COMP0129: Robotic Sensing, Manipulation and Interaction

Labs

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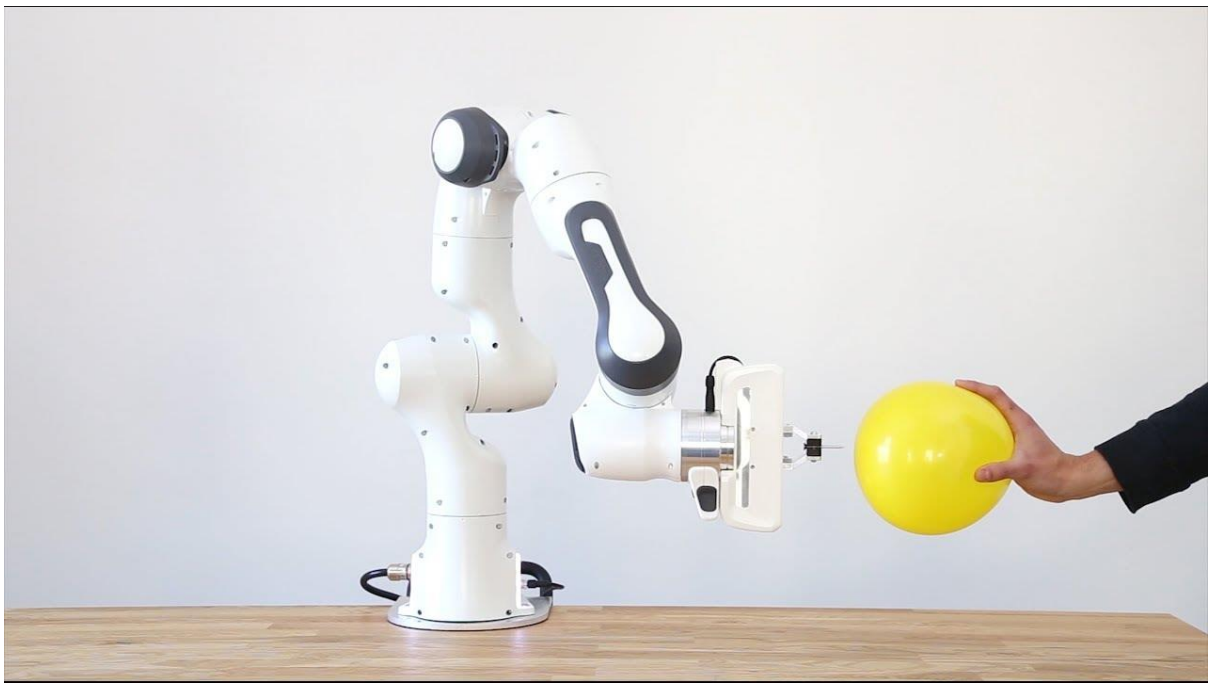

Lab 0 – Part 1/3

Date: Pre-Course
Goal: Installations of Ubuntu and ROS-Noetic

We will install: Ubuntu 20.04 LTS and ROS Noetic.

Installation: Ubuntu 20.04.05 LTS (Focal Fossa)

Following the instructions here: https://ubuntu.com/tutorials/install-ubuntu-desktop

1. Step 1 [General]: In this course we will use Ubuntu 20.04.05 LTS (Focal Fossa). It is not the most recent LTS one, but it is the one to be used with ROS Noetic.

2. Step 2 [Minimal Requirements]: A 2GHz dual core processor, 4GB RAM, ~50GB of hard-drive space, VGA capable of 1024x768 screen resolution, a USB port for the installer media, an internet connection. *These are just the minimal requirements to install Ubuntu, but the more advanced the system the better ROS and Gazebo will be able to run.*

3. Step 3 [Backups]: Backup your data on some external device. Installing an Operating System (OS) might end up in some disastrous disk format, so it is better to be ready.

4. Step 4 (Disk Partition; *optional*): If you plan to use your computer with multiple OS, then you will need to partition your hard drive. You should allow a lot of space I each partition to make it work efficiently.
   Windows:
   1) Open “Disk Management”.
   2) Right-click on your main drive (usually named as ‘C’) and select “Shrink Volume”.
   3) Enter the space size for your partition drive in MB (e.g., 40000MB for a 40GB partition).
   4) Right-click on the new, unallocated space that was created and select “New Simple Volume”.
   5) Enter the “New Simple Volume Wizard” interface by clicking “Next” and specifying the volume size.
   6) Assign the “Drive Letter”, click “Next” and then choose “Do not format this volume”.
   7) Click “Finish”.

   Mac:
   1) Launch the “Disk Utility” application.

2) Select your main hard drive.
3) Select the storage device you wish to partition from the left-side list.
4) When you select the drive, click on the “Partition” in the toolbar.
5) The pie chart shows how the drive is currently divided. Choose the “Name”, “Format” and “Size” in GB.
6) Click “Apply” and then “Partition”.

5. Step 5 [Bootable USB]: You will need to create a bootable USB. First, download the ISO image: “ubuntu 20.04-desktop-amd64.iso” from: http://releases.ubuntu.com/20.04.5 Then, you will need to burn the USB stick with the image. Follow the instructions for Windows here: https://tutorials.ubuntu.com/tutorial/tutorial-create-a-usb-stick-on-windows and the instructions for MacOS here: https://tutorials.ubuntu.com/tutorial/tutorial-create-a-usb-stick-on-macos Make sure you use the “GPT” partition scheme and “UEFI” target system instead of “BIOS”.

6. Step 6 [Ubuntu Pre-Installation]: Now you are ready to install Ubuntu 20.04.5LTS.
   1) Pre-installation (only for Windows 8):
      i. Turn off the “Fast Boot”: open the “Power Options”, select “Choose what the powers buttons do”, and then “Change Settings that are currently available”. Untick the “Turn on fast startup (recommended)” and “Save Changes”.
      ii. Disable “Secure Boot” in your (UEFI) BIOS: Hold “Shift” when you restart your PC. Select: “Troubleshoot” -> “Advanced Options” -> “UEFI Firmware Settings” -> “Restart”. Select: “Secure Boot” in “Settings” and disable “Secure Boot Enable”.

7. Step 7 [Boot from USB]: Plug in your USB that has the Ubuntu 20.04.5 LTS image and restart your computer.
   1) Boot Startup: Depending on your computer when you restart it, hold either F12, F2, Esc+F12, or Esc+F2 to see the booting options in the “BIOS/UEFI” screen. In Windows, you should boot in “UEFI BOOT” and not “LEGACY BOOT”.
   2) When the options come up, select to boot from your USB that holds the Ubuntu image.

8. Step 8 [Main Installation]: You should now be able to see the graphical Ubuntu 20.04.5 LTS interface for installation.
   1) Select: “Install Ubuntu”.
   2) Select your language. Please try to use English, as this will be easier for us to help you in the future with any Ubuntu issues.

3) Assuming you will be connected to the internet, select both “Download updates while Installing Ubuntu” and “Install third-part software for graphics and Wi-Fi hardware and additional media formats”.
4) Important: if you would like to **erase** all your hard drive and install Ubuntu, you simply select this option: “Erase disk and install Ubuntu”. Although, if you have made a partition as described above and would like to keep the other OS in the same hard drive you should select: “Something else” and press “Continue”.
5) If “Something else” is selected: First, highlight the partition you created before (try to identify it by looking its size that you dedicated). Double click on the highlighted partition. On the “Edit partition” window choose “Use as: Ext4 journaling system” and “Mount point: /”. Press “OK”. Only the square box next to your partition name should be ticked. Leave “Device for boot loader installation” as the default and press “Install Now”. If at this step a “the partition table format in use on your disks normally requires you to create a separate partition” message comes up, immediately press “Go back” and “Quit” the installation. There is something wrong and needs to be investigated further. Otherwise, press “Continue”.

9. Step 9 [System Configuration]:
    1) Select location.
    2) Select your preferred keyboard layout.
    3) Add your login details.
    4) Wait the installation to finish, remove your USB stick, press Enter and let is restart.

10. Step 10 [Boot Options]:
    1) If you have only one OS in your hard drive you are all set to start working on your Ubuntu environment.
    2) If you have dual boot, then during booting you should be prompted to choose between your previous OS and Ubuntu. If not, then a set of steps need to be followed.
        i. Load Ubuntu through the USB as you did before in Step 8.
        ii. Instead of choosing “Install Ubuntu” choose “Try Ubuntu”.
        iii. When Ubuntu comes up, open a new Terminal by pressing “Ctrl + Alt + T” and type:

```
> sudo add-apt-repository ppa:yannubuntu/boot-repair
> sudo apt-get update
> sudo apt-get install -y boot-repair && boot-repair
```

iv. In the “Boot Repair” window that pops up press “Recommended repair” and follow the instructions.
v. After this procedure is done, you must be able to choose your operating system on the dual boot screen.

11. Step 11 [Updates/Upgrades]: The first time you run Ubuntu, a message on upgrading to Ubuntu 22.04.5 LTS or later might appear. Do **not** upgrade and quit the recommendation. It will not come up again. Feel free to run any updates (> sudo apt-get update) and try to keep your system away from upgrades (> sudo apt-get upgrade).

Installation: ROS Noetic and Gazebo 11.x

Make sure you have installed the drivers of your graphics cards (NVIDIA or others) before continuing. Then we followed the instructions appeared under the following url: http://wiki.ros.org/noetic/Installation/Ubuntu. We have also prepared a script that can do the basic installation: https://github.com/RPL-CS-UCL/scripts. Either you can run the script, or you can go step-by-step. Notice that going step-by-step might be easier to debug wrong installation steps:

1. Step 1: Configure your Ubuntu repositories to allow "restricted", "universe", and "multiverse" and update. Open a terminal (Ctrl+Alt+T) and type:

```
sudo add-apt-repository restricted
sudo add-apt-repository universe
sudo add-apt-repository multiverse

sudo apt-get update
```

2. Step 2: Install some essential packages. In the terminal type:

```
sudo apt-get install git cmake cmake-curses-gui build-essential gitg git-gui meld
sudo apt-get install terminator mercurial libmatio-dev doxygen kazam kdevelop
```

3. Step 3: Setup ROS's sources.list.d. In the terminal type:

```
sudo sh -c 'echo "deb http://packages.ros.org/ros/ubuntu $(lsb_release -sc) main" >
/etc/apt/sources.list.d/ros-latest.list'
```

4. Step 4: Setup ROS keys. In the terminal type:

```
sudo apt-key adv --keyserver 'hkp://keyserver.ubuntu.com:80' --recv-key
C1CF6E31E6BADE8868B172B4F42ED6FBAB17C654
```

5. Step 5: Setup Gazebo's sources.list.d. In the terminal type:

```
sudo sh -c 'echo "deb http://packages.osrfoundation.org/gazebo/ubuntu-stable
`lsb_release -cs` main" > /etc/apt/sources.list.d/gazebo-stable.list'
```

6. Step 6: Setup Gazebo's keys. In the terminal type:

```
wget http://packages.osrfoundation.org/gazebo.key -O - | sudo apt-key add -
```

7. Step 7: Run an update. In the terminal type:

```
sudo apt update
```

8. Step 8: Install the full version of ROS. In the terminal type:

```
sudo apt-get install ros-noetic-desktop-full
```

9. Step 9: Install the full version of ROS. In the terminal type:

```
sudo apt-get install ros-noetic-eigen-conversions ros-noetic-kdl-parser
sudo apt-get install ros-noetic-effort-controllers ros-noetic-controller-manager
sudo apt-get install ros-noetic-transmission-interface
sudo apt-get install ros-noetic-gazebo-ros-*
sudo apt-get install ros-noetic-joint-state-publisher
sudo apt-get install ros-noetic-combined-robot-hw
sudo apt-get install ros-noetic-control-* ros-noetic-controller-*
sudo apt-get install ros-noetic-effort-controllers ros-noetic-position-controllers
sudo apt-get install ros-noetic-velocity-controllers ros-noetic-twist-mux
sudo apt-get install ros-noetic-diff-drive-controller ros-noetic-costmap-*
sudo apt-get install ros-noetic-moveit ros-noetic-moveit-core
sudo apt-get install ros-noetic-teb-local-planner ros-noetic-move-base
sudo apt-get install ros-noetic-moveit-kinematics ros-noetic-robot-localization
sudo apt-get install ros-noetic-combined-robot-hw ros-noetic-joint-limits-interface
sudo apt-get install ros-noetic-gmapping ros-noetic-amcl
sudo apt-get install ros-noetic-position-controllers
sudo apt-get install ros-noetic-joint-trajectory-controller
sudo apt-get install ros-noetic-moveit-visual-tools
sudo apt-get install ros-noetic-moveit-ros-planning-interface
sudo apt-get install ros-noetic-ros-control ros-noetic-ros-controllers
sudo apt-get install ros-noetic-global-planner ros-noetic-gazebo-ros-control
sudo apt-get install ros-noetic-catkin
sudo apt-get install ros-noetic-tf-conversions
```

10. Step 10: Environment Setup. In the terminal type:

```
echo "source /opt/ros/noetic/setup.bash"  >> ~/.bashrc
source ~/.bashrc
```

11. Step 11: Install the dependencies for building packages. In the terminal type:

```
sudo apt install python3-pip python3-rosdep python3-rosinstall python3-rosinstall-generator python3-wstool python3-catkin-tools
```

12. Step 12: Initialize rosdep. In the terminal type:

```
sudo rosdep init
rosdep update
```

Quiz

1. Make sure that ROS is working, by typing the following commands in a terminal:
   > roscore
   > rostopic list

   What do you see as output?

2. Try to check the version of your Gazebo. You should have Gazebo 11.x (e.g., 11.1.0).
   > gazebo --version