

SLAM

Study:

ROS 및 SLAM Tutorial 입문기

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ROS-melodic 환경에서 패키지 설치하기

```
$ sudo apt-get install ros-melodic-joy ros-melodic-teleop-twist-joy ros-melodic-teleop-twist-keyboard ros-melodic-laser-proc ros-melodic-rgb-d-launch ros-melodic-depthimage-to-laserscan ros-melodic-rosserial-arduino ros-melodic-rosserial-python ros-melodic-rosserial-server ros-melodic-rosserial-client ros-melodic-rosserial-msgs ros-melodic-amcl ros-melodic-map-server ros-melodic-move-base ros-melodic-urdf ros-melodic-xacro ros-melodic-compressed-image-transport ros-melodic-rqt-image-view ros-melodic-gmapping ros-melodic-navigation
```

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ROS-melodic 환경에서 패키지 설치하기

- 현재 나의 환경 :
1. Ubuntu 18.04
 2. ROS-melodic
 3. CUDA setting : X

```
$ cd mkdir -p ~/catkin_ws/src
$ cd ~/catkin_ws/src/
$ git clone https://github.com/ROBOTIS-GIT/turtlebot3.git
$ git clone https://github.com/ROBOTIS-GIT/turtlebot3_msgs.git
$ git clone https://github.com/ROBOTIS-GIT/turtlebot3_simulations.git
$ cd ~/catkin_ws && catkin_make
```

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Gazebo 상에서 가상의 로봇을 구동

```
$ roscore
```

```
$ cd catkin_ws
```

```
$ source devel/setup.bash
```

```
$ export TURTLEBOT3_MODEL=waffle_pi
```

```
$ roslaunch turtlebot3_gazebo turtlebot3_world.launch
```

만약 실행 중 아래의 오류가 발생하면

```
[Err] [REST.cc:205] Error in REST request
```

```
Libcurl: (51) SSL : no alternative certificate subject name matches target host name 'api.ignitionfuel.org'
```

```
gedit ~/.ignition/fuel/config.yaml
```

```
url: https://api.ignitionfuel.org ->
```

```
url: https://api.ignitionrobotics.org
```

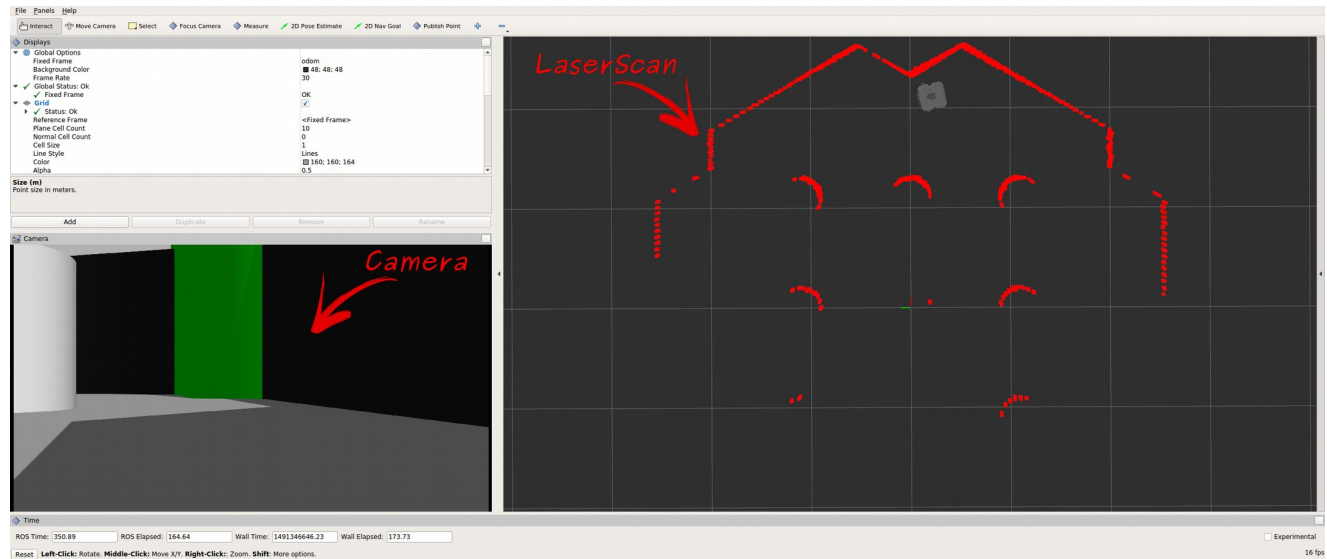
로 수정

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Gazebo 상에서 가상의 로봇을 구동

```
$ cd catkin_ws  
$ source devel/setup.bash  
$ roslaunch turtlebot3_teleop turtlebot3_teleop_key.launch
```

```
$ cd catkin_ws  
$ source devel/setup.bash  
$ export TURTLEBOT3_MODEL=waffle_pi  
$ roslaunch turtlebot3_gazebo turtlebot3_gazebo_rviz.launch
```



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Gazebo 상에서 SLAM 하기

주의 ! 이전 과정을 모두 종료 후(roscore 포함) 시작할 것

▪ Gazebo 실행

```
$ cd catkin_ws  
source devel/setup.bash  
export TURTLEBOT3_MODEL=waffle_pi  
roslaunch turtlebot3_gazebo turtlebot3_world.launch
```

▪ SLAM 실행

```
$ cd catkin_ws  
source devel/setup.bash  
export TURTLEBOT3_MODEL=waffle_pi  
roslaunch turtlebot3_slam turtlebot3_slam.launch slam_methods:=gmapping
```

▪ 터틀봇 원격 조종

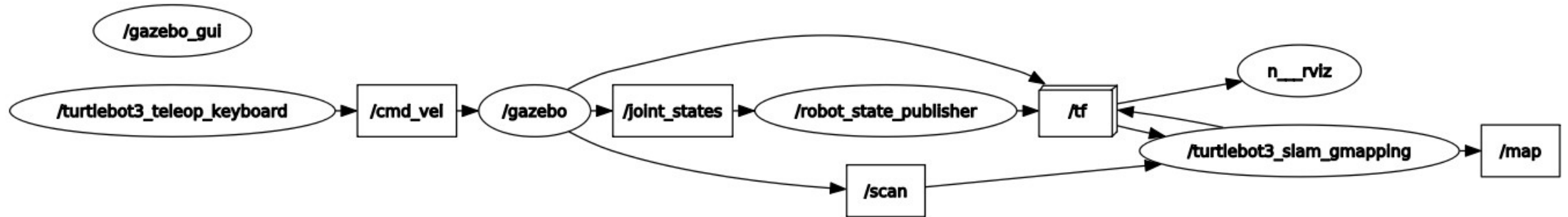
```
$ cd catkin_ws  
source devel/setup.bash  
export TURTLEBOT3_MODEL=waffle_pi  
roslaunch turtlebot3_teleop turtlebot3_teleop_key.launch
```

▪ 지도 출력

```
$ cd catkin_ws  
$ source devel/setup.bash  
$ rosrun map_server map_saver -f ~/map
```

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rqt_graph



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roslaunch

```
gmac92@gmac92:~$ roslaunch list
/gazebo
/gazebo_gui
/robot_state_publisher
/rosout
/rqt_gui_cpp_node_3799
/rqt_gui_py_node_3799
/rviz
/turtlebot3_slam_gmapping
/turtlebot3_teleop_keyboard
gmac92@gmac92:~$
```


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Rqt -> Topic Monitor

Default - rqt

File Plugins Running Perspectives Help

Topic Monitor

Topic	Type	Bar
<input type="checkbox"/> /camera/parameter_descriptions	dynamic_reconfigure/ConfigDescription	
<input type="checkbox"/> /camera/parameter_updates	dynamic_reconfigure/Config	
<input checked="" type="checkbox"/> /camera/rgb/camera_info	sensor_msgs/CameraInfo	
<input type="checkbox"/> /camera/rgb/image_raw	sensor_msgs/Image	
<input type="checkbox"/> /camera/rgb/image_raw/compressed	sensor_msgs/CompressedImage	
<input type="checkbox"/> /camera/rgb/image_raw/compressed/parameter_descriptions	dynamic_reconfigure/ConfigDescription	
<input type="checkbox"/> /camera/rgb/image_raw/compressed/parameter_updates	dynamic_reconfigure/Config	
<input type="checkbox"/> /camera/rgb/image_raw/compressedDepth	sensor_msgs/CompressedImage	
<input type="checkbox"/> /camera/rgb/image_raw/compressedDepth/parameter_descriptions	dynamic_reconfigure/ConfigDescription	
<input type="checkbox"/> /camera/rgb/image_raw/compressedDepth/parameter_updates	dynamic_reconfigure/Config	
<input type="checkbox"/> /camera/rgb/image_raw/theora	theora_image_transport/Package	
<input type="checkbox"/> /camera/rgb/image_raw/theora/parameter_descriptions	dynamic_reconfigure/ConfigDescription	
<input type="checkbox"/> /camera/rgb/image_raw/theora/parameter_updates	dynamic_reconfigure/Config	
<input type="checkbox"/> /clicked_point	geometry_msgs/PointStamped	
<input type="checkbox"/> /clock	roscpp_msgs/Clock	
<input type="checkbox"/> /cmd_vel	geometry_msgs/Twist	
<input type="checkbox"/> /gazebo/link_states	gazebo_msgs/LinkStates	
<input type="checkbox"/> /gazebo/model_states	gazebo_msgs/ModelStates	
<input type="checkbox"/> /gazebo/parameter_descriptions	dynamic_reconfigure/ConfigDescription	
<input type="checkbox"/> /gazebo/parameter_updates	dynamic_reconfigure/Config	
<input type="checkbox"/> /imu	sensor_msgs/Imu	
<input type="checkbox"/> /initialpose	geometry_msgs/PoseWithCovarianceStamped	
<input type="checkbox"/> /joint_states	sensor_msgs/JointState	
<input type="checkbox"/> /map	nav_msgs/OccupancyGrid	
<input type="checkbox"/> /map_metadata	nav_msgs/MapMetaData	
<input type="checkbox"/> /move_base_simple/goal	geometry_msgs/PoseStamped	
<input type="checkbox"/> /odom	nav_msgs/Odometry	
<input type="checkbox"/> /rosout	roscpp_msgs/Log	
<input type="checkbox"/> /rosout_agg	roscpp_msgs/Log	
<input type="checkbox"/> /scan	sensor_msgs/LaserScan	
<input type="checkbox"/> /tf	tf2_msgs/TFMessage	
<input type="checkbox"/> /tf_static	tf2_msgs/TFMessage	
<input type="checkbox"/> /turtlebot3_slam_gmapping/entropy	std_msgs/Float64	

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rosservice list

```
금 21 : 09
c92: ~/catkin_ws
gmac92@gmac92: ~/catkin_ws 79x53
/camera/rgb/image_raw/compressed/set_parameters
/camera/rgb/image_raw/compressedDepth/set_parameters
/camera/rgb/image_raw/theora/set_parameters
/camera/set_camera_info
/camera/set_parameters
/dynamic_map
/gazebo/apply_body_wrench
/gazebo/apply_joint_effort
/gazebo/clear_body_wrenches
/gazebo/clear_joint_forces
/gazebo/delete_light
/gazebo/delete_model
/gazebo/get_joint_properties
/gazebo/get_light_properties
/gazebo/get_link_properties
/gazebo/get_link_state
/gazebo/get_loggers
/gazebo/get_model_properties
/gazebo/get_model_state
/gazebo/get_physics_properties
/gazebo/get_world_properties
/gazebo/pause_physics
/gazebo/reset_simulation
/gazebo/reset_world
/gazebo/set_joint_properties
/gazebo/set_light_properties
/gazebo/set_link_properties
/gazebo/set_link_state
/gazebo/set_logger_level
/gazebo/set_model_configuration
```

```
/gazebo/set_model_state
/gazebo/set_parameters
/gazebo/set_physics_properties
/gazebo/spawn_sdf_model
/gazebo/spawn_urdf_model
/gazebo/unpause_physics
/gazebo_gui/get_loggers
/gazebo_gui/set_logger_level
/imu_service
/robot_state_publisher/get_loggers
/robot_state_publisher/set_logger_level
/rosout/get_loggers
/rosout/set_logger_level
/rqt_gui_cpp_node_3799/get_loggers
/rqt_gui_cpp_node_3799/set_logger_level
/rqt_gui_py_node_3799/get_loggers
/rqt_gui_py_node_3799/set_logger_level
/rviz/get_loggers
/rviz/reload_shaders
/rviz/set_logger_level
/turtlebot3_slam_gmapping/get_loggers
/turtlebot3_slam_gmapping/set_logger_level
/turtlebot3_teleop_keyboard/get_loggers
/turtlebot3_teleop_keyboard/set_logger_level
gmac92@gmac92: ~ 79x1
```

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Gazebo 상에서 Navigation 하기

▪ Gazebo 실행

```
$ cd catkin_ws  
$ source devel/setup.bash  
$ export TURTLEBOT3_MODEL=waffle_pi  
$ roslaunch turtlebot3_gazebo turtlebot3_world.launch
```

주의 ! 이전 과정을 모두 종료 후(roscore 포함) 시작할 것

```
$ cd catkin_ws  
$ source devel/setup.bash  
$ export TURTLEBOT3_MODEL=waffle_pi  
$ roslaunch turtlebot3_navigation turtlebot3_navigation.launch map_file:=$HOME/map.yaml
```

