu

Publishers:

* /turtlebot3_core (http://10.0.1.57:45775/)

Subscribers:

```
msg_imu = rostopic("echo", "/imu")
```

msg_imu =

ROS Imu message with properties:

```
MessageType: 'sensor_msgs/Imu'
Header: [1x1 Header]
Orientation: [1x1 Quaternion]
AngularVelocity: [1x1 Vector3]
LinearAcceleration: [1x1 Vector3]
OrientationCovariance: [9x1 double]
AngularVelocityCovariance: [9x1 double]
LinearAccelerationCovariance: [9x1 double]
```

Use showdetails to show the contents of the message

```
msg_imu.AngularVelocity
```

```
ans =
ROS Vector3 message with properties:
```

```
MessageType: 'geometry_msgs/Vector3'
X: 0
Y: 0
Z: 0
```

Use showdetails to show the contents of the message

```
msg_imu.LinearAcceleration
```

```
ans =
ROS Vector3 message with properties:
```

```
MessageType: 'geometry_msgs/Vector3'
X: 0.1598
Y: -0.0646
Z: 9.9455
```

Use showdetails to show the contents of the message

/odom

```
rostopic info /odom
```

Type: nav_msgs/Odometry

Publishers:

* /turtlebot3_core (http://10.0.1.57:45775/)

Subscribers:

```
msg_odom = rostopic("echo", "/odom")
```

```
msg_odom =
ROS Odometry message with properties:
```

```
MessageType: 'nav_msgs/Odometry'
Header: [1x1 Header]
Pose: [1x1 PoseWithCovariance]
Twist: [1x1 TwistWithCovariance]
ChildFrameId: 'base_footprint'
```

Use showdetails to show the contents of the message

```
msg_odom.Pose.Pose.Position
```

```
ans =  
ROS Point message with properties:  
  
  MessageType: 'geometry_msgs/Point'  
    X: 1.3375e-11  
    Y: 3.2724e-09  
    Z: 0  
  
Use showdetails to show the contents of the message
```

```
msg_odom.Pose.Pose.Position
```

```
ans =  
ROS Point message with properties:  
  
  MessageType: 'geometry_msgs/Point'  
    X: 1.3375e-11  
    Y: 3.2724e-09  
    Z: 0  
  
Use showdetails to show the contents of the message
```