



1290

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DEPARTAMENTO DE
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Autonomous Robotic Systems 2021/2022 Master's in electrical and Computer Engineering

Software Installation Guidelines

Software requirements, for this course:

- MatLab (2021b).
- ROS - Robot Operating System (both ROS Melodic and ROS 2 Dashing versions).
- Gazebo 9 - Robot simulation software.

Note: The installation of ROS is not a trivial task, especially for inexperienced Linux users. It is recommended to use a pre-installed ROS + Gazebo virtual machine (Ubuntu 18 Bionic) image, which the download link is available bellow.

MatLab

Go to the Mathworks website, login with your student account, download and install the latest version (2021b):

https://www.mathworks.com/products/get-matlab.html?s_tid=gn_getml

The following toolboxes are required:

- Statistics and Machine Learning Toolbox.
- Robotics System Toolbox.
- ROS ToolBox.

Download Virtual Machine image

Download the virtual machine image with ROS and Gazebo already installed (on a guest OS: Ubuntu 18 Bionic).

VMware compressed image (7.8GB):

https://ssd.mathworks.com/supportfiles/ros/virtual_machines/v2/ros_melodic_dashing_gazebov9_linux_win_v4.zip

This file needs to be uncompressed, which results in a folder with 25GB.

Virtual Machine player (software to run the image)

- Windows and Linux users should use VMware Player software.
- macOS users could use VMware Fusion Player (free for students) or VirtualBox (free, open source), however, VirtualBox users must download specific virtual image file (see below).

Download and install VMware Player software

<https://www.vmware.com/go/getplayer-win>

(windows 64-bits)

<https://www.vmware.com/go/getplayer-linux> (linux 64-bits)

Download and install VMware Fusion Player (mac 64-bits)
(requires creating an account)

<https://customerconnect.vmware.com/web/vmware/evalcenter?p=fusion-player-personal>
(press licence & download option)

- Decompress the archive to a location on your hard drive.
- Start VMware Player.
- In VMware Player, press Open a Virtual Machine.
- Browse to the location of the Ubuntu image, select the `ros_melodic_dashing_gazebo9.vmx` file.
- Start the virtual machine.
- (Press “I copied it”, if a window opens that asks if you copied or moved the virtual machine)

Alternative for macOS users:

Download and install VirtualBox

<https://download.virtualbox.org/virtualbox/6.1.18/VirtualBox-6.1.18-142142-OSX.dmg>

VirtualBox image

https://ssd.mathworks.com/supportfiles/ros/virtual_machines/v2/ros_melodic_dashing_gazebo9_mac_v4.ova

- Start VirtualBox.
- In VirtualBox, select the Import Appliance entry in the File menu.
- Verify the virtual machine settings and press Import (might take a few minutes).
- Start the virtual machine.

Run Virtual Machine (VM)

Check VM settings before running the first time.

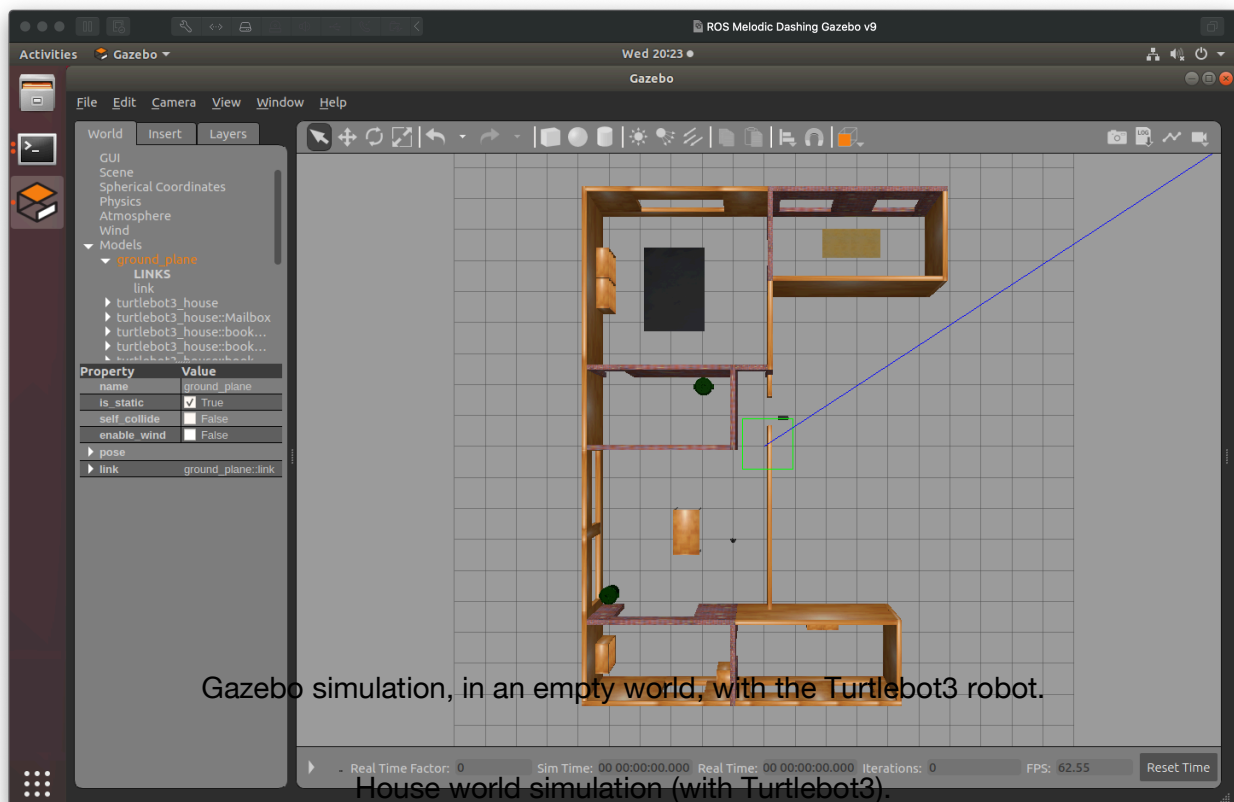
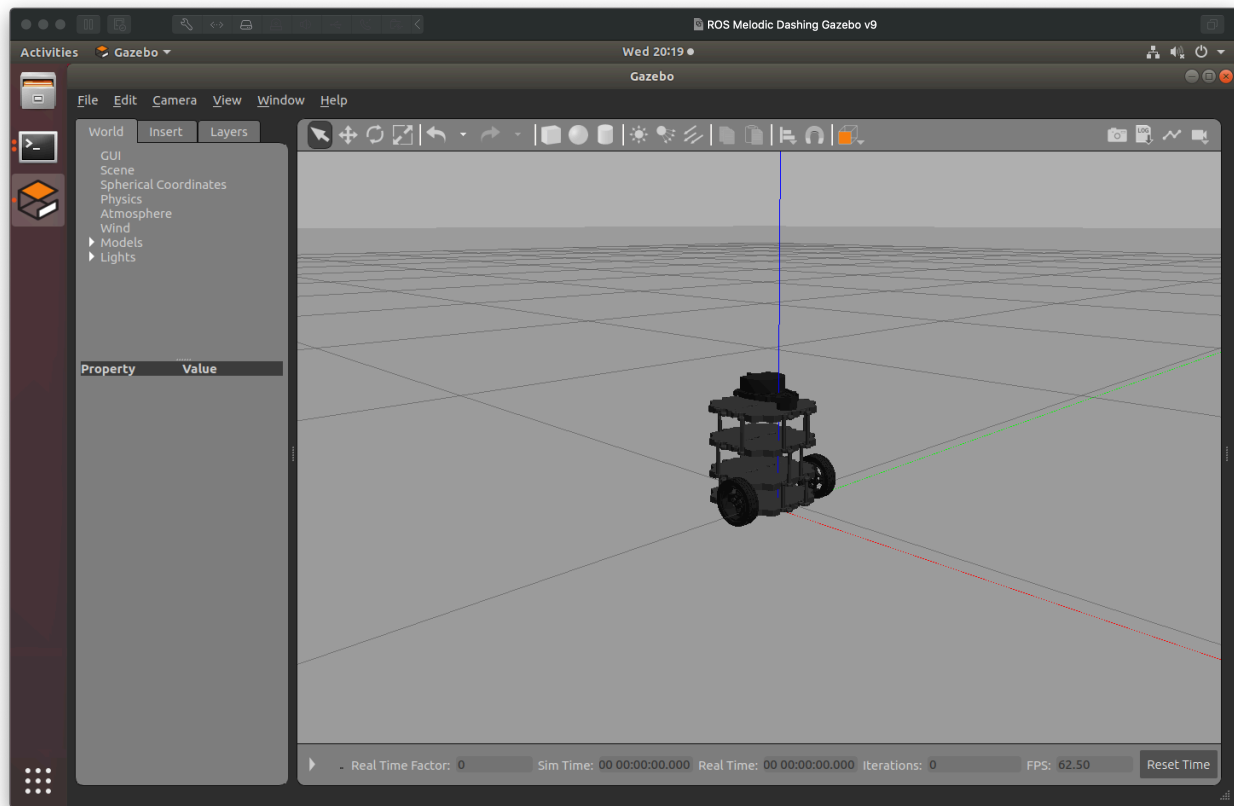
- Use 2 processors w/ 4GB RAM is enough (in old machines select 1 CPU and 2GB RAM).

- [Optional] Choose Bridged Network (autodetect) in the network adapter section.



Bridged network allows the VM IP address to be in the same range that the host machine.

- Launch the virtual machine.
- Check the username, password and IP address (shown at the wallpaper's top right)
- Update, if required, the keyboard layout, in Settings App (language and region - input sources).
- The display resolution could be adjusted in the Settings App > Devices > Screen Display.
- Open terminal, and run the start-up (empty) Gazebo world:
`user@ubuntu:~$./start-gazebo-empty.sh`
- For TurtleBot3 examples, use the previous Gazebo Empty or Gazebo House scripts (`start-gazebo-house.sh`)



Run MatLab demos:

In the provided demos (that can be found at the student's repository webpage), the TurtleBot is controlled under a MatLab environment, exchanging messages with the Gazebo simulator through ROS.

- Download all (*.m) files and copy them to the MatLab working folder.
- Edit the `TurtleBot.m` file and update the local host and virtual machine IP addresses (`IP_OF_TURTLEBOT` and `IP_OF_HOST_COMPUTER` string variables at the class constructor).
- The IP address of your machine can be found using the `ifconfig` terminal command (linux and Mac) or `ipconfig` (windows).

Read robot location

- Launch the virtual machine.
- Open terminal and start the empty Gazebo world (`./start-gazebo-empty.sh`).
- Launch MatLab (host)
- Run the `demoPose.m`

Read lidar data

- Launch the virtual machine.
- Open terminal and start the house Gazebo world (`./start-gazebo-house.sh`).
- Launch MatLab (host)
- Run the `demoLidar.m`

**References (and useful links):**

Mathworks:

<https://www.mathworks.com/help/ros/ug/get-started-with-gazebo-and-a-simulated-turtlebot.html>
<https://www.mathworks.com/help/ros/ug/communicate-with-the-turtlebot.html>

TurtleBot3 resources:

<https://emanual.robotis.com/docs/en/platform/turtlebot3/features/#features>
<https://emanual.robotis.com/docs/en/platform/turtlebot3/simulation/>

VMware Fusion (download archive):

https://customerconnect.vmware.com/downloads/info/slug/desktop_end_user_computing/vmware_fusion/12_0

Alternative link (with vm images and vm player software):

<https://mega.nz/folder/DVEmXZgR#CTO0cXiQRVT3PKujQYtDsw>