

# **Chapter 1**

## **ROS SLAM & Navigation 1**

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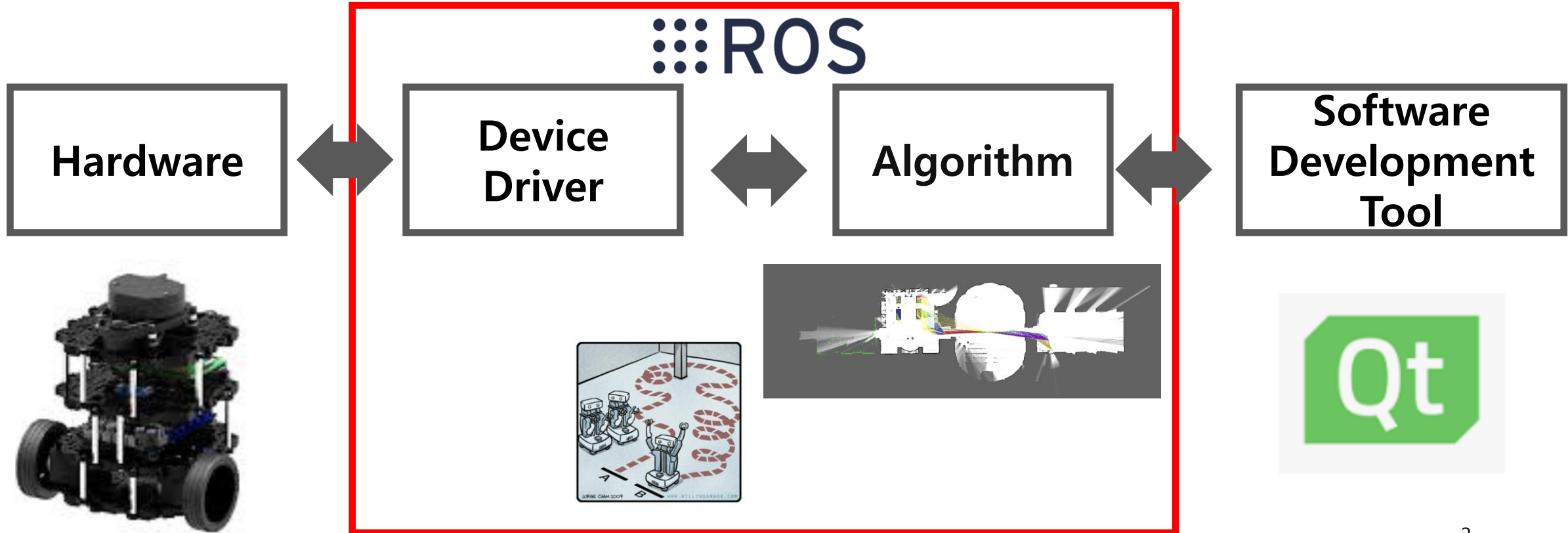
**구선생 로보틱스**

1. ROS 란 무엇인가?
2. Gazebo 소개
3. SLAM 및 Navigation

# ROS란 무엇인가?

## 개요

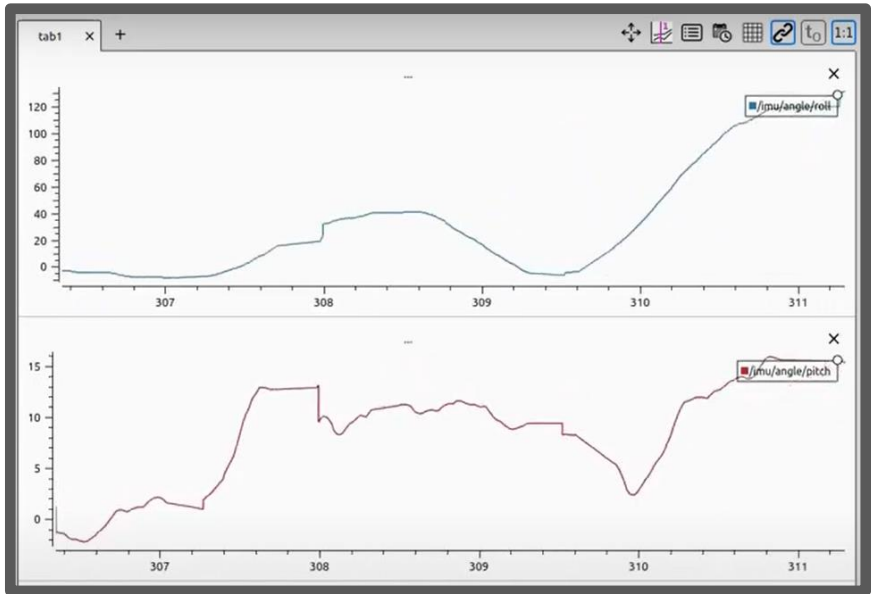
- Robot Operating System의 약자
- 로봇 소프트웨어를 구축하는데 도움이 되는 라이브러리



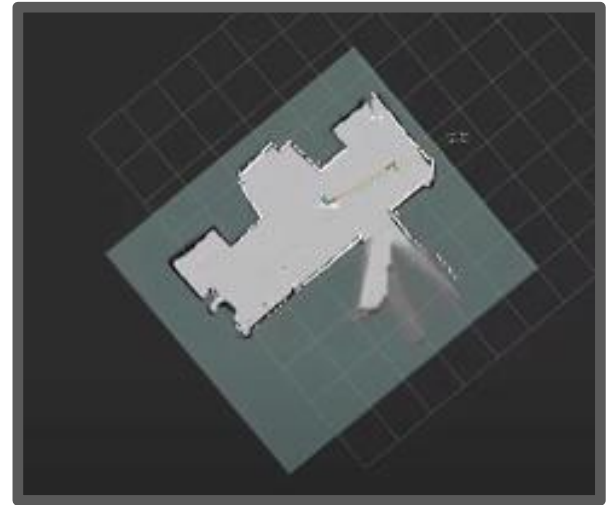
# ROS란 무엇인가?

## 왜 ROS를 사용해야 하는가?

- 모듈화의 이점
- 개발 및 유지보수 시간 단축
- SLAM 및 Navigation 등 다양한 오픈소스 제공



	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
3	2.1	0	0	0	0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	2.4	0	0	0	0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	2.7	0	0	0	0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	3	0	0	0	0	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	3.3	0	0	0	0	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	3.6	0	0	0	0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	3.9	0	0	0	0	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	4.2	0	0	0	0	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	4.5	0	0	0	0	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	4.8	0	0	0	0	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	5.1	0	0	0	0	5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	5.4	0	0	0	0	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	5.7	0	0	0	0	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	6	0	0	0	0	6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	6.3	0	0	0	0	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	6.6	0	0	0	0	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	6.9	0	0	0	0	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	7.2	0	0	0	0	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	7.5	0	0	0	0	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	7.8	0	0	0	0	7.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	8.1	0	0	0	0	8.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	8.4	0	0	0	0	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	8.7	0	0	0	0	8.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	9	0	0	0	0	9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	9.3	0	0	0	0	9.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	9.6	0	0	0	0	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	9.9	0	0	0	0	9.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	0.3	0	0	0	0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	0.6	0	0	0	0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	0.9	0	0	0	0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	1.2	0	0	0	0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	1.5	0	0	0	0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	1.8	0	0	0	0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
37	2.1	0	0	0	0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	2.4	0	0	0	0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	2.7	0	0	0	0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	3	0	0	0	0	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	3.3	0	0	0	0	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	3.6	0	0	0	0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	3.9	0	0	0	0	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	4.2	0	0	0	0	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

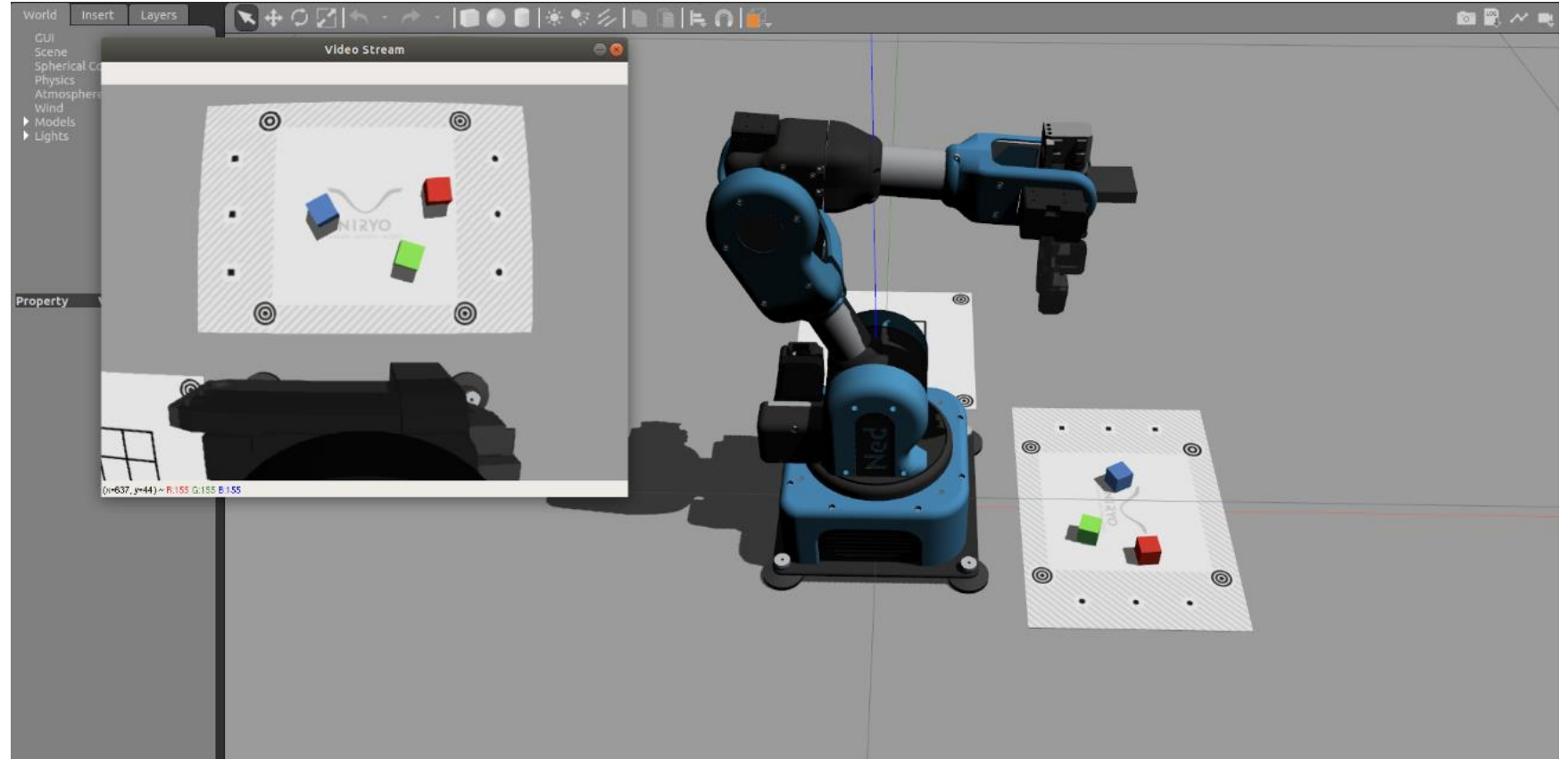


위의 기능을 모듈형태로 오픈소스로 제공하고 있어 쉽게 적용 가능

1. ROS 란 무엇인가?
- 2. Gazebo 소개**
3. SLAM 및 Navigation

# Gazebo 소개

## Gazebo 란?



**Robot 시뮬레이션을 위한 툴, ROS를 지원한다**

**상세 내용은 아래 위키 참고**

[https://classic.gazebosim.org/tutorials?tut=ros\\_overview](https://classic.gazebosim.org/tutorials?tut=ros_overview)

# Gazebo 소개

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## Gazebo를 이용하여 Turtlebot 시뮬레이션 구동 종속성 패키지 설치

```
$ sudo apt-get install ros-noetic-joy
$ sudo apt-get install ros-noetic-teleop-twist-joy
$ sudo apt-get install ros-noetic-teleop-twist-keyboard
$ sudo apt-get install ros-noetic-laser-proc
$ sudo apt-get install ros-noetic-rgbd-launch
$ sudo apt-get install ros-noetic-rosserial-arduino
$ sudo apt-get install ros-noetic-rosserial-python
$ sudo apt-get install ros-noetic-rosserial-client
$ sudo apt-get install ros-noetic-rosserial-msgs
$ sudo apt-get install ros-noetic-amcl
$ sudo apt-get install ros-noetic-map-server
$ sudo apt-get install ros-noetic-move-base
$ sudo apt-get install ros-noetic-urdf
$ sudo apt-get install ros-noetic-xacro
$ sudo apt-get install ros-noetic-compressed-image-transport
$ sudo apt-get install ros-noetic-rqt*
```

# Gazebo 소개

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## Gazebo를 이용하여 Turtlebot 시뮬레이션 구동

### 종속성 패키지 설치

```
$ sudo apt-get install ros-noetic-rviz  
$ sudo apt-get install ros-noetic-gmapping  
$ sudo apt-get install ros-noetic-navigation  
$ sudo apt-get install ros-noetic-interactive-markers
```

### 터틀봇&시뮬레이션 패키지 설치

```
$ 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
```

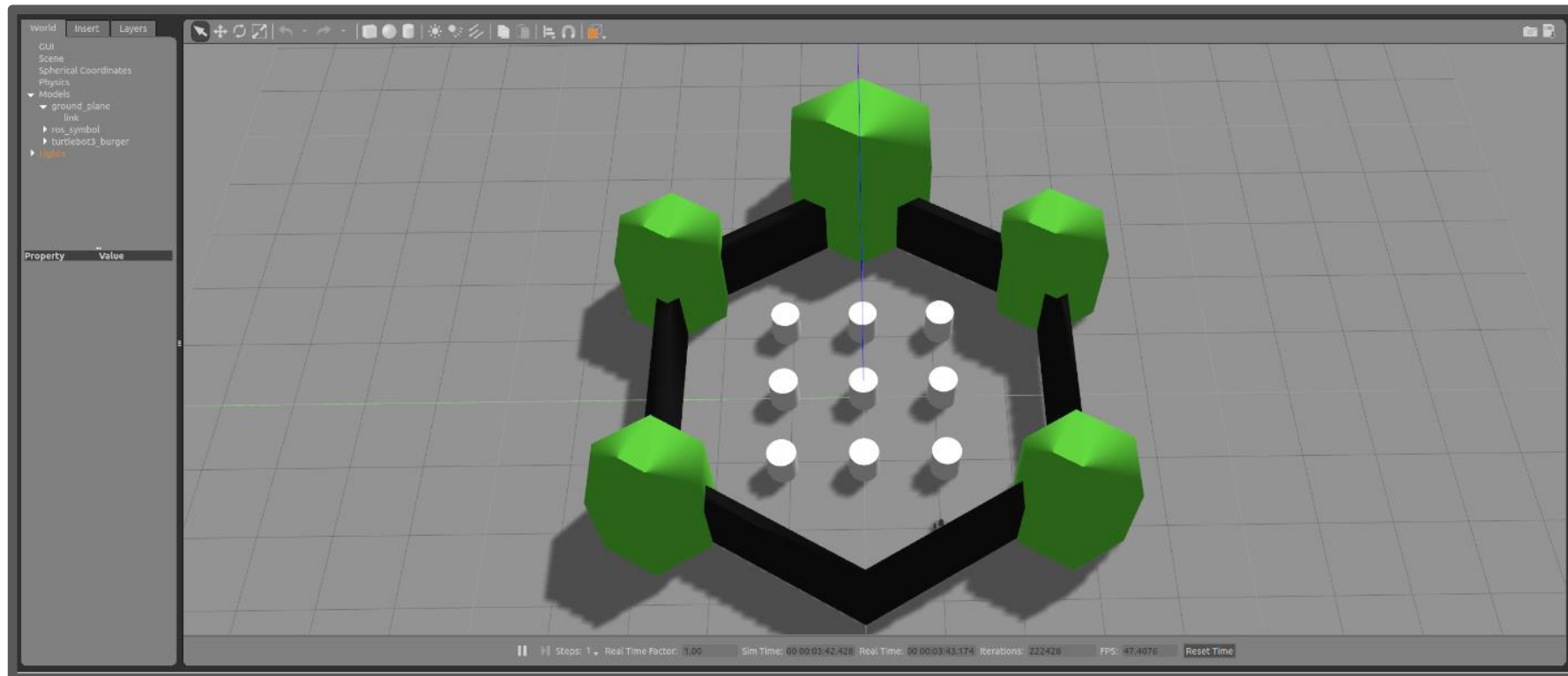


# Gazebo 소개

## Gazebo를 이용하여 Turtlebot 시뮬레이션 구동

### 터틀봇 Gazebo 실행

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



1. ROS 란 무엇인가?
2. Gazebo 소개
3. **SLAM 및 Navigation**

# SLAM 및 Navigation

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## Gazebo를 이용하여 SLAM

### 1) Turtlebot Gazebo 실행

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

### 2) Turtlebot SLAM 실행

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

### 3) Turtlebot 조종

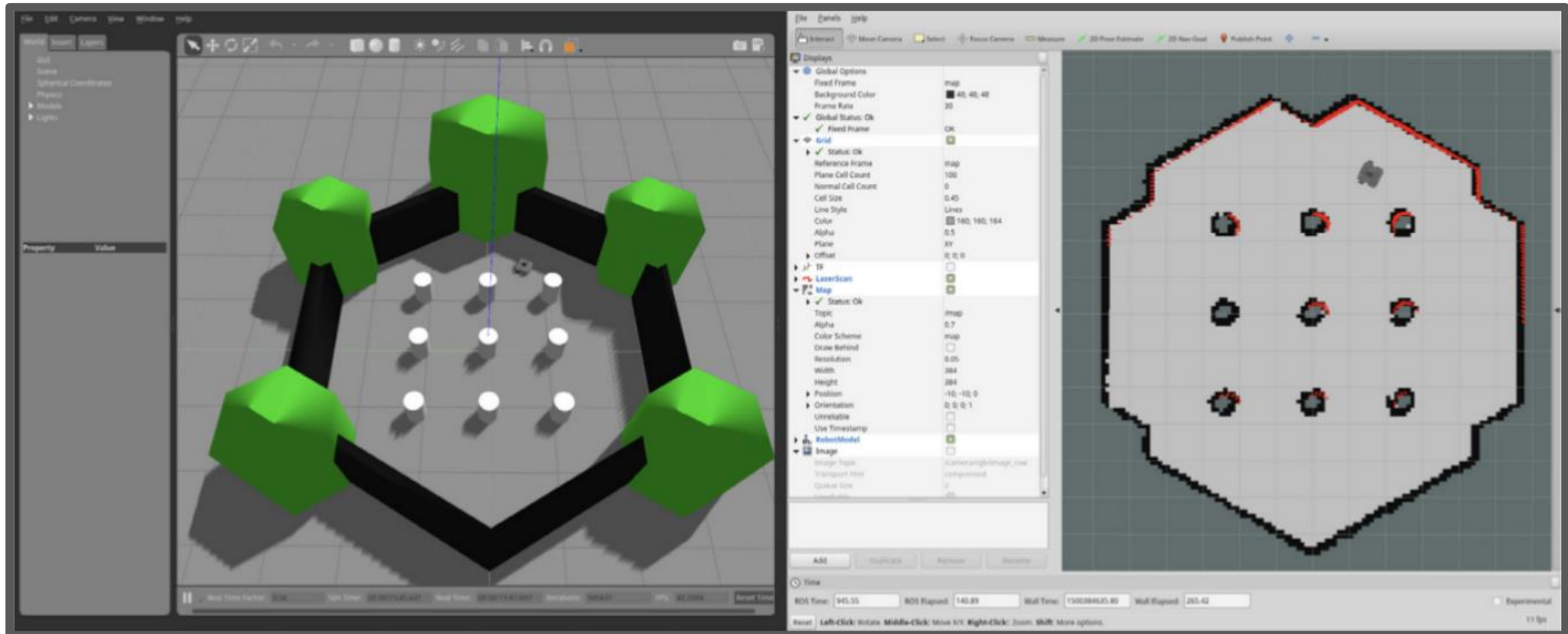
```
$ export TURTLEBOT3_MODEL=burger  
$ roslaunch turtlebot3_teleop turtlebot3_teleop_key.launch
```

# SLAM 및 Navigation

## Gazebo를 이용하여 SLAM

### 4) Map 저장

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



# SLAM 및 Navigation

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## Gazebo를 이용하여 Navigation

### 1) Turtlebot Gazebo 실행

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

### 2) Turtlebot Navigation 실행

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