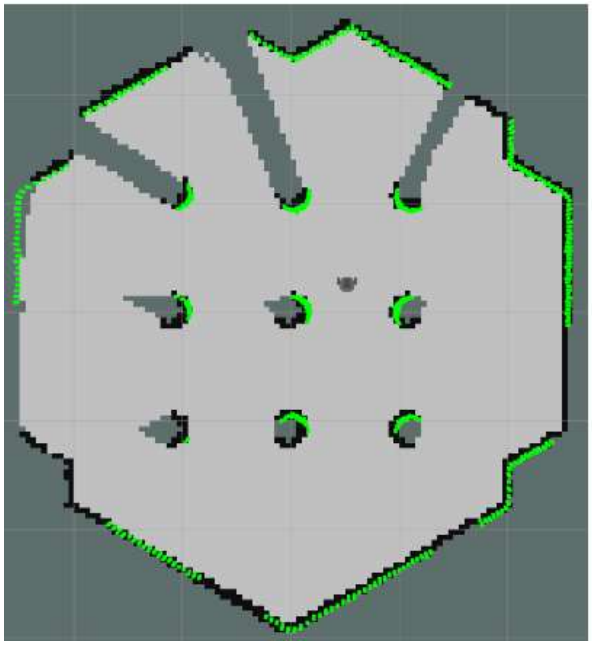
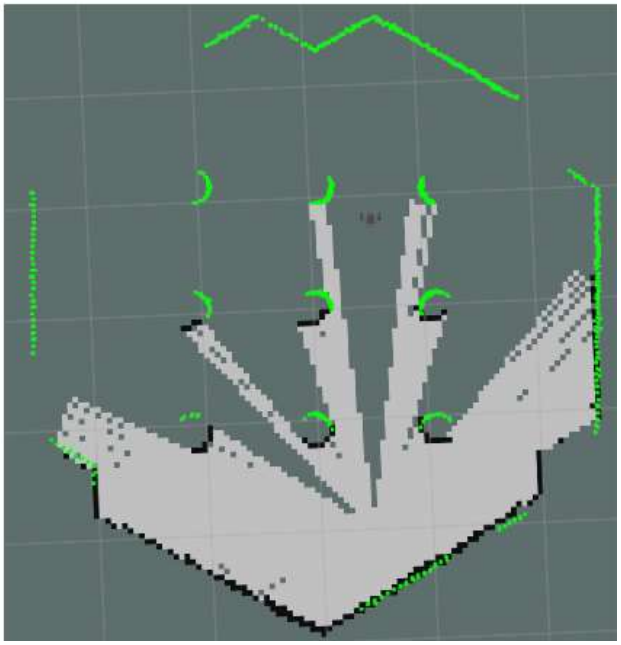
Module 9 ROS Hands-on Turtlebot3

SLAM

map update interval = 2.0



map update interval = 20.0



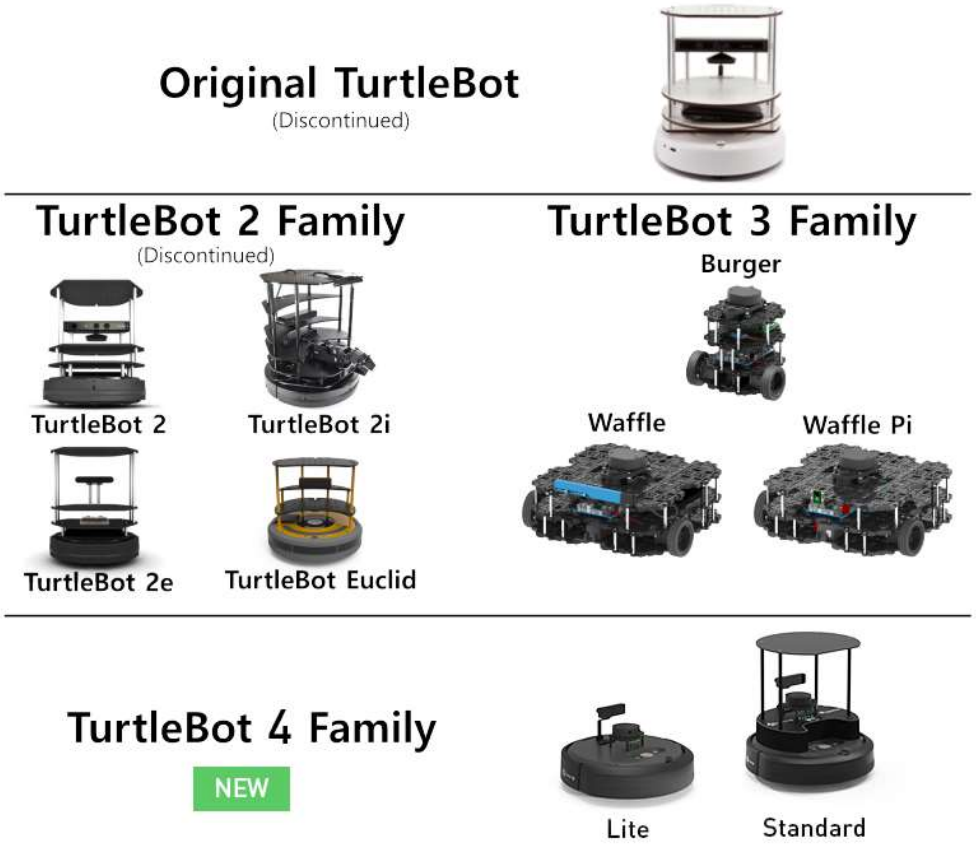
Practice

To create a practice session using TurtleBot3 for SLAM (Simultaneous Localization and Mapping), you will need the following key components:

- ROS (Robot Operating System)
- TurtleBot3 Packages
- Gazebo Simulation Environment
- SLAM Packages
- Teleoperation Node
- Map Visualization (RVIZ)

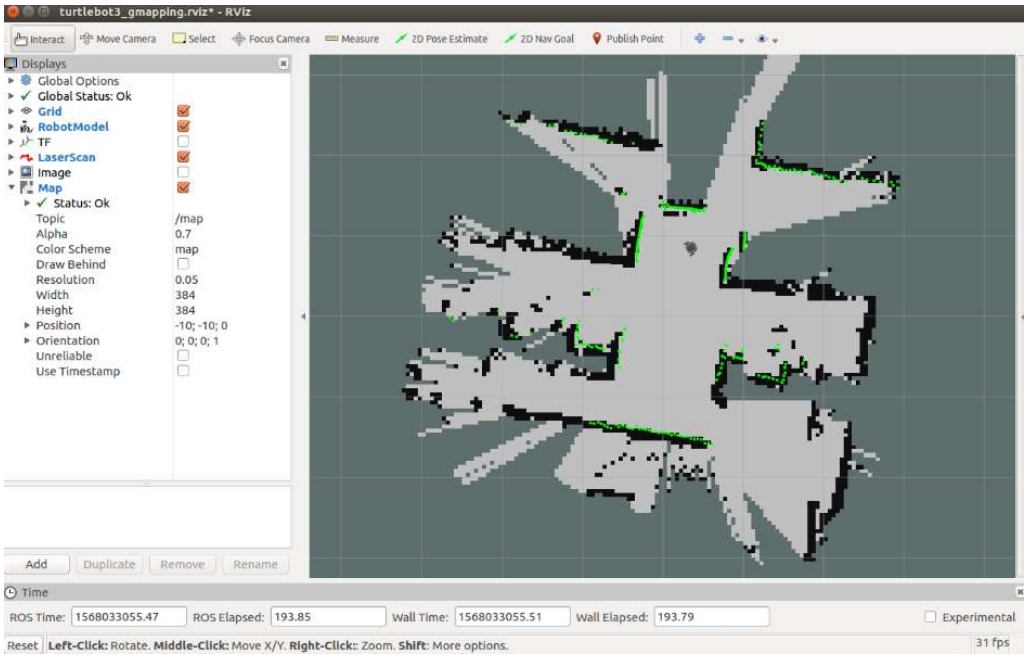
Step 0.1: Install Turtlebot

```
$ sudo apt-get install ros-melodic-dynamixel-sdk
$ sudo apt-get install ros-melodic-turtlebot3-msgs
$ sudo apt-get install ros-melodic-turtlebot3
```



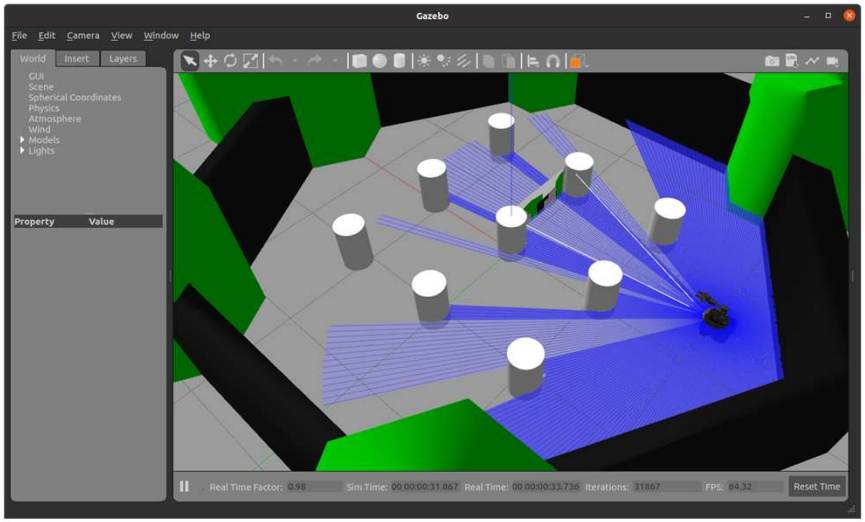
Step 0.2: Install Navigation Stack

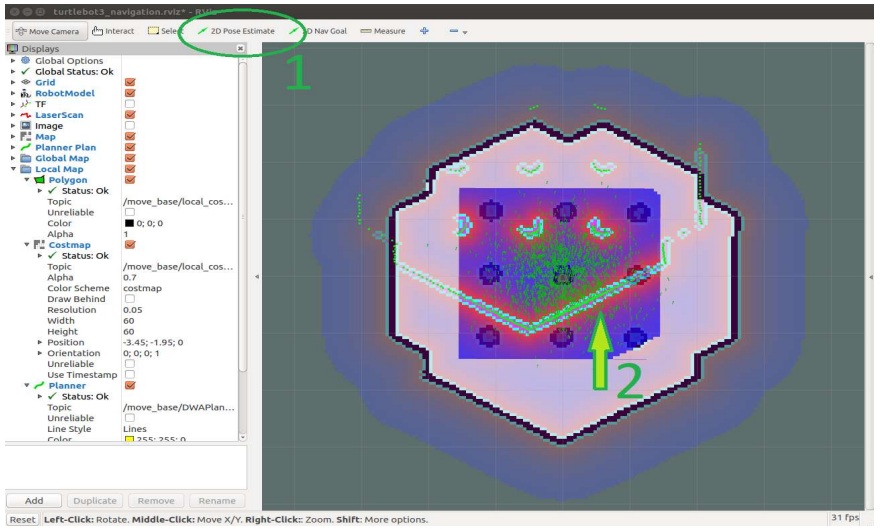
```
sudo apt-get install ros-melodic-amcl \
ros-melodic-map-server \
ros-melodic-gmapping \
ros-melodic-navigation \
ros-melodic-teleop-twist-joy\
ros-melodic-teleop-twist-keyboard\
ros-melodic-joy \
ros-melodic-interactive-markers \
 ros-melodic-move-base ros-melodic-urdf ros-melodic-xacro
```



Step 0.3: Install Gazebo and Rviz

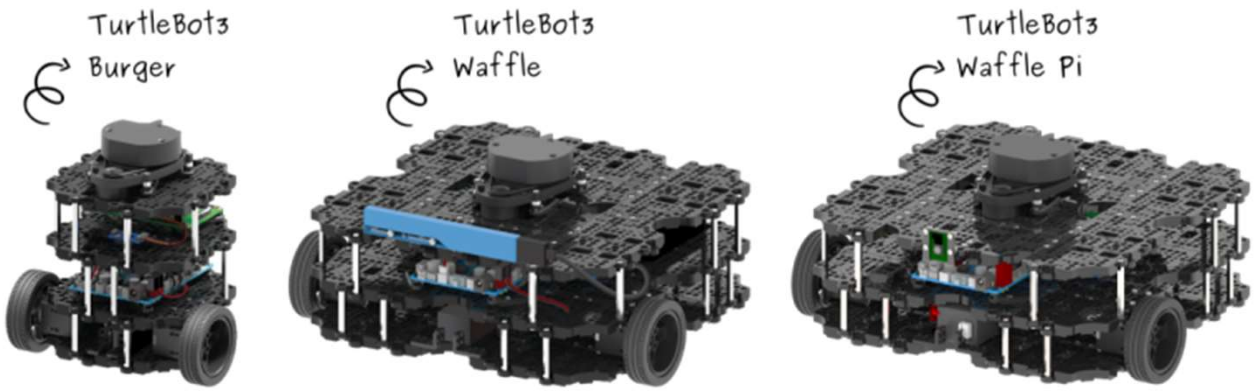
```
sudo apt-get install ros-melodic-gazebo-ros-control \
ros-melodic-gazebo-ros-pkgs \
ros-melodic-rviz
```





Step 1: Choose Turtlebot model

```
export TURTLEBOT3_MODEL=burger
export TURTLEBOT3_MODEL=waffle
export TURTLEBOT3_MODEL=waffle_pi
```

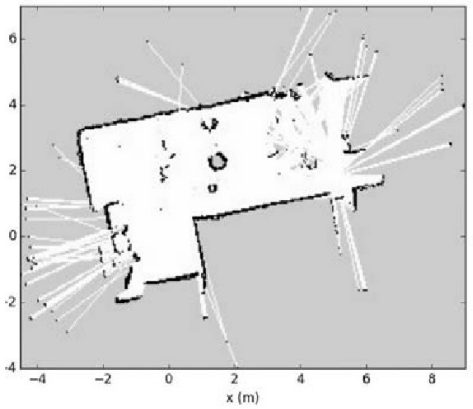


Step 2: Initiate Gazebo Virtual Environment(New Terminal)

```
roslaunch turtlebot3_gazebo turtlebot3_world.launch
```

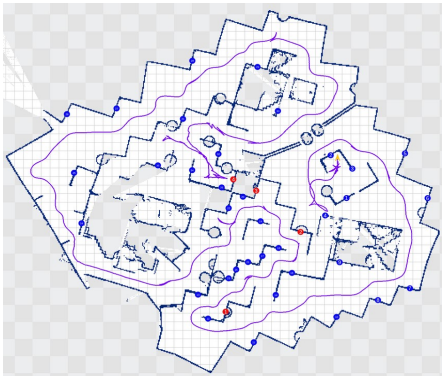
Step 3: Activate the SLAM Stack (New Terminal)

Gmapping is used as a default SLAM method



gmapping

cartographer



hector

karto

```
roslaunch turtlebot3_slam turtlebot3_slam.launch slam_methods:=gmapping
```

Step 4: Run the Teleoperation Node (New Terminal)

Moving around:

w

a s d

x

w/x : increase/decrease linear velocity
a/d : increase/decrease angular velocity
space key, s : force stop

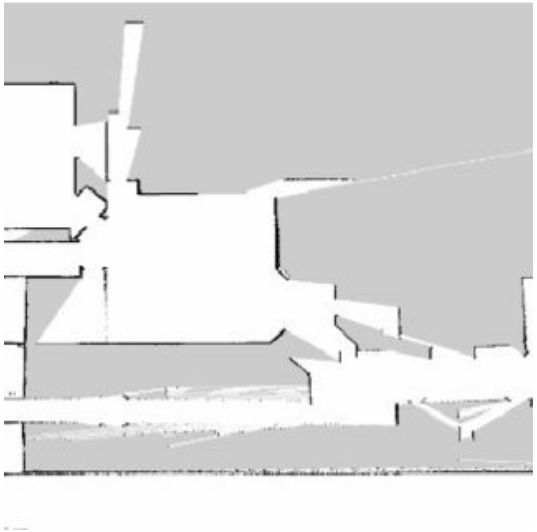
CTRL-C to quit

```
process[turtlebot_teleop_keyboard-1]: started with pid [31241]

Control Your Turtlebot!
---------------------------
Moving around:
   u    i    o
   j    k    l
   m    ,    .

q/z : increase/decrease max speeds by 10%
w/x : increase/decrease only linear speed by 10%
e/c : increase/decrease only angular speed by 10%
space key, k : force stop
anything else : stop smoothly

CTRL-C to quit

currently:      speed 0.2       turn 1
currently:      speed 0.22      turn 1
currently:      speed 0.242     turn 1.1
currently:      speed 0.2662    turn 1.1
currently:      speed 0.29282   turn 1.21
```

```
roslaunch turtlebot3_teleop turtlebot3_teleop_key.launch
```

Step 5: Save Maps (New Terminal)

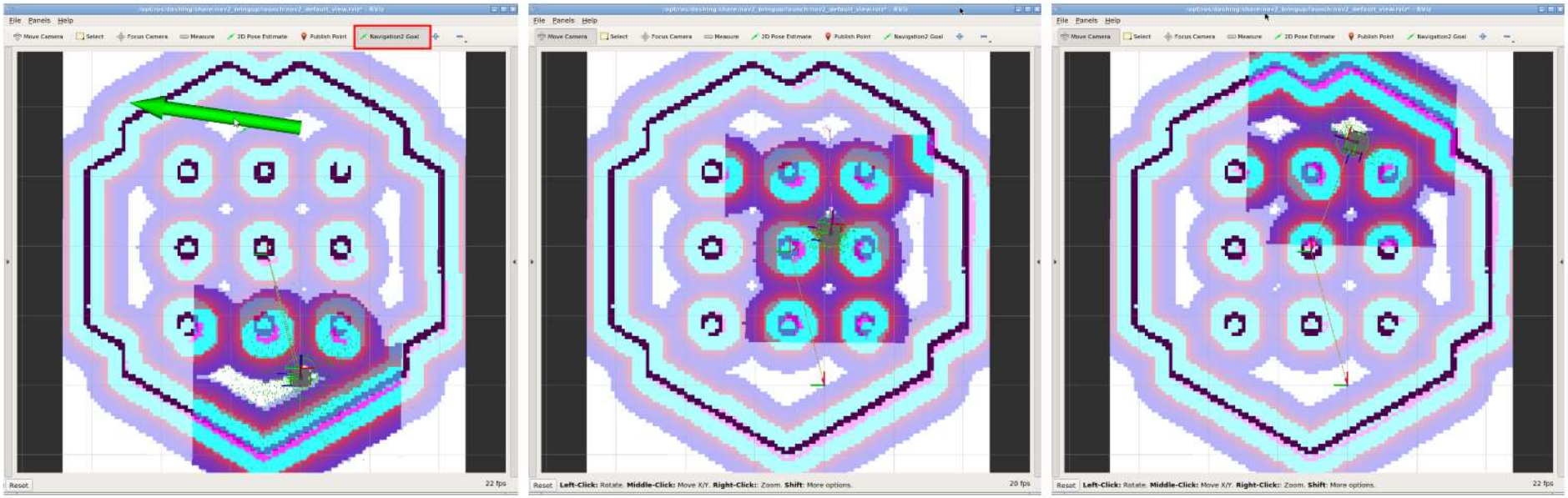
Both map.pgm (Portable Grey Map) and map.yaml will be saved



```
image: map.pgm
resolution: 0.050000
origin: [-100.000000, -100.000000, 0.000000]
negate: 0
occupied_thresh: 0.65
free_thresh: 0.196
```

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

Step 6: Run the Navigation Node (New Terminal)



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

Submission: Submit map file, screenshots of maps and Navigation in action