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# Path 3: Artificial Intelligence in Robotics

## Task 4

## Use any SLAM approach to create and save a map

## Simultaneous Localization and Mapping (SLAM)

In computational geometry, simultaneous localization and mapping is the computational problem of constructing or updating a map of an unknown environment while simultaneously keeping track of an agent's location within it.

- **Localization**: inferring location given a map.
- **Mapping**: inferring a map given locations.
- **SLAM**: learning a map and locating the robot simultaneously.

### The SLAM Problem

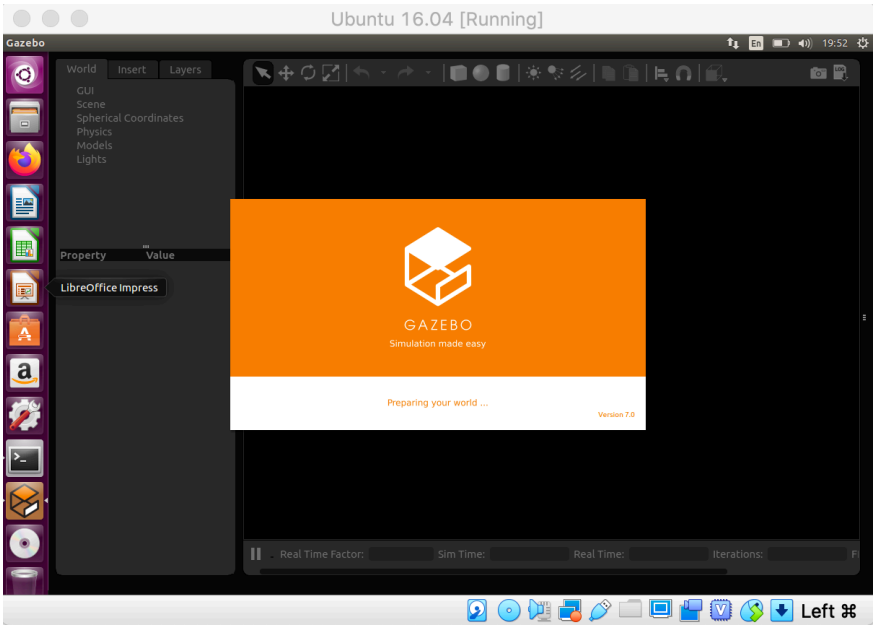
- SLAM is considered a fundamental problems for robots to become truly autonomous
- Large variety of different SLAM approaches have been developed
- The majority uses probabilistic concepts
- History of SLAM dates back to the mid-eighties

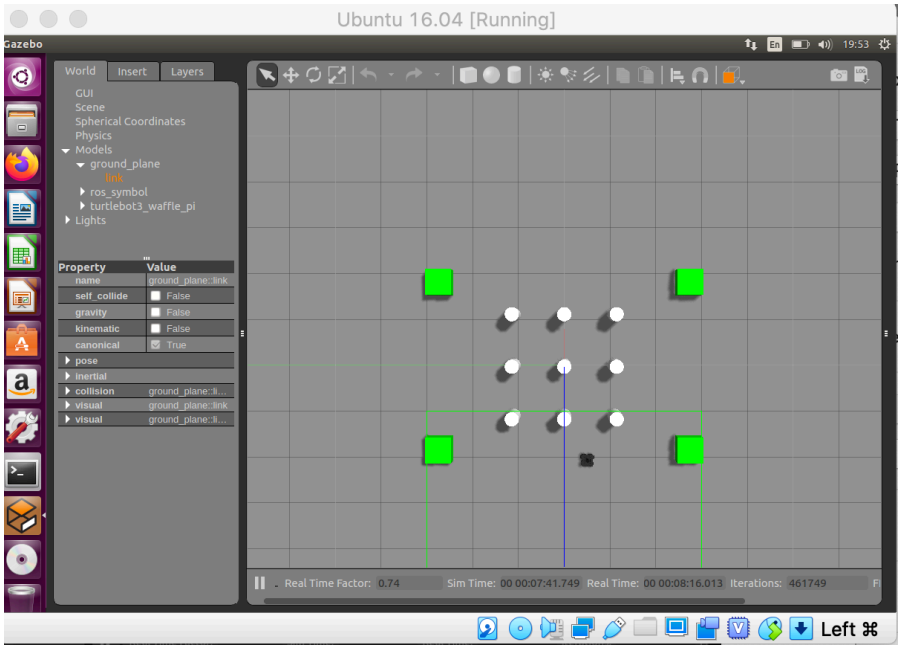
### Virtual SLAM with TurtleBot3

For virtual SLAM in Gazebo, instead of running the actual robot, you can select the various environments and robot models mentioned above, and the SLAM-related commands will use the ROS packages used in the SLAM section.

1. Launch Gazebo

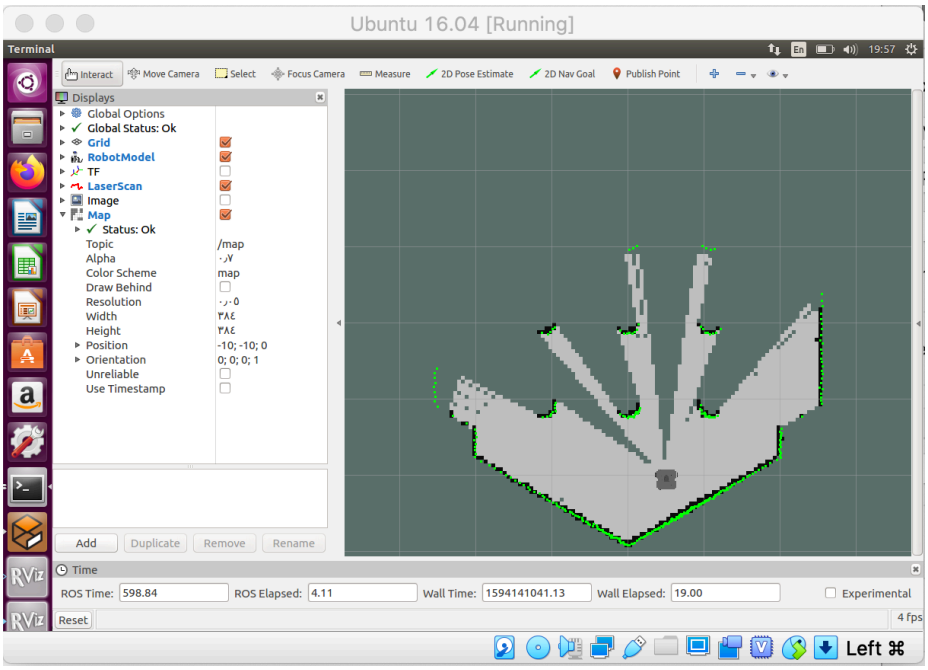
```
$ export TURTLEBOT3_MODEL=waffle_pi
$ roslaunch turtlebot3_gazebo turtlebot3_world.launch
```



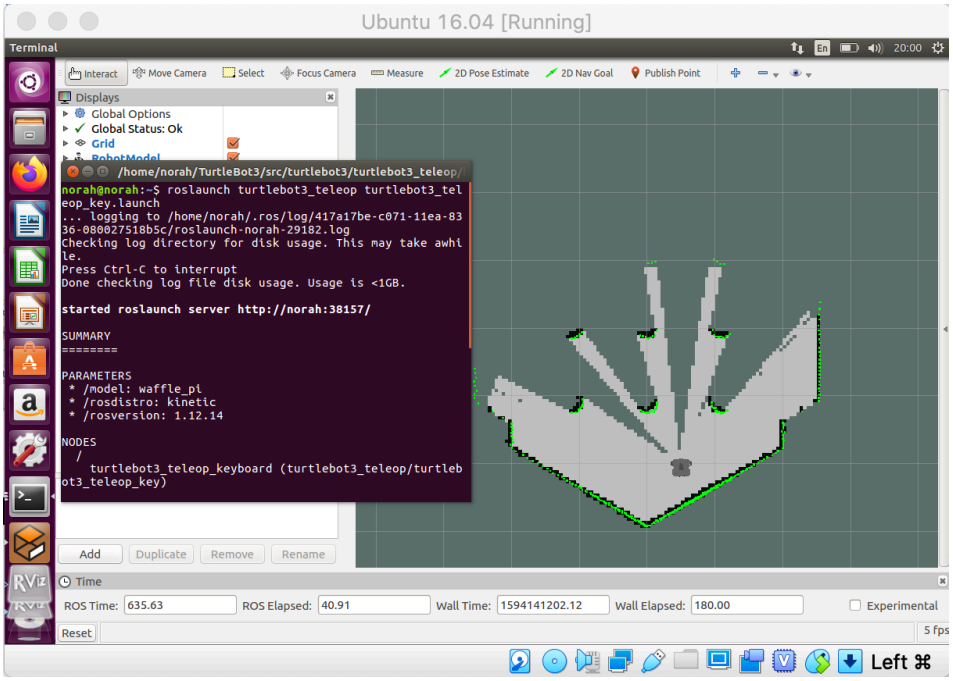
## 2. Launch SLAM

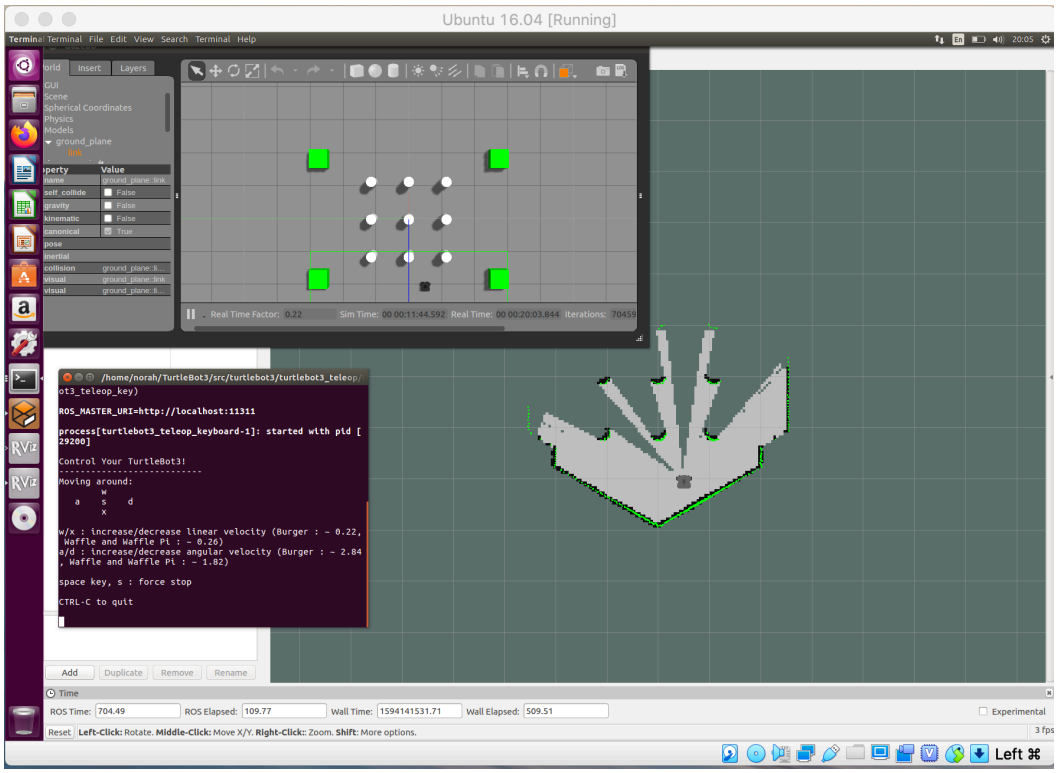
```
$ export TURTLEBOT3_MODEL=waffle_pi
$ roslaunch turtlebot3_slam turtlebot3_slam.launch
slam_methods:=gmapping
```




## 3. Remotely Control TurtleBot3

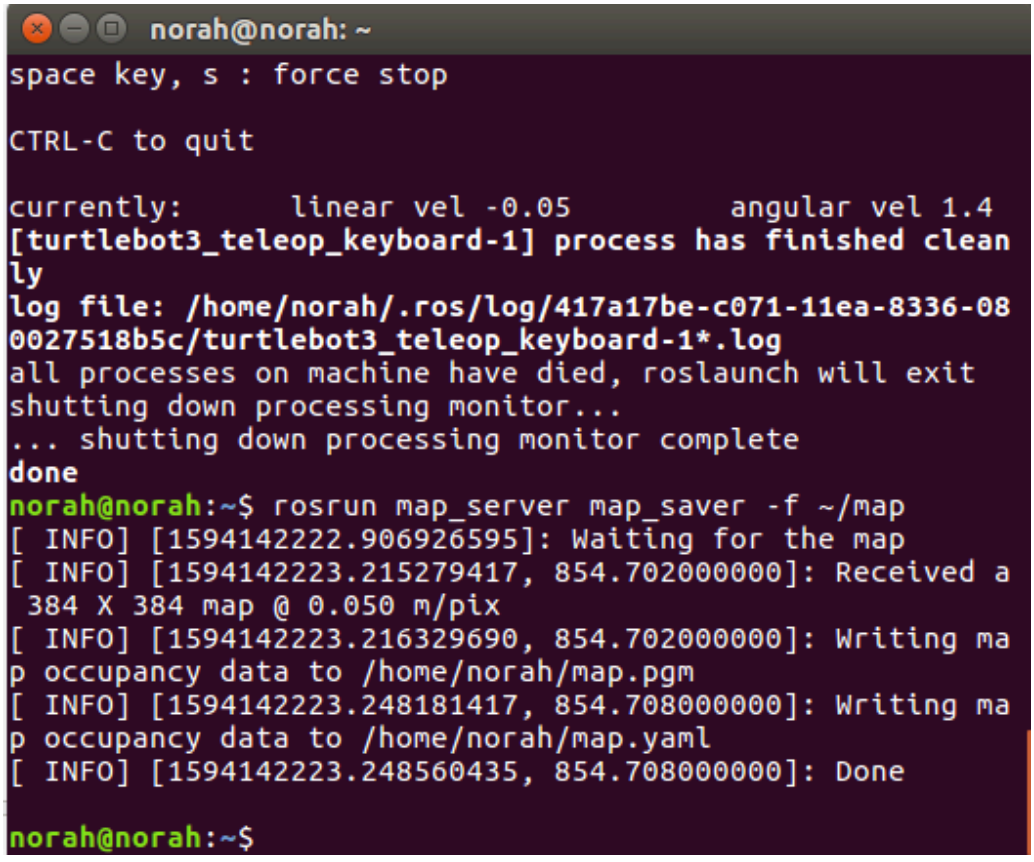
```
$ roslaunch turtlebot3_teleop turtlebot3_teleop_key.launch
```






5. Save the Map

```
$ rosrun map_server map_saver -f ~/map
```



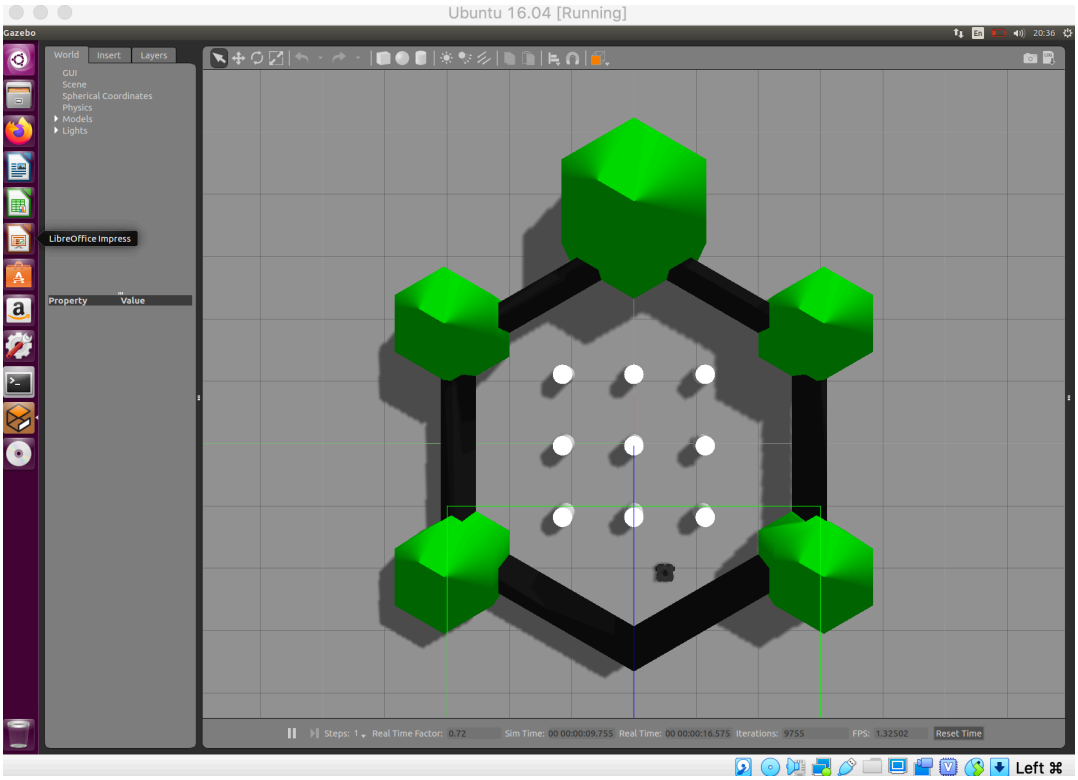
## Virtual Navigation with TurtleBot3

For virtual Navigation in Gazebo, instead of running the actual robot, you can select the various environments and robot models mentioned above, and the Navigation-related commands will use the ROS packages used in the Navigation section.

### Virtual Navigation Execution Procedure

Terminate all applications that were executed during the virtual SLAM practice and execute related packages in the following instruction, the robot will appear on the previously generated map. After setting the initial position of the robot on the map, set the destination to run the navigation as shown in figure below. The initial position only needs to be set once.

1. Execute Gazebo



2. Execute Navigation: open new terminal and write:

```
$ export TURTLEBOT3_MODEL=waffle_pi
$ roslaunch turtlebot3_navigation turtlebot3_navigation.launch
map_file:=$HOME/map.yaml
```