Autonomous Systems Virtual Machine Setup Guide

1 Setup a Virtual Machine from scratch

- Install the VMware Workstation Player from: https://www.vmware.com/in/products/workstation-player/workstation-player-evaluation.html
- Download the Ubuntu 20.04 iso file from: https://releases.ubuntu.com/focal/
- To run virtual machines in your pc you have to enable that option in the computer's BIOS. To do so, restart your computer and press the key that will open the BIOS menu before the OS startup
- Open VMware
- Click on "Create a New Virtual Machine" (Figure 1)
- Select the iso file of the Ubuntu 20.04 and click next (Figure 2)
- Enter your OS information (Full name, User name and Password) and click next (Figure 3)
- Enter the virtual machine name and the location to store them and click next (Figure 4)
- Select the virtual machine size and click next (Figure 5)
- To better customize the virtual machine press the "Customize Hardware" button (Figure 6)
- To finalize the virtual machine setup click Finish (Figure 6)

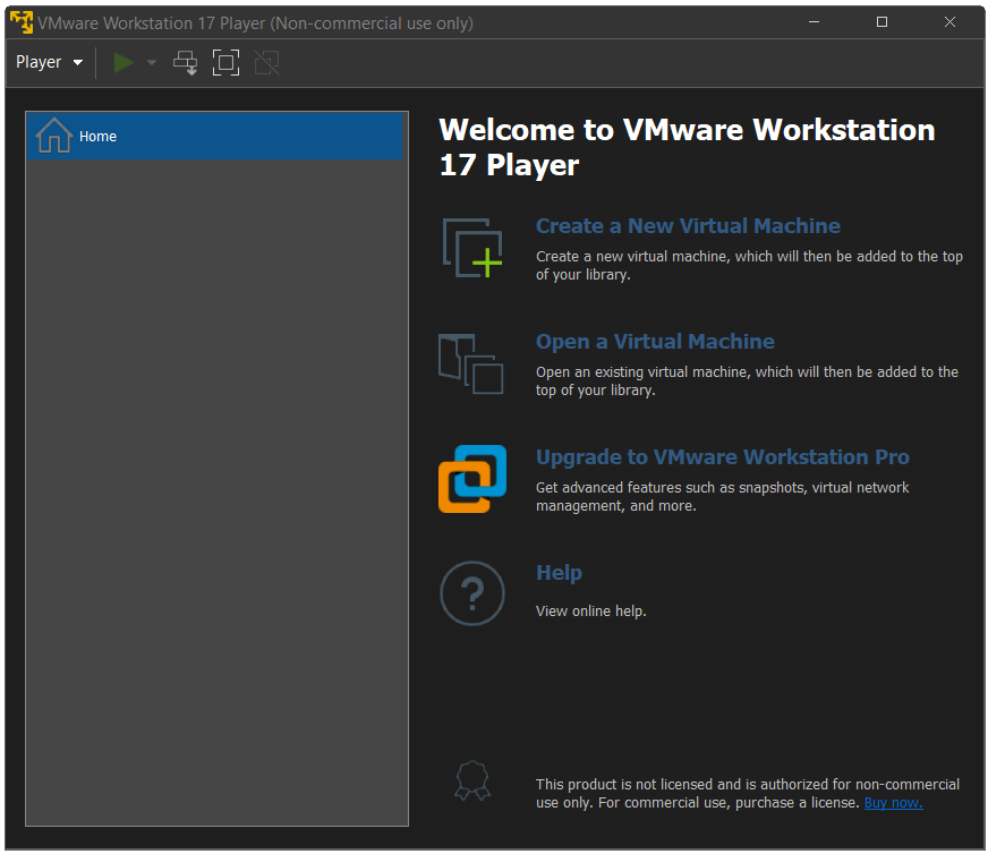

Figure 1: Create Virtual Machine

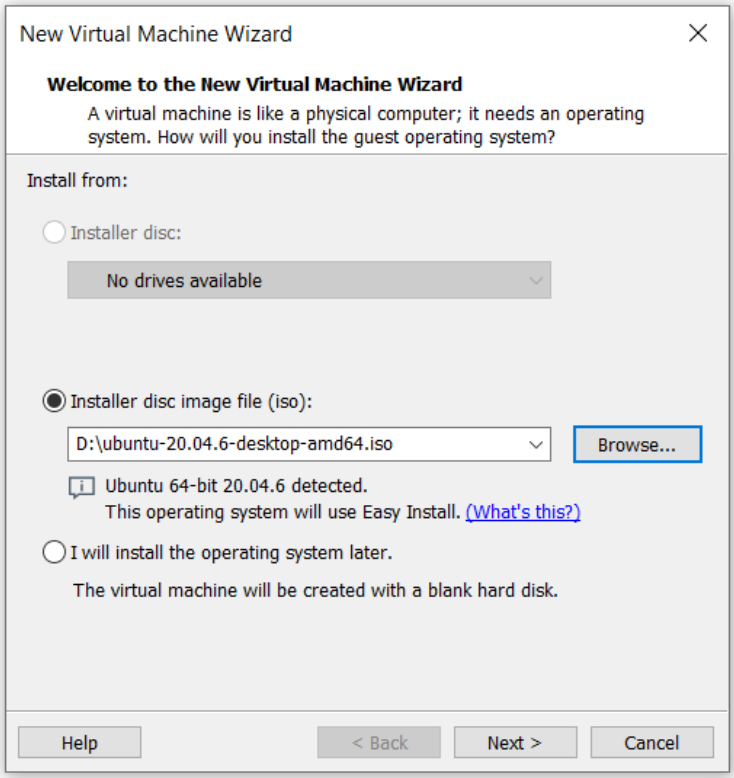

Figure 2: Select Ubuntu iso file

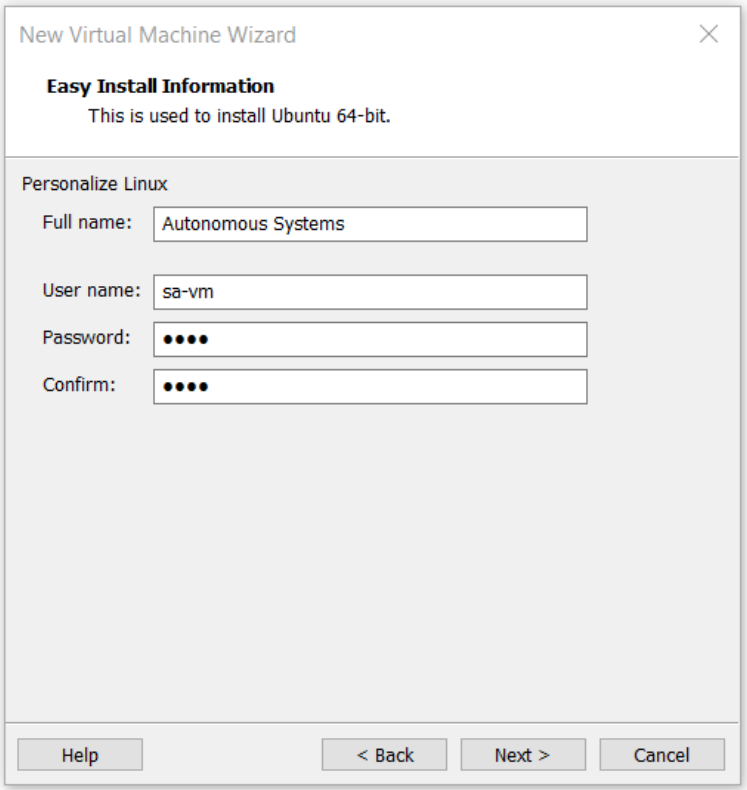

Figure 3: Configure Operation System credentials

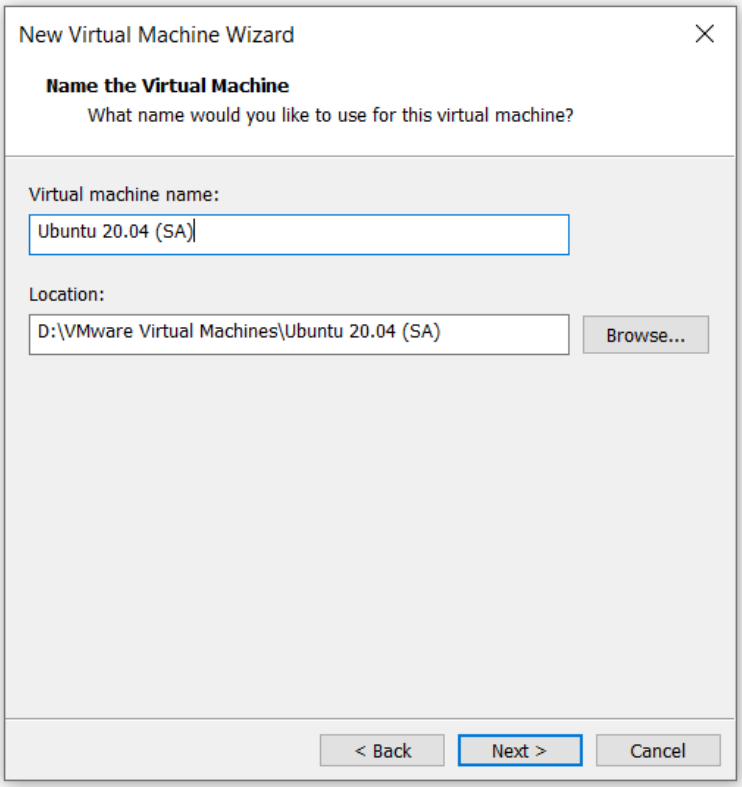

Figure 4: Select Virtual Machine name and location

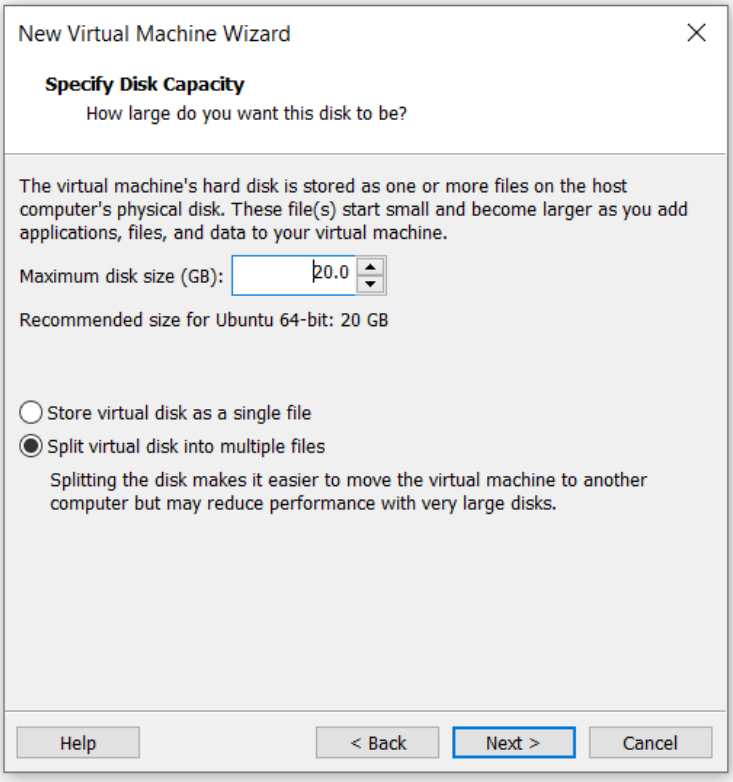

Figure 5: Select Virtual Machine maximum disk size

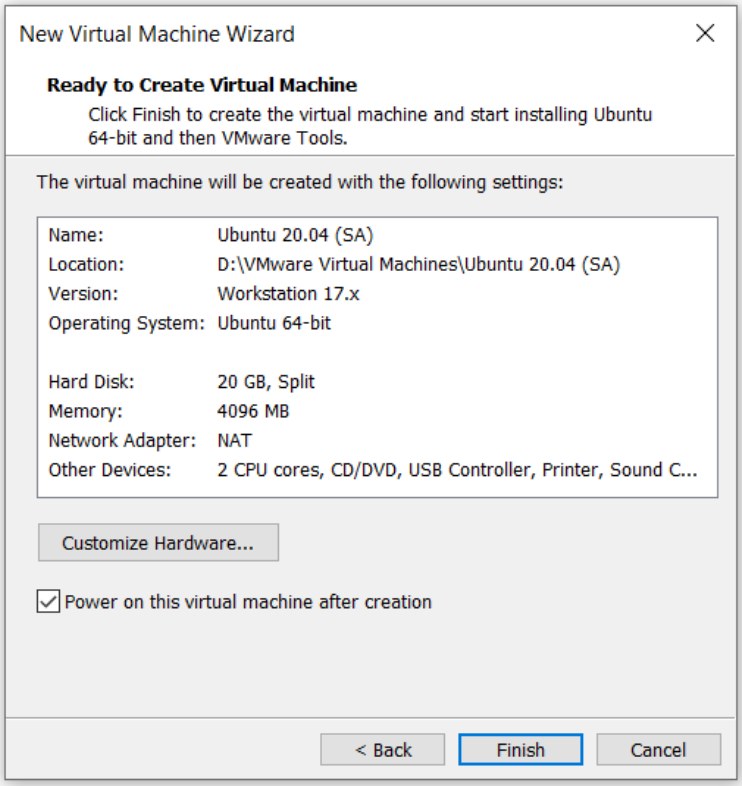

Figure 6: Customize Virtual Machine Hardware

2 Setup Additional Software

2.1 Setup ROS Noetic

- Open the terminal (Crtl + Alt + T)

```
$ sudo apt update && sudo apt upgrade
$ sudo sh -c 'echo "deb http://packages.ros.org/ros/ubuntu $(lsb_release
↪  -sc) main" > /etc/apt/sources.list.d/ros-latest.list'
$ sudo apt install curl
$ curl -s https://raw.githubusercontent.com/ros/rosdistro/master/ros.asc
↪  | sudo apt-key add -
$ sudo apt update
$ sudo apt install ros-noetic-desktop
$ sudo apt install build-essential
$ echo "source /opt/ros/noetic/setup.bash" >> ~/.bashrc
$ source ~/.bashrc
```

2.2 Create a ROS Workspace

- Open the terminal (Crtl + Alt + T)

```
$ mkdir -p ~/catkin_ws/src
$ cd ~/catkin_ws/
$ catkin_make
$ echo "source ~/catkin_ws/devel/setup.bash" >> ~/.bashrc
$ source ~/.bashrc
```

2.3 Install VS Code

- Open the terminal (Crtl + Alt + T)

```
$ sudo snap install --classic code
```

- Recommended extensions (C/C++ and Cmake)

2.4 Install Terminator

- Open the terminal (Crtl + Alt + T)

```
$ sudo apt install terminator
```

- Use-full Commands:
  - Crtl + Shift + O (Split terminals horizontally)
  - Crtl + Shift + E (Split terminals vertically)
  - Crtl + Shift + T (Open new tab)

3 Import preconfigured virtual machine

- Install the VMware Workstation Player from: https://www.vmware.com/in/products/workstation-player/workstation-player-evaluation.html
- Download the preconfigured virtual machine form: https://drive.google.com/drive/u/1/folders/18ewjFRvgO6VWfVcNuUg1e03WfC-KZfky
- To run virtual machines in your pc you have to enable that option in the computer's BIOS. To do so, restart your computer and press the key that will open the BIOS menu before the OS startup
- Open VMware
- Click on "Open a Virtual Machine" (Figure 1)
- Select the "Ubuntu 20.04 (SA).ova" file that was downloaded earlier (Figure 7)
- Select the name and the location for the virtual machine and press import (Figure 8)
- Wait until the virtual machine is ready (Figure 9)
- Run the virtual machine with the Ubuntu password "12345"

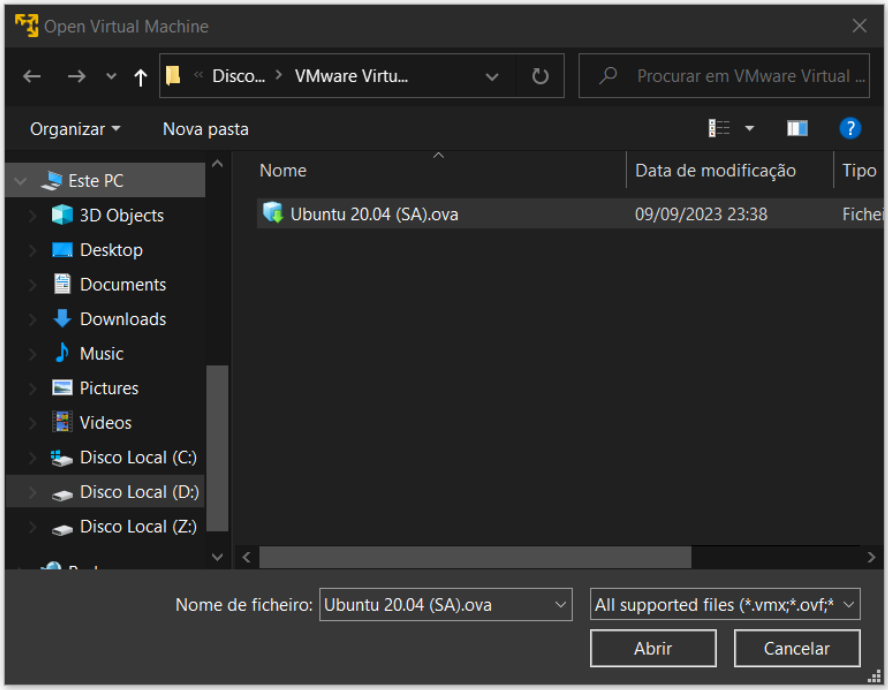

Figure 7: Select the preconfigured Virtual Machine .ova file

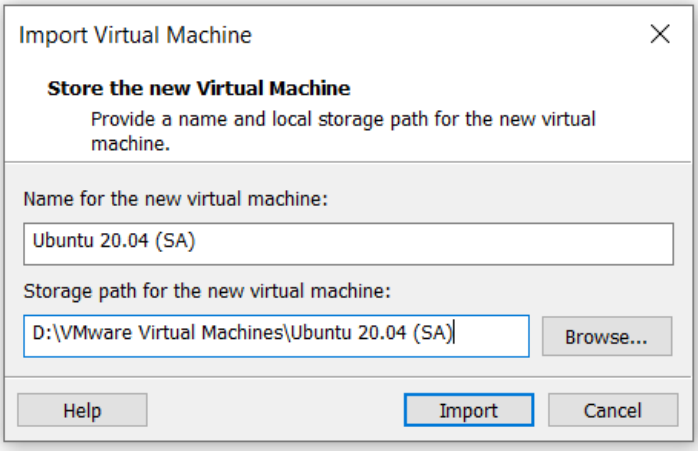

Figure 8: Select the Virtual Machine name and location

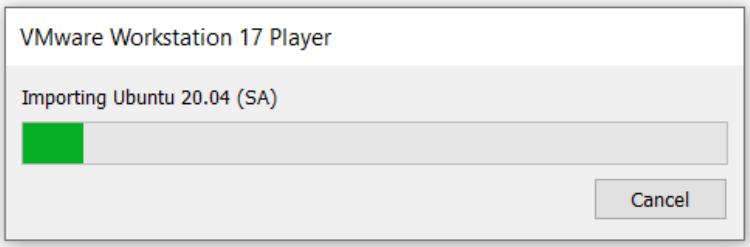

Figure 9: Wait until the virtual machine is ready

4 Install and run the Autonomous Systems ROS package

- Copy and paste the "autonomous_systems" folder inside the "carkin_ws/src" directory
- To compile the code go the "catkin_ws" directory and run the command "catkin_make":

```
$ cd ~/catkin_ws
$ catkin_make
```

- To run the ROS nodes execute the following command:

```
$ roslaunch sa_robot_ros_nav_conf wake_up_simulated_robot.launch
```

- To stop the ROS nodes press Crtl + C in the terminal
- To edit the code open the navigation controller package:

```
$ cd ~/catkin_ws/src/autonomous_systems/sa_ros_nav_controller/
```

- Open the VScode in that directory with:

```
$ code .
```

- Edit the file SARosNavController.cpp in the folder "src/sa_ros_nav_controller"
- Don't forget to compile the code before running it
- To execute the control functions (GoToXY, FollowLine and FollowCircle), the ROS nodes must first be running in a terminal window. Then, in another window, execute one of the following instructions:
  - GoToXY: rosservice call /unnamed_robot/gotoxy_srv – xf(m) yf(m) thetaf(deg)

    ```
    $ rosservice call /unnamed_robot/gotoxy_srv -- 0.5 0.5 90
    ```

  - FollowLine: rosservice call /unnamed_robot/followline_srv – xi(m) yi(m) xf(m) yf(m) thetaf(deg)

    ```
    $ rosservice call /unnamed_robot/followline_srv -- 0 0 1.5 0 180
    ```

  - FollowCircle: rosservice call /unnamed_robot/followcircle_srv – xc(m) yc(m) r(m) anglef(deg) thetaf(deg)

    ```
    $ rosservice call /unnamed_robot/followcircle_srv -- 1 1 1 -90 40 0
    ```