

SLAM

Simultaneous localization and mapping (SLAM) 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. SLAM algorithms are based on concepts in computational geometry and computer vision, and are used in robot navigation, robotic mapping and odometry for virtual reality or augmented reality.

SLAM algorithms are tailored to the available resources, hence not aimed at perfection, but at operational compliance. Published approaches are employed in self-driving cars, unmanned aerial vehicles, autonomous underwater vehicles, planetary rovers, newer domestic robots and even inside the human body.

How is the robot moved from one point to another :

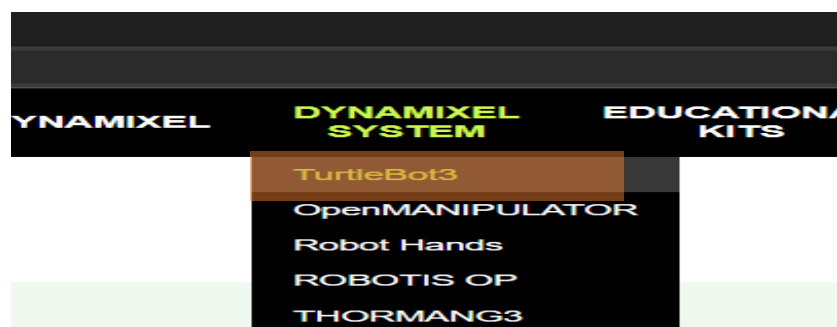
- **Position**

- Sensing
- Map
- Path

- **How to using slam by ROS – Gmapping :**

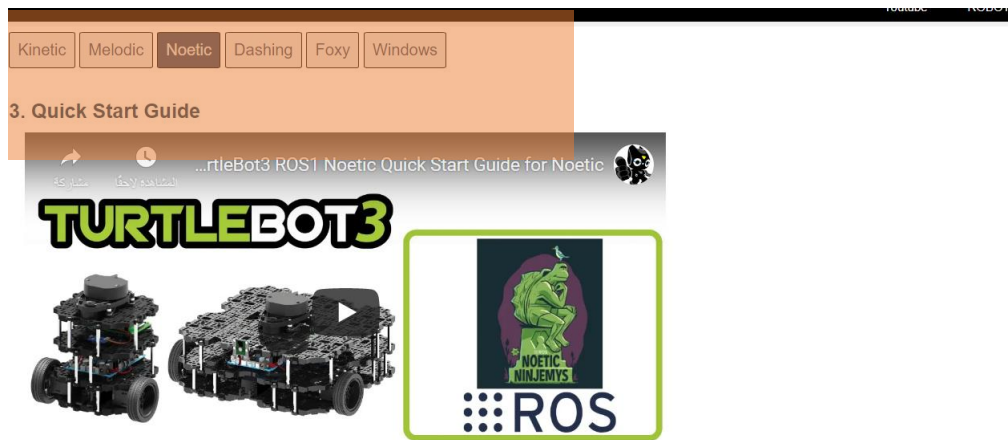
- **Click here**

<https://emanual.robotis.com/docs/en/platform/turtlebot3/quick-start/>



- gh the **ROBOTIS Download Center**, such as Drav

- select the version :



- open terminal window :
write :

```
$ sudo apt update
$ sudo apt upgrade
$ wget https://raw.githubusercontent.com/ROBOTIS-GIT/robotis_tools/master/install_ros_noetic.sh
$ chmod 755 ./install_ros_noetic.sh
$ bash ./install_ros_noetic.sh

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

```
rafa@rafa-VirtualBox: ~  
rafa@rafa-VirtualBox:~$ sudo apt-get install ros-noetic-joy ros-noetic-teleop-twist-joy \  
> ros-noetic-teleop-twist-keyboard ros-noetic-laser-proc \  
> ros-noetic-rgbd-launch ros-noetic-rosserial-arduino \  
> ros-noetic-rosserial-python ros-noetic-rosserial-client \  
> ros-noetic-rosserial-msgs ros-noetic-amcl ros-noetic-map-server \  
> ros-noetic-move-base ros-noetic-urdf ros-noetic-xacro \  
> ros-noetic-compressed-image-transport ros-noetic-rqt* ros-noetic-rviz \  
> ros-noetic-gmapping ros-noetic-navigation ros-noetic-interactive-markers  
[sudo] password for rafa:  
%قراءة قوائم الحزم... تمّ
```

Install TurtleBot3 Packages:

```
$ sudo apt install ros-noetic-dynamixel-sdk  
$ sudo apt install ros-noetic-turtlebot3-msgs  
$ sudo apt install ros-noetic-turtlebot3  
سيتم ترقيتها، 0 مثبتة حديثاً، 0 لإزالتها و 0 لم يتم ترقيتها 0  
rafa@rafa-VirtualBox:~$ sudo apt install ros-noetic-dynamixel-sdk  
%قراءة قوائم الحزم... تمّ  
Building dependency tree  
Reading state information... تمّ  
ros-noetic-dynamixel-sdk is already the newest version (3.7.51-4focal.20220106.235702).  
The following packages were automatically installed and are no longer required:  
  libfwupdplugin1 linux-headers-5.13.0-52-generic  
  linux-hwe-5.13-headers-5.13.0-52 linux-image-5.13.0-52-generic  
  linux-modules-5.13.0-52-generic linux-modules-extra-5.13.0-52-generic  
Use 'sudo apt autoremove' to remove them.  
سيتم ترقيتها، 0 مثبتة حديثاً، 0 لإزالتها و 0 لم يتم ترقيتها 0  
rafa@rafa-VirtualBox:~$ sudo apt install ros-noetic-turtlebot3-msgs  
%قراءة قوائم الحزم... تمّ  
Building dependency tree  
Reading state information... تمّ  
ros-noetic-turtlebot3-msgs is already the newest version (1.0.1-1focal.20210423.224157).  
The following packages were automatically installed and are no longer required:  
  libfwupdplugin1 linux-headers-5.13.0-52-generic  
  linux-hwe-5.13-headers-5.13.0-52 linux-image-5.13.0-52-generic  
  linux-modules-5.13.0-52-generic linux-modules-extra-5.13.0-52-generic  
Use 'sudo apt autoremove' to remove them.  
سيتم ترقيتها، 0 مثبتة حديثاً، 0 لإزالتها و 0 لم يتم ترقيتها 0  
rafa@rafa-VirtualBox:~$ sudo apt install ros-noetic-turtlebot3  
%قراءة قوائم الحزم... تمّ  
Building dependency tree  
Reading state information... تمّ
```

- Second step :

5. Navigation

6. Simulation

6. 1. Gazebo Simulation

6. 2. SLAM Simulation

6. 3. Navigation Simulation

6. 4. Fake Node Simulation

6. 5. Standalone Gazebo Simulat...

Install Simulation Package :

```
$ cd ~/catkin_ws/src/  
$ git clone -b noetic-devel https://github.com/ROBOTIS-  
GIT/turtlebot3_simulations.git  
$ cd ~/catkin_ws && catkin_make
```

You have three options:

```
burger  
waffle  
waffle_pi
```

select one of them :

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



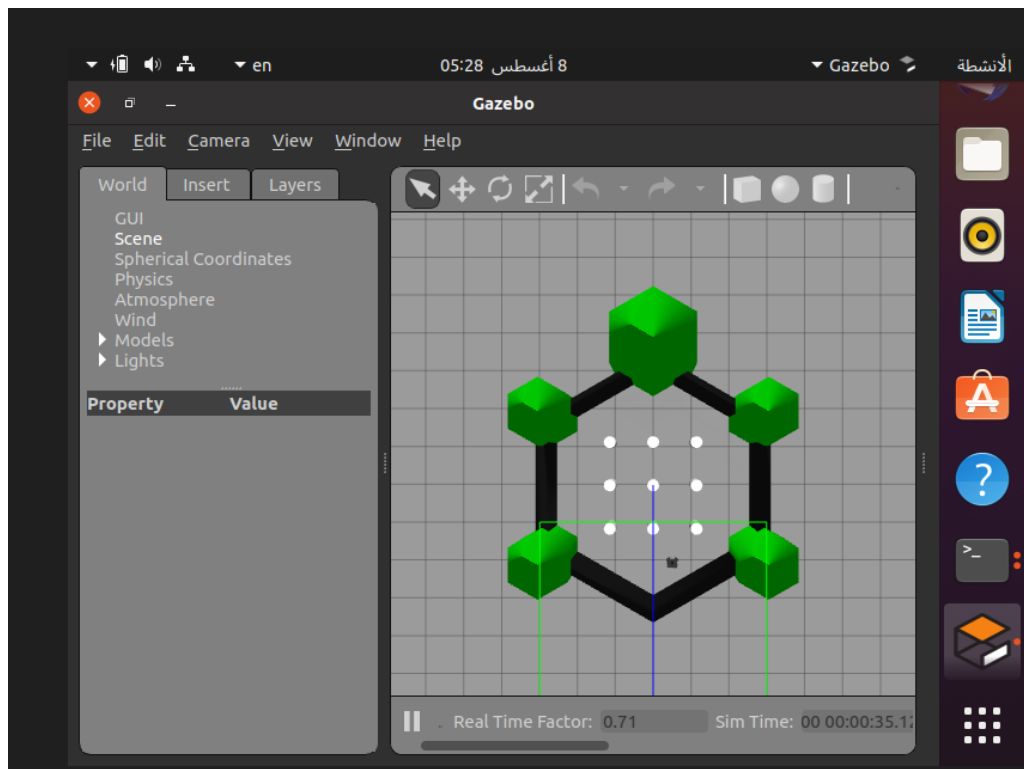
-

In order to teleoperate the TurtleBot3 with the keyboard, launch the teleoperation node with below command in **a new terminal window**.

```
$ export TURTLEBOT3_MODEL=waffle
```

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

Then open Gazebo page :



5. Navigation

6. Simulation

6. 1. Gazebo Simulation

6. 2. SLAM Simulation

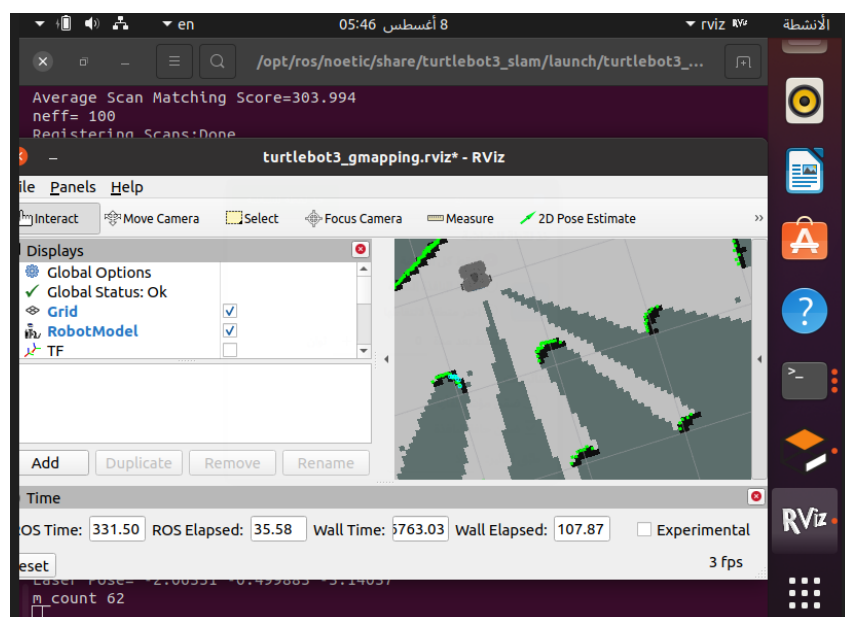
6. 3. Navigation Simulation

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6. 5. Standalone Gazebo Simulat...

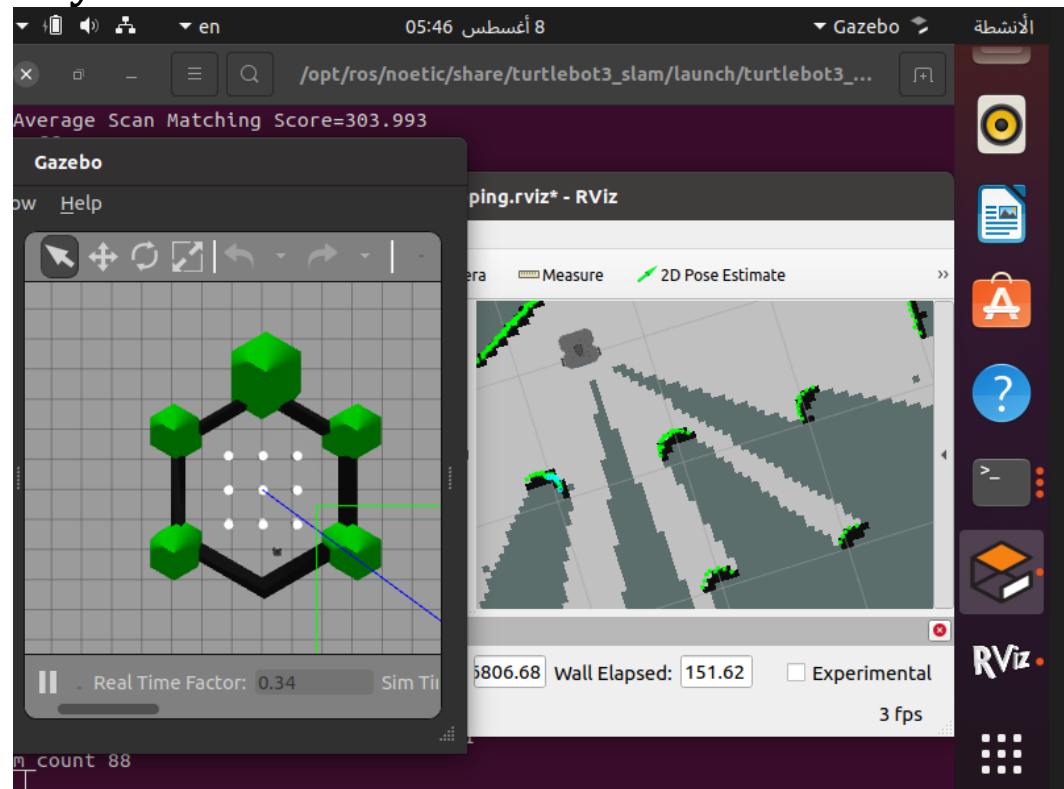
Launch Simulation World :

```
$ export TURTLEBOT3_MODEL=waffle
$ roslaunch turtlebot3_gazebo turtlebot3_world.launch
$ export TURTLEBOT3_MODEL=waffle
$ roslaunch turtlebot3_slam turtlebot3_slam.launch
slam_methods:=gmapping
```



End step :

Swipe in directions controlled from the keyboard



END ...