無人載具技術與應用
ROS-Ubuntu

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ROS SLAM / gmapping demo

$ sudo apt-get install ros-noetic-slam-gmapping
$ sudo apt-get install ros-noetic-navigation

ROS Navigation stack. Code for finding where the robot is and how it can get somewhere else.

1,804 commits | 13 branches | 115 releases | 85 contributors

Branch: melodic-devel | New pull request | Find file | Clone or downloa

SteveMacenski and mikeferguson fix typo for parameter beam_skip_error_threshold but bandaged for oth... | Latest commit c3f6b9a 7 days

amcl	fix typo for parameter beam_skip_error_threshold but bandaged for oth...	7 days
base_local_planner	1.16.2	2 months
carrot_planner	1.16.2	2 months
clear_costmap_recovery	1.16.2	2 months
costmap_2d	1.16.2	2 months
dwa_local_planner	1.16.2	2 months
fake_localization	1.16.2	2 months
global_planner	1.16.2	2 months
map_server	1.16.2	2 months
move_base	1.16.2	2 months
move_slow_and_clear	1.16.2	2 months
nav_core	1.16.2	2 months
navfn	remove const from create_nav_plan_astar	8 days
navigation	1.16.2	2 months
rotate_recovery	1.16.2	2 months

gmapping

indigo | kinetic | lunar *Show EOL distros:*

Documentation Status

slam_gmapping: *gmapping* | *openslam_gmapping*

Package Summary

✔ Released ✔ Continuous Integration ✔ Documented

This package contains a ROS wrapper for OpenSlam's Gmapping. The gmapping package provides laser-based SLAM (Simultaneous Localization and Mapping), as a ROS node called slam_gmapping. Using slam_gmapping, you can create a 2-D occupancy grid map (like a building floorplan) from laser and pose data collected by a mobile robot.

map_server

indigo | kinetic | lunar | melodic *Show EOL distros:*

Documentation Status

navigation: *amcl* | *base_local_planner* | *carrot_planner* | *clear_costmap_recovery* | *costmap_fake_localization* | *global_planner* | *map_server* | *move_base* | *move_base_msgs* | *move_slow* | *robot_pose_ekf* | *rotate_recovery* | *voxel_grid*

Package Summary

✔ Released ✔ Documented

map_server provides the `map_server` ROS Node, which offers map data as a ROS Service. It also provides the `map_saver` command-line utility, which allows dynamically generated maps to be saved to file.

Branch: kinetic-devel ▾ **turtlebot3** / turtlebot3_slam / launch / **turtlebot3_gmapping.launch** Find file Copy path

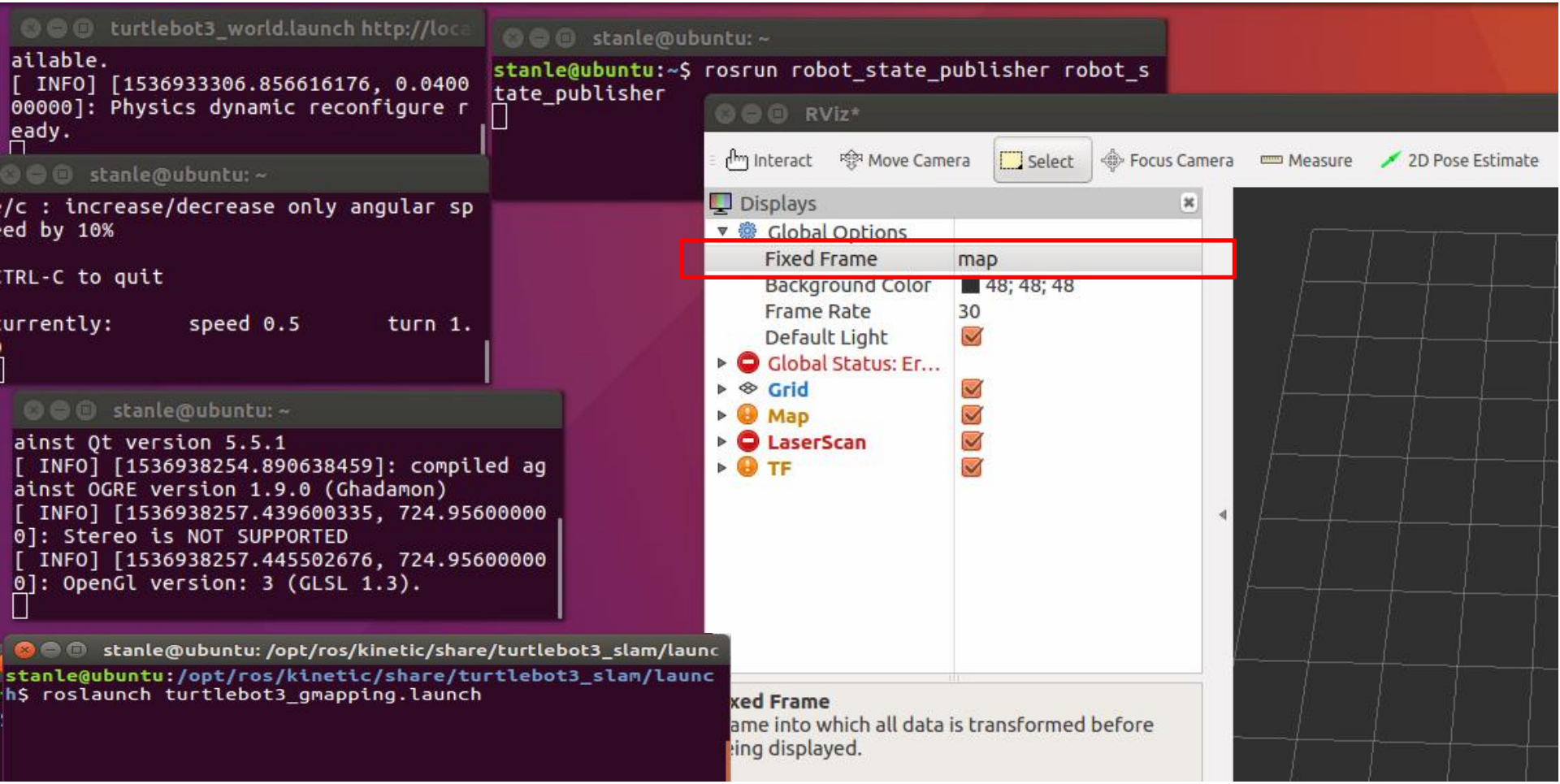
routiful add arguments 79560d9 on 11 Jul

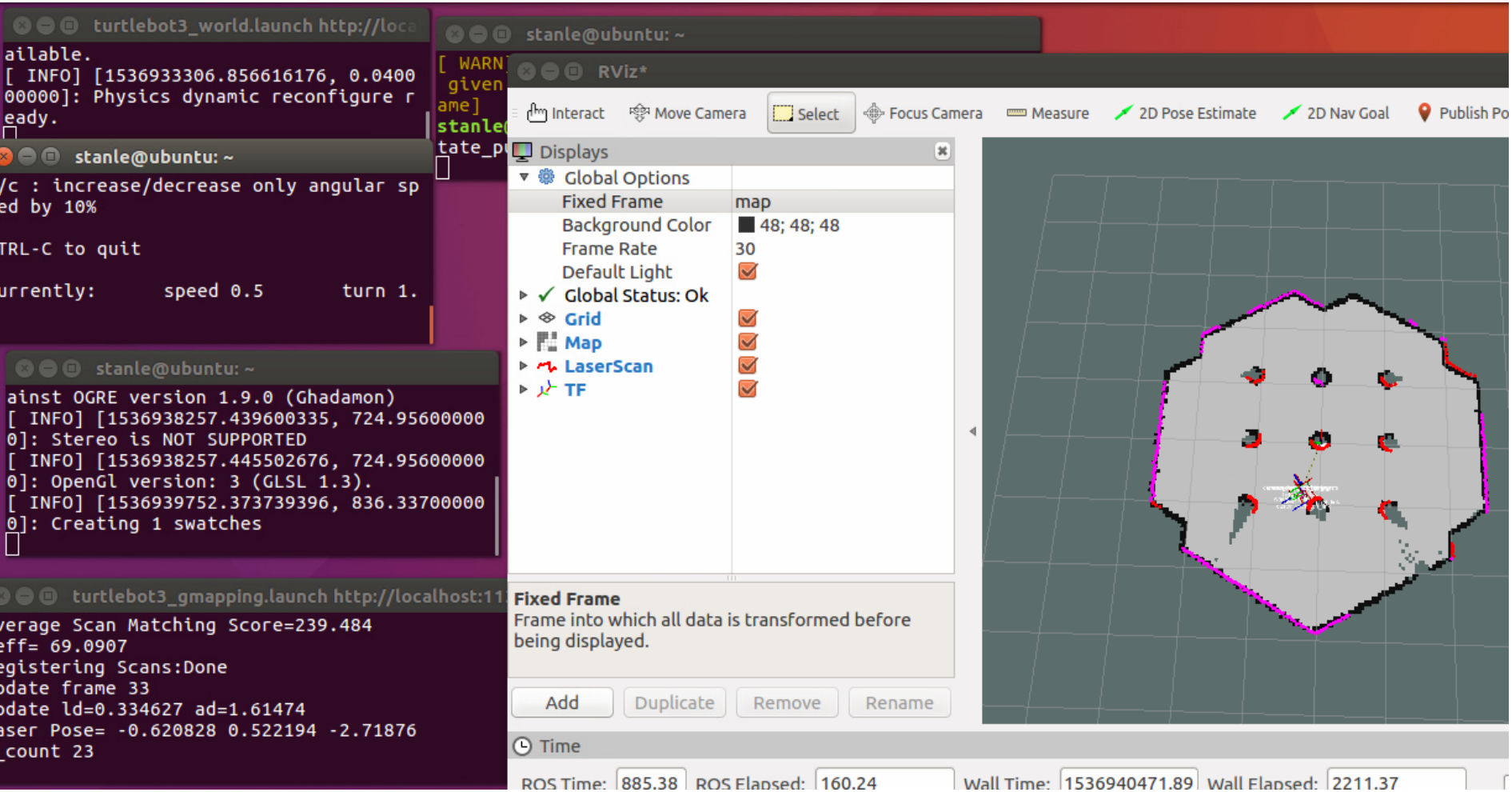
2 contributors

45 lines (43 sloc) | 1.83 KB Raw Blame History

```
<launch>
  <!-- Arguments -->
  <arg name="model" default="$(env TURTLEBOT3_MODEL)" doc="model type [burger, waffle, waffle_pi]"/>
  <arg name="configuration_basename" default="turtlebot3_lds_2d.lua"/>
  <arg name="set_base_frame" default="base_footprint"/>
  <arg name="set_odom_frame" default="odom"/>
  <arg name="set_map_frame"  default="map"/>

  <!-- Gmapping -->
  <node pkg="gmapping" type="slam_gmapping" name="turtlebot3_slam_gmapping" output="screen">
    <param name="base_frame" value="$(arg set_base_frame)"/>
    <param name="odom_frame" value="$(arg set_odom_frame)"/>
    <param name="map_frame"  value="$(arg set_map_frame)"/>
    <param name="map_update_interval" value="2.0"/>
    <param name="maxUrange" value="3.0"/>
    <param name="sigma" value="0.05"/>
    <param name="kernelSize" value="1"/>
    <param name="lstep" value="0.05"/>
    <param name="astep" value="0.05"/>
    <param name="iterations" value="5"/>
    <param name="lsigma" value="0.075"/>
    <param name="ogain" value="3.0"/>
    <param name="lskip" value="0"/>
    <param name="minimumScore" value="50"/>
    <param name="srr" value="0.1"/>
    <param name="srt" value="0.2"/>
    <param name="str" value="0.1"/>
    <param name="stt" value="0.2"/>
```


turtlebot3_world.launch http://loca
ailable.
[INFO] [1536933306.856616176, 0.0400
00000]: Physics dynamic reconfigure r
eady.
stanle@ubuntu: ~
stanle@ubuntu:~$ rosrun robot_state_publisher robot_s
tate_publisher
RViz*
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
Displays
Global Options
Fixed Frame
map
Background Color
48; 48; 48
Frame Rate
30
Default Light
Global Status: Er...
Grid
Map
LaserScan
TF
stanle@ubuntu: ~
/c : increase/decrease only angular sp
ed by 10%
TRL-C to quit
urrently: speed 0.5 turn 1.
stanle@ubuntu: ~
ainst Qt version 5.5.1
[INFO] [1536938254.890638459]: compiled ag
ainst OGRE version 1.9.0 (Ghadamon)
[INFO] [1536938257.439600335, 724.95600000
0]: Stereo is NOT SUPPORTED
[INFO] [1536938257.445502676, 724.95600000
0]: OpenGl version: 3 (GLSL 1.3).
stanle@ubuntu: /opt/ros/kinetic/share/turtlebot3_slam/launc
stanle@ubuntu:/opt/ros/kinetic/share/turtlebot3_slam/launc
h$ roslaunch turtlebot3_gmapping.launch
xed Frame
ame into which all data is transformed before
ing displayed.


turtlebot3_world.launch http://loca
ailable.
[INFO] [1536933306.856616176, 0.0400
00000]: Physics dynamic reconfigure r
eady.
stanle@ubuntu: ~
/c : increase/decrease only angular sp
ed by 10%
TRL-C to quit
urrently: speed 0.5 turn 1.
stanle@ubuntu: ~
ainst OGRE version 1.9.0 (Ghadamon)
[INFO] [1536938257.439600335, 724.95600000
0]: Stereo is NOT SUPPORTED
[INFO] [1536938257.445502676, 724.95600000
0]: OpenGl version: 3 (GLSL 1.3).
[INFO] [1536939752.373739396, 836.33700000
0]: Creating 1 swatches
turtlebot3_gmapping.launch http://localhost:11
verage Scan Matching Score=239.484
eff= 69.0907
egistering Scans:Done
odate frame 33
odate ld=0.334627 ad=1.61474
aser Pose= -0.620828 0.522194 -2.71876
_count 23
stanle@ubuntu: ~
[WARN
given
ame]
stanle
tate_p
RViz*
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Po
Displays
Global Options
Fixed Frame
map
Background Color
48; 48; 48
Frame Rate
30
Default Light
Global Status: Ok
Grid
Map
LaserScan
TF
Fixed Frame
Frame into which all data is transformed before being displayed.
Add
Duplicate
Remove
Rename
Time
ROS Time:
885.38
ROS Elapsed:
160.24
Wall Time:
1536940471.89
Wall Elapsed:
2211.37

2. Command-line Tools

2.1 map_server

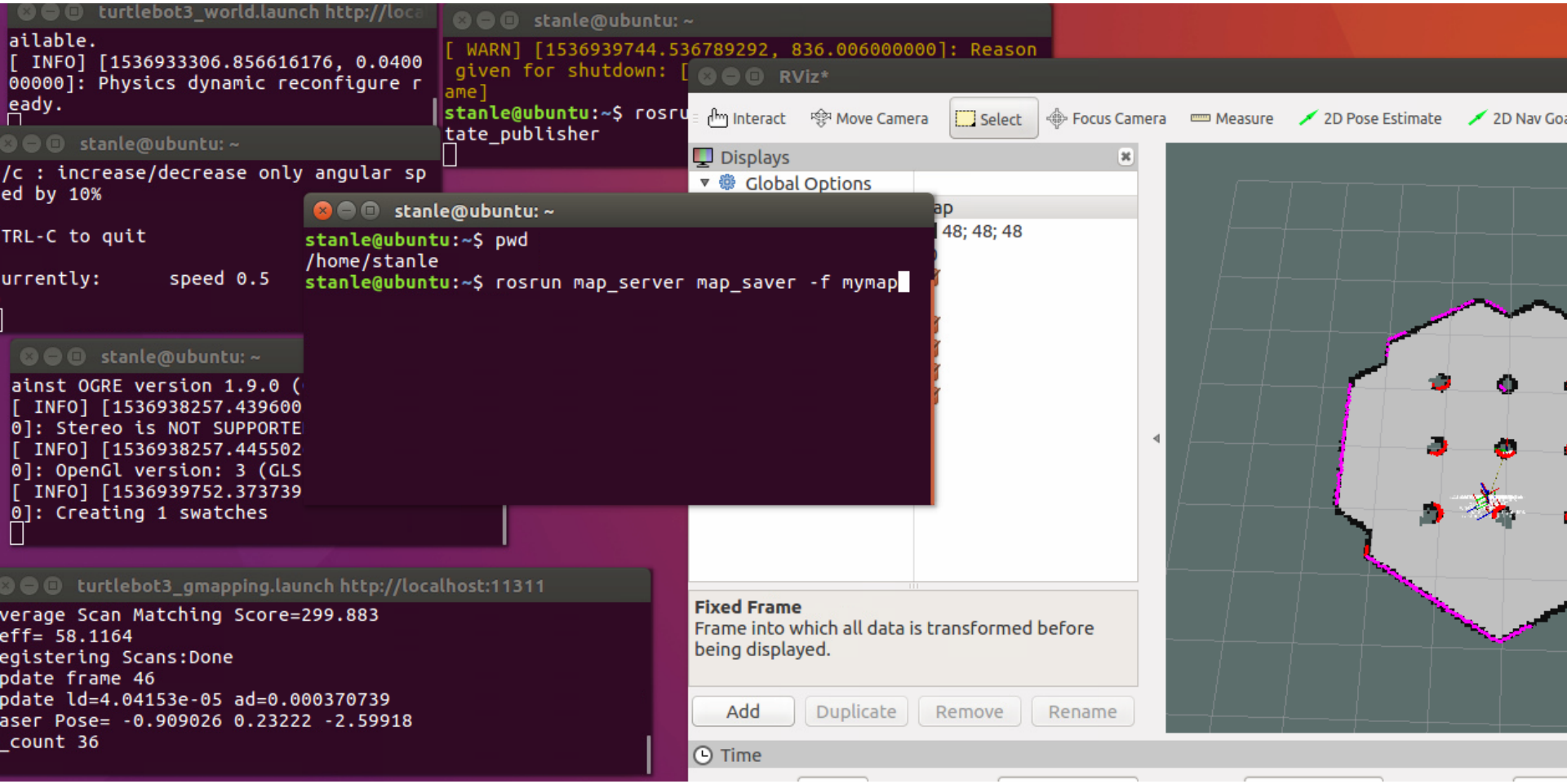
`map_server` is a ROS node that reads a map from disk and offers it via a ROS service.
The current implementation of the map_server converts color values in the map image data into ternary occupancy values: free (0), occupied (100), and unknown (-1). Future versions of this tool may use the values between 0 and 100 to communicate finer gradations of occupancy.

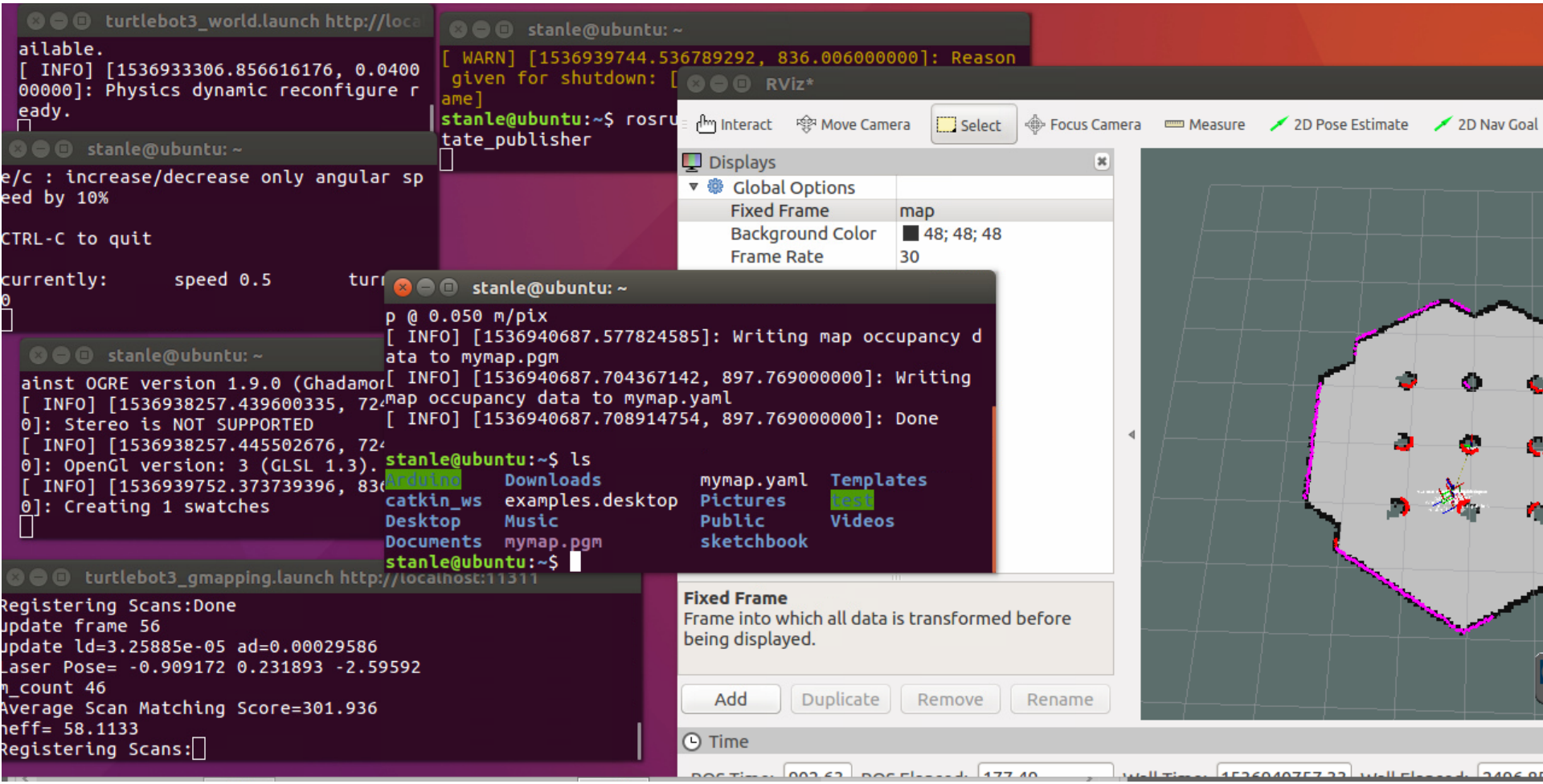
2.1.1 Usage

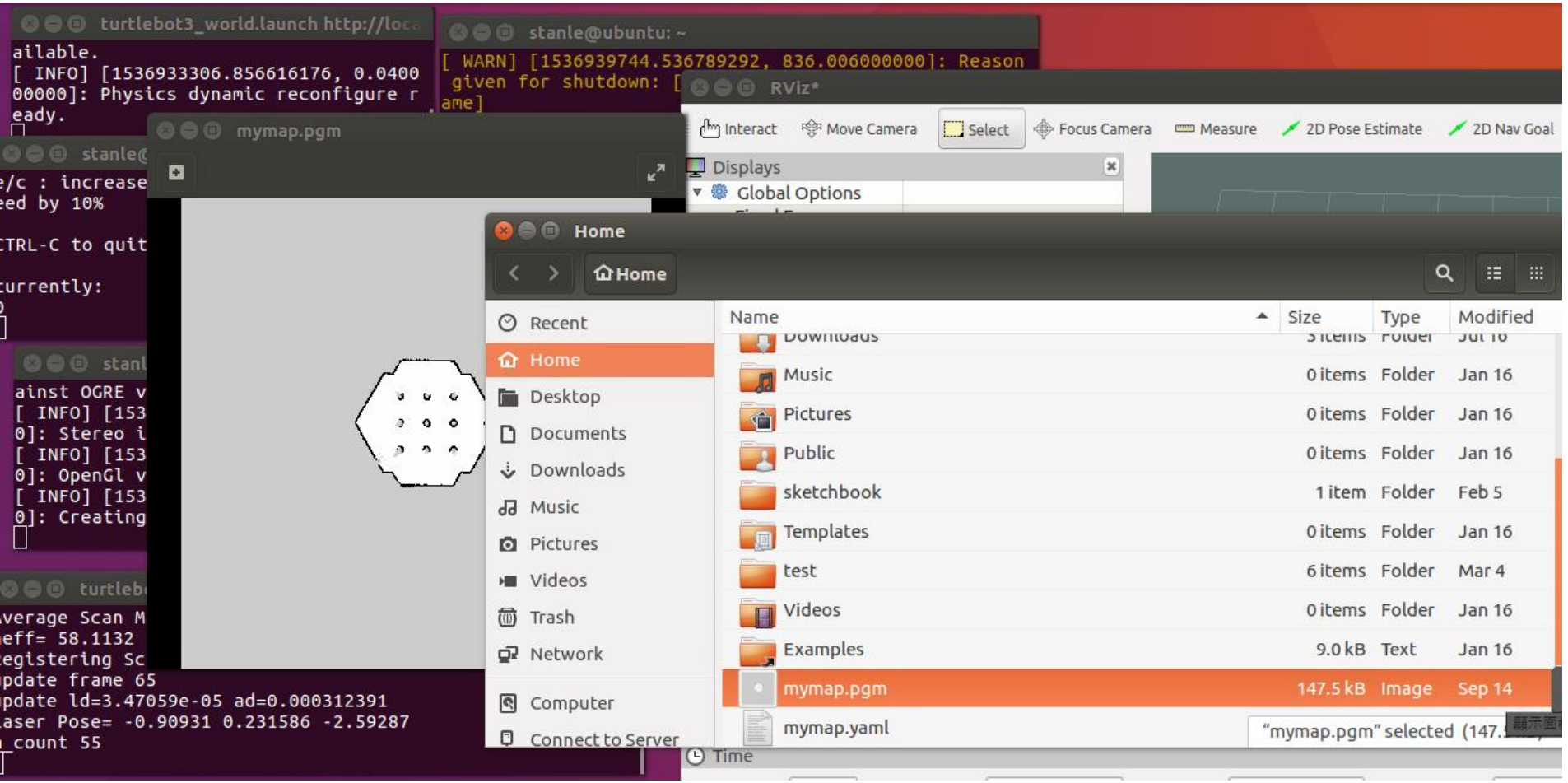
```
map_server <map.yaml>
```

2.1.2 Example

```
rosrun map_server map_server mymap.yaml
```


turtlebot3_world.launch http://loca
ailable.
[INFO] [1536933306.856616176, 0.0400
00000]: Physics dynamic reconfigure r
eady.
stanle@ubuntu: ~
/c : increase/decrease only angular sp
ed by 10%
TRL-C to quit
urrently: speed 0.5
stanle@ubuntu: ~
ainst OGRE version 1.9.0 (
[INFO] [1536938257.439600
0]: Stereo is NOT SUPPORTE
[INFO] [1536938257.445502
0]: OpenGl version: 3 (GLS
[INFO] [1536939752.373739
0]: Creating 1 swatches
stanle@ubuntu: ~
[WARN] [1536939744.536789292, 836.006000000]: Reason
given for shutdown: [
ame]
stanle@ubuntu:~$ rosru
tate_publisher
stanle@ubuntu: ~
stanle@ubuntu:~$ pwd
/home/stanle
stanle@ubuntu:~$ rosrun map_server map_saver -f mymap
turtlebot3_gmapping.launch http://localhost:11311
verage Scan Matching Score=299.883
eff= 58.1164
egistering Scans:Done
pdate frame 46
pdate ld=4.04153e-05 ad=0.000370739
aser Pose= -0.909026 0.23222 -2.59918
_count 36
RViz*
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goa
Displays
Global Options
48; 48; 48
Fixed Frame
Frame into which all data is transformed before being displayed.
Add
Duplicate
Remove
Rename
Time


turtlebot3_world.launch http://loca
ailable.
[INFO] [1536933306.856616176, 0.0400
00000]: Physics dynamic reconfigure r
eady.
stanle@ubuntu: ~
e/c : increase/decrease only angular sp
eed by 10%
CTRL-C to quit
currently: speed 0.5
stanle@ubuntu: ~
ainst OGRE version 1.9.0 (Ghadamor
[INFO] [1536938257.439600335, 72
0]: Stereo is NOT SUPPORTED
[INFO] [1536938257.445502676, 72
0]: OpenGl version: 3 (GLSL 1.3).
[INFO] [1536939752.373739396, 83
0]: Creating 1 swatches
turtlebot3_gmapping.launch http://localhost:11311
Registering Scans:Done
update frame 56
update ld=3.25885e-05 ad=0.00029586
Laser Pose= -0.909172 0.231893 -2.59592
n_count 46
Average Scan Matching Score=301.936
neff= 58.1133
Registering Scans:
stanle@ubuntu: ~
[WARN] [1536939744.536789292, 836.006000000]: Reason
given for shutdown: [
ame]
stanle@ubuntu:~$ rosru
tate_publisher
stanle@ubuntu: ~
p @ 0.050 m/pix
[INFO] [1536940687.577824585]: Writing map occupancy d
ata to mymap.pgm
[INFO] [1536940687.704367142, 897.769000000]: Writing
map occupancy data to mymap.yaml
[INFO] [1536940687.708914754, 897.769000000]: Done
stanle@ubuntu:~$ ls
Arduino Downloads mymap.yaml Templates
catkin_ws examples.desktop Pictures test
Desktop Music Public Videos
Documents mymap.pgm sketchbook
stanle@ubuntu:~$
RViz*
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Displays
Global Options
Fixed Frame map
Background Color 48; 48; 48
Frame Rate 30
Fixed Frame
Frame into which all data is transformed before being displayed.
Add
Duplicate
Remove
Rename
Time


turtlebot3_world.launch http://loca
ailable.
[INFO] [1536933306.856616176, 0.0400
00000]: Physics dynamic reconfigure r
eady.
stanle@ubuntu: ~
[WARN] [1536939744.536789292, 836.006000000]: Reason
given for shutdown: [
ame]
RViz*
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Displays
Global Options
mymap.pgm
stanle@
e/c : increase
eed by 10%
CTRL-C to quit
currently:
stanl
ainst OGRE v
[INFO] [153
0]: Stereo i
[INFO] [153
0]: OpenGl v
[INFO] [153
0]: Creating
turtleb
verage Scan M
eff= 58.1132
egistering Sc
pdate frame 65
pdate ld=3.47059e-05 ad=0.000312391
aser Pose= -0.90931 0.231586 -2.59287
_count 55
Home
Home
Recent
Home
Desktop
Documents
Downloads
Music
Pictures
Videos
Trash
Network
Computer
Connect to Server
Name
Size
Type
Modified
Music 0 items Folder Jan 16
Pictures 0 items Folder Jan 16
Public 0 items Folder Jan 16
sketchbook 1 item Folder Feb 5
Templates 0 items Folder Jan 16
test 6 items Folder Mar 4
Videos 0 items Folder Jan 16
Examples 9.0 kB Text Jan 16
mymap.pgm 147.5 kB Image Sep 14
mymap.yaml
"mymap.pgm" selected
Time

gmapping

- sudo apt-get install ros-noetic-slam-gmapping
- sudo apt-get install ros-noetic-navigation
- sudo apt-get install ros-noetic-teleop-twist-keyboard

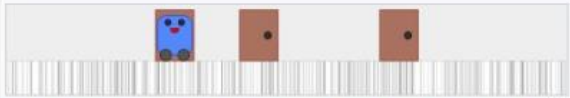
- roslaunch turtlebot3_gazebo turtlebot3_world.launch
- roslaunch turtlebot3_slam turtlebot3_gmapping.launch
- rosrun robot_state_publisher robot_state_publisher
- rosrun teleop_twist_keyboard teleop_twist_keyboard.py
- rviz

- rosrun map_server map_saver -f mymap.yaml

AMCL 定位

AMCL蒙地卡羅定位升級版

$t = 0$

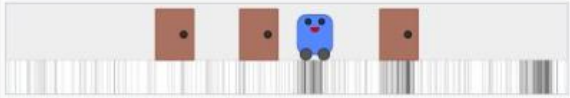


The algorithm initializes with a uniform distribution of particles. The robot considers itself equally likely to be at any point in space along the corridor, even though it is physically at the first door.

Sensor update: the robot detects **a door**. It assigns a weight to each of the particles. The particles which are likely to give this sensor reading receive a higher weight.

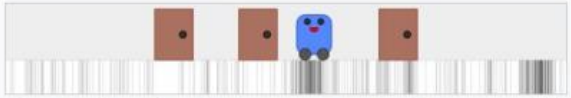
Resampling: the robot generates a set of new particles, with most of them generated around the previous particles with more weight. It now believes it is at one of the three doors.

$t = 1$



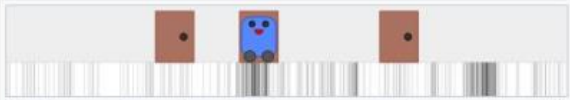
Motion update: the robot moves some distance to the right. All particles also move right, and some noise is applied. The robot is physically between the second and third doors.

Sensor update: the robot detects **no door**. It assigns a weight to each of the particles. The particles likely to give this sensor reading receive a higher weight.



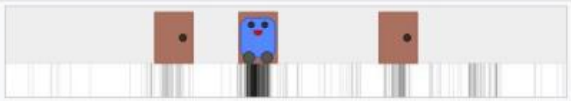
Resampling: the robot generates a set of new particles, with most of them generated around the previous particles with more weight. It now believes it is at one of two locations.

$t = 2$



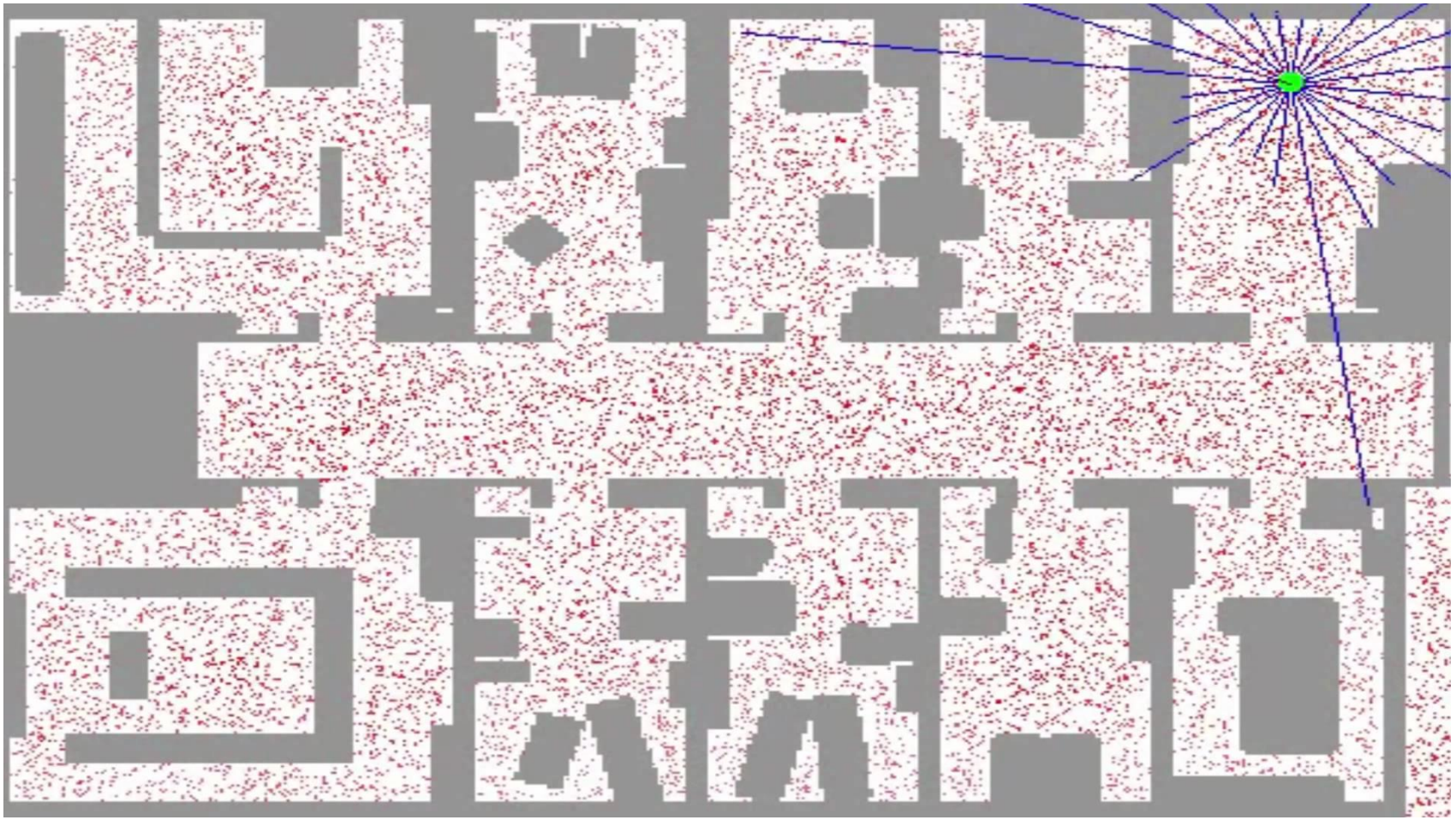
Motion update: the robot moves some distance to the left. All particles also move left, and some noise is applied. The robot is physically at the second door.

Sensor update: the robot detects **a door**. It assigns a weight to each of the particles. The particles likely to give this sensor reading receive a higher weight.

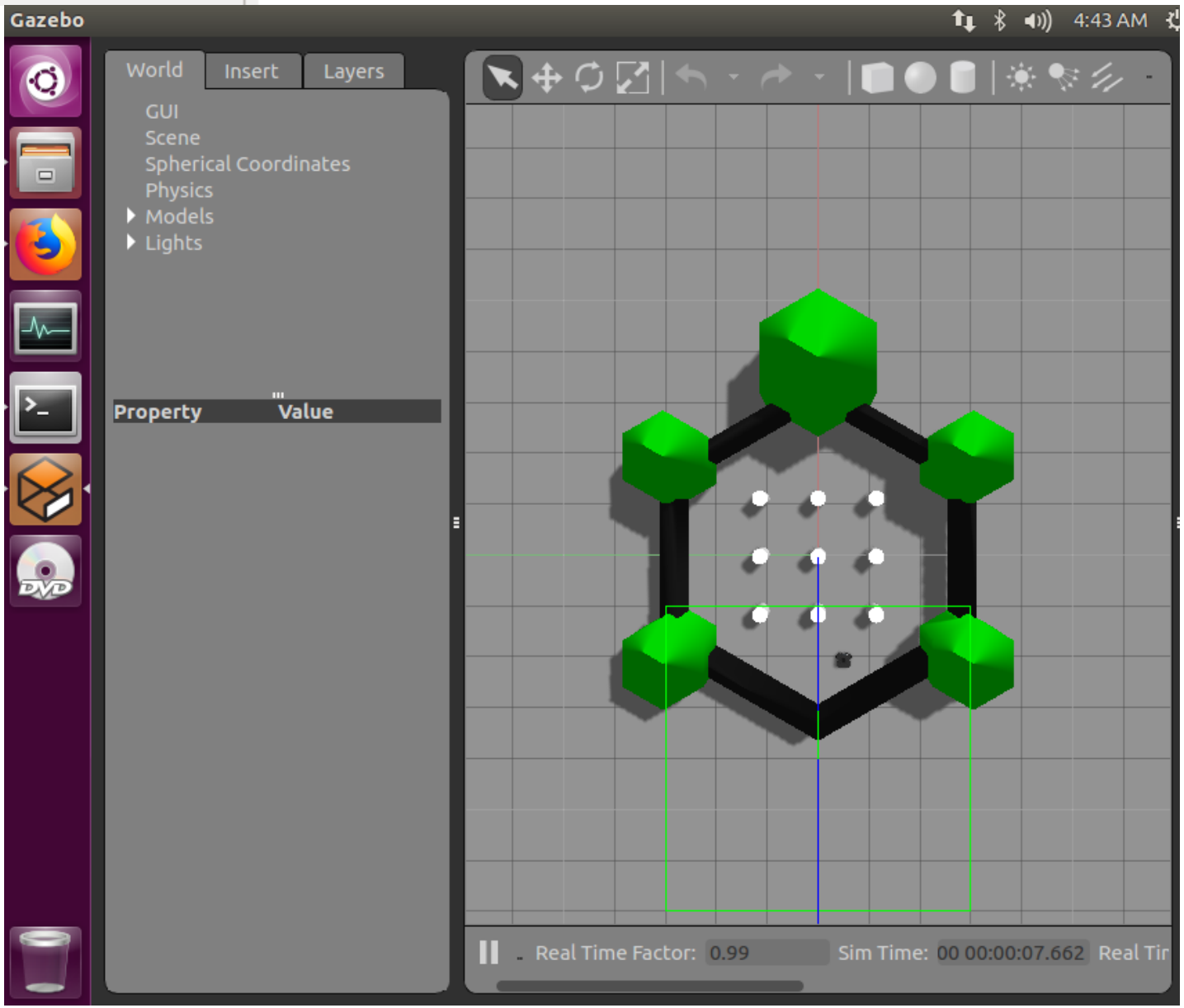


Resampling: the robot generates a set of new particles, with most of them generated around the previous particles with more weight. The robot has successfully localized itself.

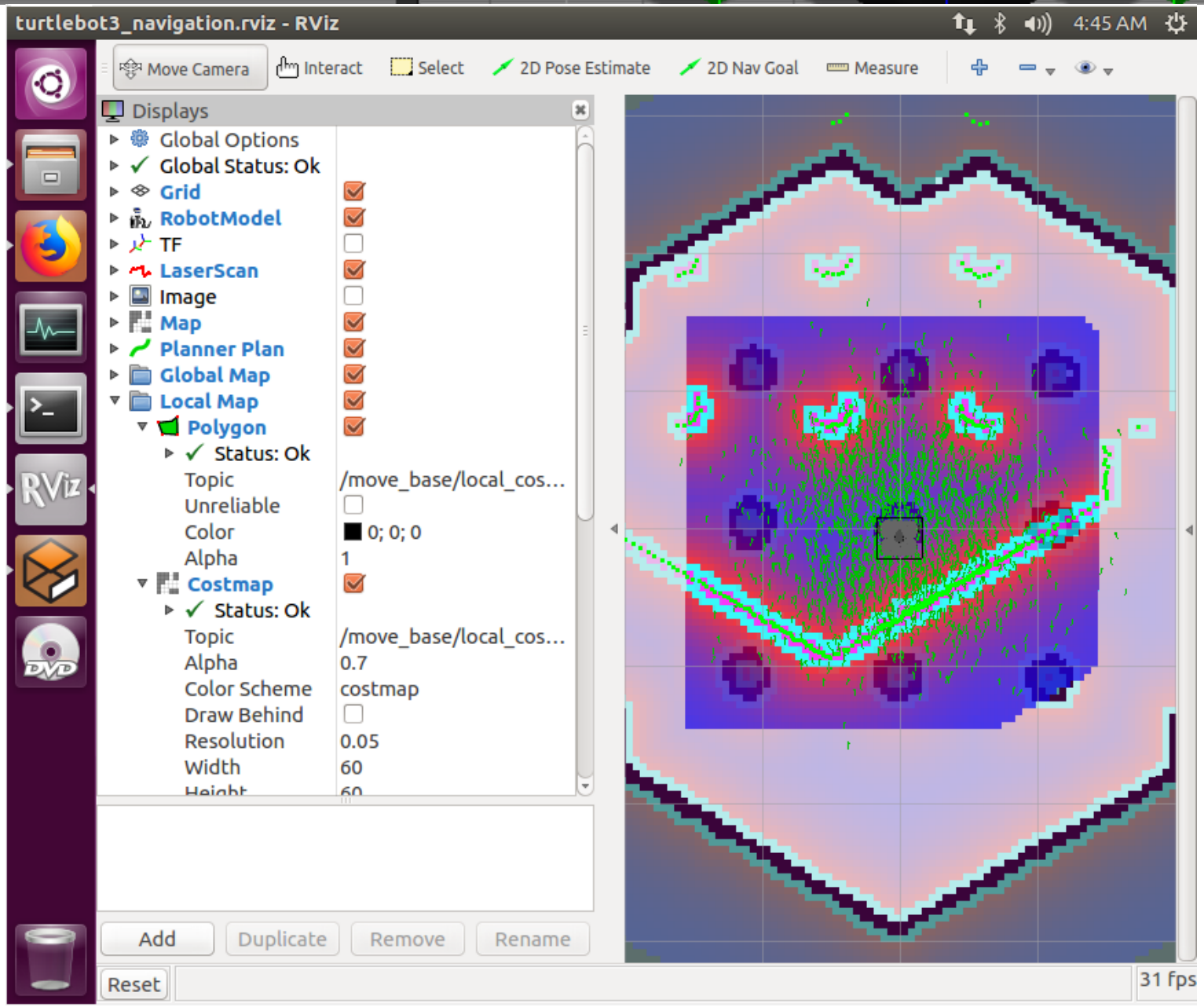
AMCL蒙地卡羅定位升級版



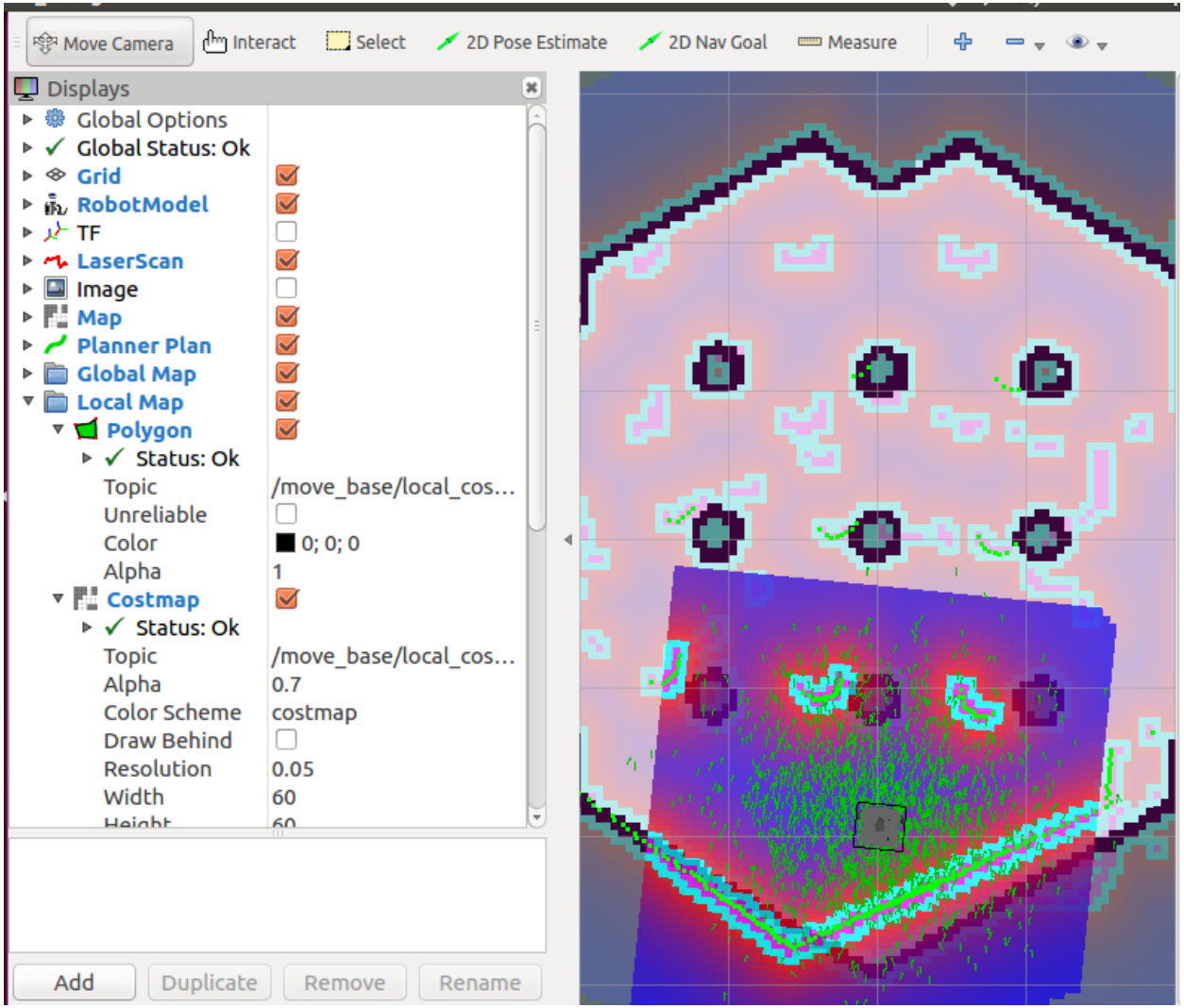
```
peter@ubuntu:~$ roslaunch turtlebot3_gazebo turtlebot3_world.launch
```

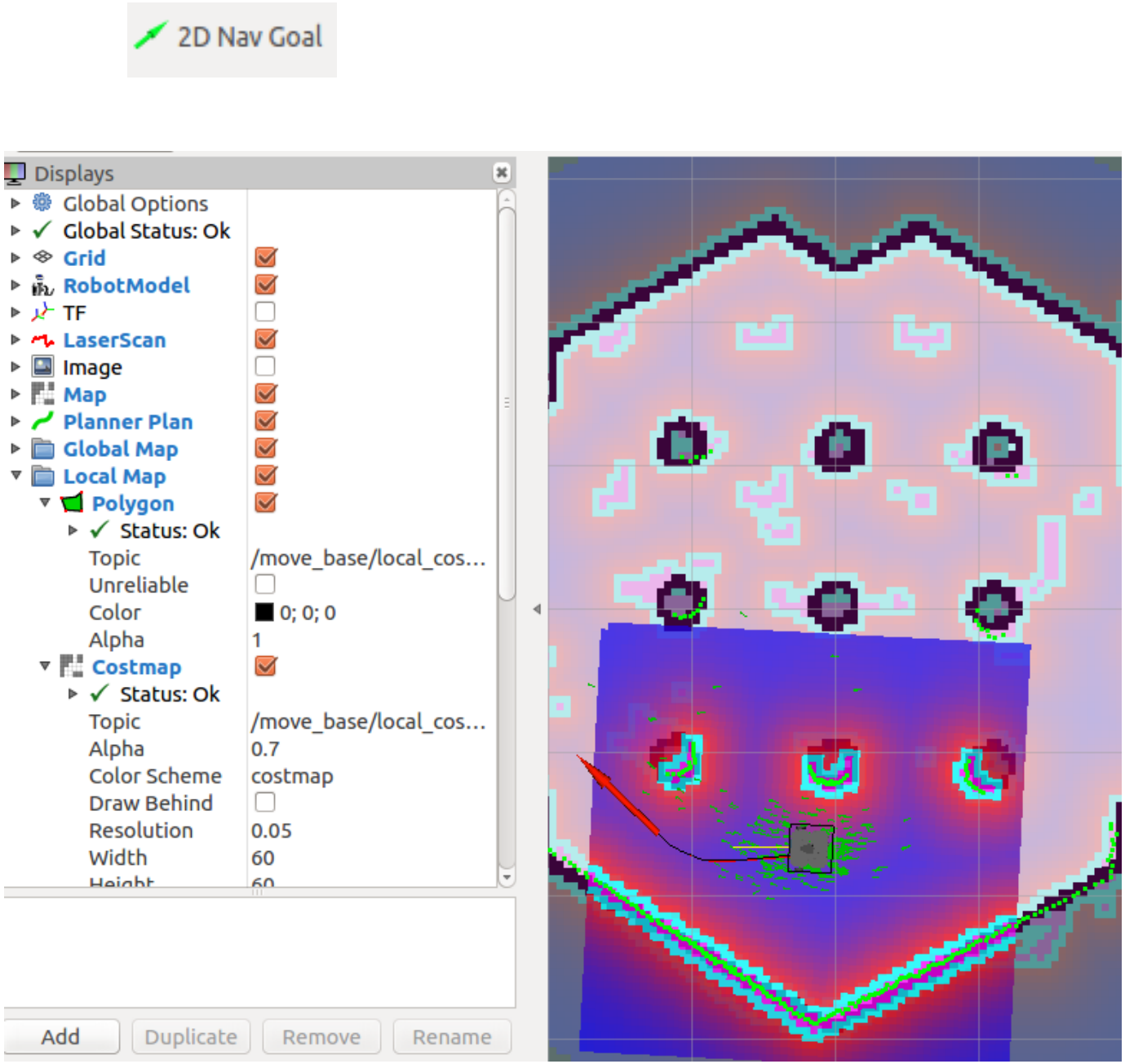


```
peter@ubuntu:~$ roslaunch turtlebot3_navigation turtlebot3_navigation.launch
```



2D Pose Estimate


Move Camera
Interact
Select
2D Pose Estimate
2D Nav Goal
Measure
Displays
Global Options
Global Status: Ok
Grid
RobotModel
TF
LaserScan
Image
Map
Planner Plan
Global Map
Local Map
Polygon
Status: Ok
Topic
/move_base/local_cos...
Unreliable
Color
0; 0; 0
Alpha
1
Costmap
Status: Ok
Topic
/move_base/local_cos...
Alpha
0.7
Color Scheme
costmap
Draw Behind
Resolution
0.05
Width
60
Add
Duplicate
Remove
Rename


2D Nav Goal
Displays
Global Options
Global Status: Ok
Grid
RobotModel
TF
LaserScan
Image
Map
Planner Plan
Global Map
Local Map
Polygon
Status: Ok
Topic
/move_base/local_cos…
Unreliable
Color
0; 0; 0
Alpha
1
Costmap
Status: Ok
Topic
/move_base/local_cos…
Alpha
0.7
Color Scheme
costmap
Draw Behind
Resolution
0.05
Width
60
Add
Duplicate
Remove
Rename

Localization定位

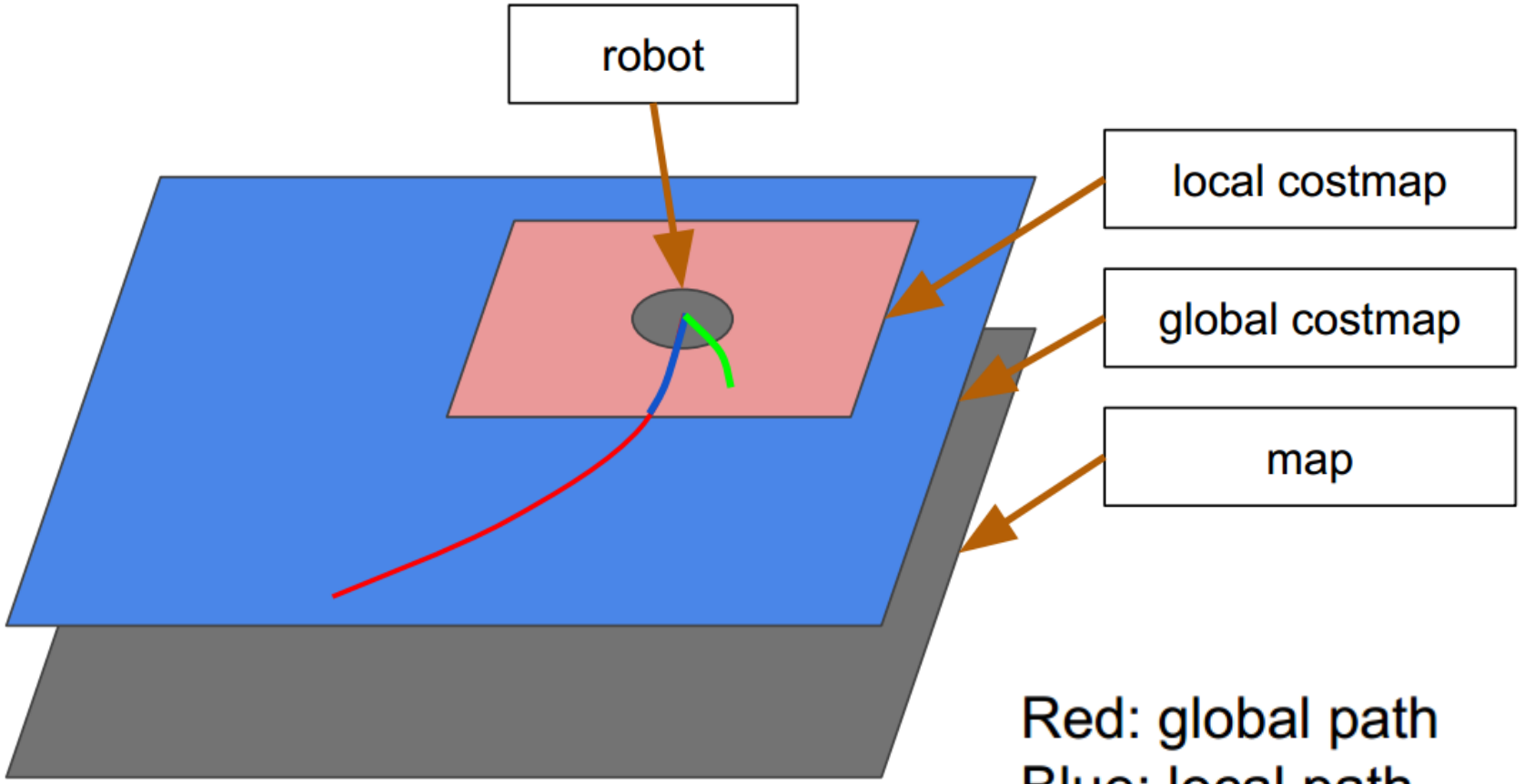
- roslaunch turtlebot3_gazebo turtlebot3_world.launch
- roslaunch turtlebot3_navigation turtlebot3_navigation.launch

sudo apt install ros-noetic-turtlebot3-navigation

出現提示map server，move base及dwa local planner錯誤，可以進行對應ROS版本下package的安裝，本處使用的是noetic

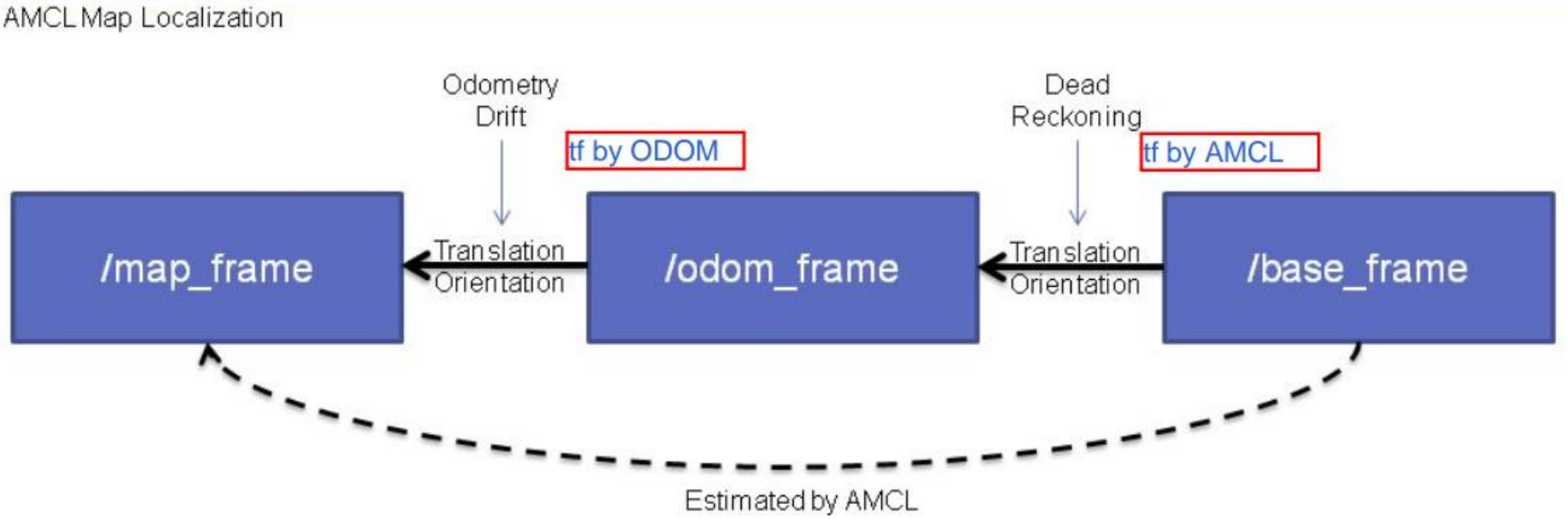
```
sudo apt-get install ros-noetic-map-server
sudo apt-get install ros-noetic-move-base
sudo apt-get install ros-noetic-dwa-local-planner
```

costmap



Red: global path
Blue: local path
Green: dwa

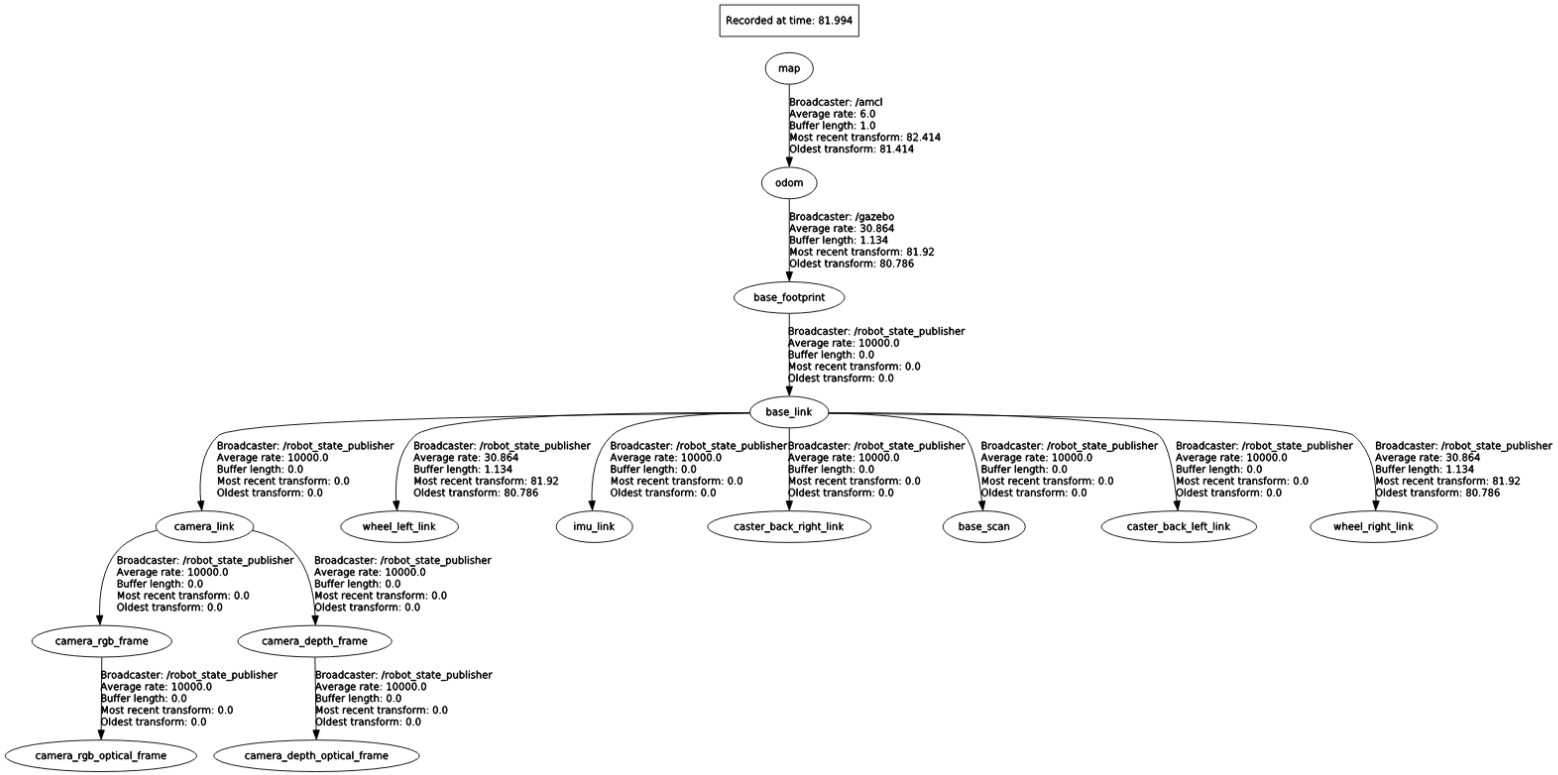
AMCL TF 樹


AMCL Map Localization
Odometry
Drift
tf by ODOM
Dead
Reckoning
tf by AMCL
/map_frame
Translation
Orientation
/odom_frame
Translation
Orientation
/base_frame
Estimated by AMCL

AMCL TF 樹

rosrun rqt_tf_tree rqt_tf_tree

```
peter@peter-lenovo-g50-80:~/catkin_ws$ rosrun rqt_tf_tree rqt_tf_tree
```



作業1

- 透過map_server 建立地圖，並上傳相關檔案

- 參考3/14上課內容，"ROS-Class-3.pdf"

- 加分部分
- 1. 3/28 前上傳(提早上傳加分)
- 2. 地圖存檔時用學號當檔名，如U123456.pgm與U123456.yaml
- 3. 紀錄實驗過程於word檔，紀錄所下的命令與回應，可多利用截圖(圖文並茂加分)

- 上傳作業包含:
- 1. U123456.pgm(檔名用學號)
- 2. U123456.yaml(檔名用學號)
- 3. 實驗紀錄word檔