

Agenda March 22, 2022 March 29, April 5, 2022

Make sure your HW6 report is turned in. -20 if after tomorrow.

HW6\_CENG5437\_MobileProjectReport\_SP\_2022\_March22\_.pdf3

## 2. CHAPTER 3 TEXTBOOK Description and control of a Robot

### Driving Around with TurtleBot Chapter 3

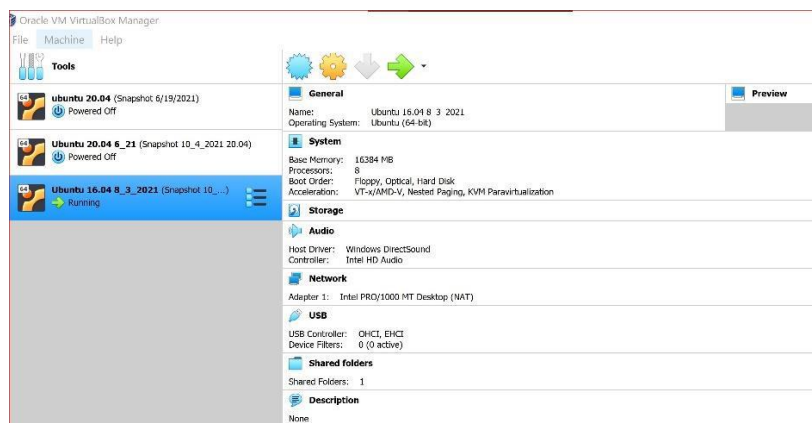
- Loading the TurtleBot simulation software and using Gazebo with TurtleBot
- Setting up your system to control a real TurtleBot from its own netbook computer or wirelessly from a remote computer
- **Controlling the movement of the TurtleBot with ROS terminal commands or using the keyboard for control in teleoperation**
- **Creating a Python script which, when executed, moves TurtleBot**
- Using rqt tools to provide a GUI that aids the user in analyzing robot programs and also monitoring and controlling the robot
- **Exploring an environment using TurtleBot's odometry data**
- Executing the automatic docking program of TurtleBot
- Introducing a newer version of TurtleBot, called TurtleBot 3, and describing the simulation and keyboard control of a real TurtleBot 3

ROS\_ROBOTICS\_BY\_EXAMPLE\_SECOND\_EDITION.docx

Text (CENG 5435: Robotics and ROS)

Let's talk about Turtlebot in Chapter 3 – Simulation and the Real Turtlebot

### VirtualBox Demo of Chapter 3. Ubuntu 16.04 ROS Kinetic



Chapter3\_Turtlebot 3\_22\_2022.txt

TB\_Ch3\_Run\_3\_22\_2022.txt

### 3. My Introduction to Navigation Slides

2\_IntroToTurtlebot&Navigation\_Presentation1\_3\_22&29\_2022.pptx

Maybe Quick Quaternions A Tutorial on Euler Angles and Quaternions.pdf

The teleop code:

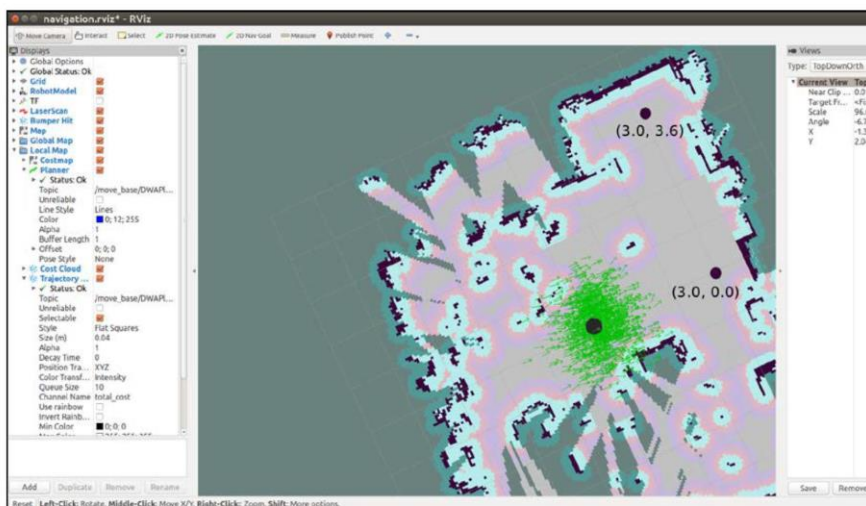
[https://github.com/turtlebot/turtlebot/blob/melodic/turtlebot\\_teleop/scripts/turtlebot\\_teleop\\_key](https://github.com/turtlebot/turtlebot/blob/melodic/turtlebot_teleop/scripts/turtlebot_teleop_key)

### 4\_SLAM Examples from Textbook Page 145 to 200 in Textbook

*Navigating the World with TurtleBot*

In this chapter, you will learn the following topics:

- How 3D vision sensors work
- The difference between the four primary 3D sensors for TurtleBot
- Details on a 2D vision system for TurtleBot 3
- Information on TurtleBot environmental variables and the ROS software required for the sensors
- ROS tools for the rgb and depth camera output
- How to use TurtleBot to map a room using **Simultaneous Localization and Mapping (SLAM)**
- How to operate TurtleBot in autonomous navigation mode by **adaptive monte carlo localization (amcl)**
- How to navigate TurtleBot to a location without a map
- How to navigate TurtleBot to waypoints with a Python script and a map



Goal locations chosen in rviz

Our Glorious Result  
Page 189

## HOW DO ROBOTS NAVIGATE?

"Little Lost Robot" is a [science fiction short story](#) by American writer [Isaac Asimov](#). It was first published in the March 1947 issue of [Astounding Science Fiction](#) and reprinted in the collections [I, Robot](#) (1950), [The Complete Robot](#) (1982), [Robot Dreams](#) (1986), and [Robot Visions](#) (1990).



5\_SensorFusion 5\_sensor Fusion\_References\_3\_2021.pdf

Play for about 4 minutes – MATLAB Tech Talk #1 Sensor Fusion

<https://www.youtube.com/watch?v=6qV3YjFppuc&t=678s>

• **State vector:**  $\begin{bmatrix} x & y & z & \alpha & \beta & \gamma & \dot{x} & \dot{y} & \dot{z} & \dot{\alpha} & \dot{\beta} & \dot{\gamma} & \ddot{x} & \ddot{y} & \ddot{z} \end{bmatrix}$

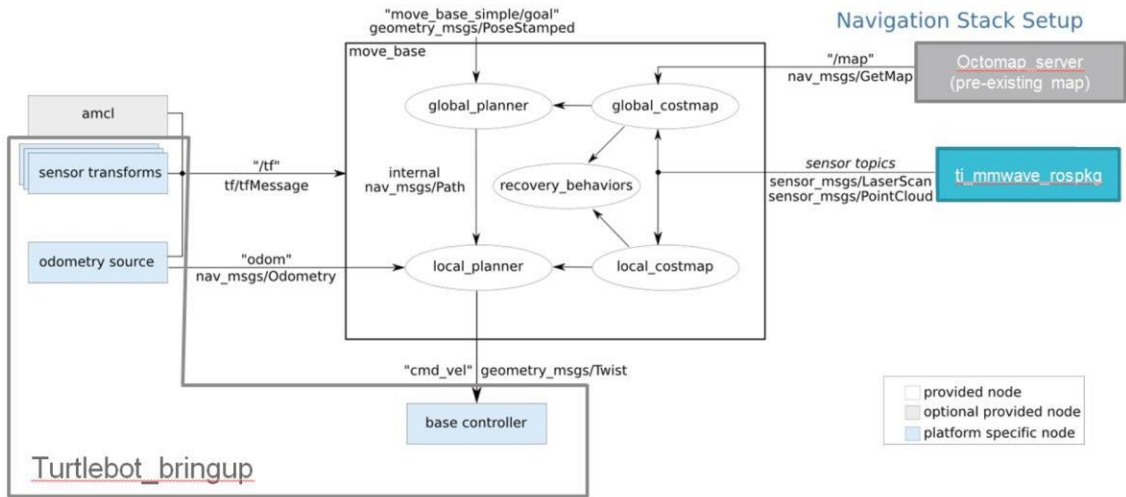


Figure 10. ROS library navigation stack used with the IWR1443BOOST-equipped Turtlebot 2.