SYDE-352 Project Student Page

Introduction

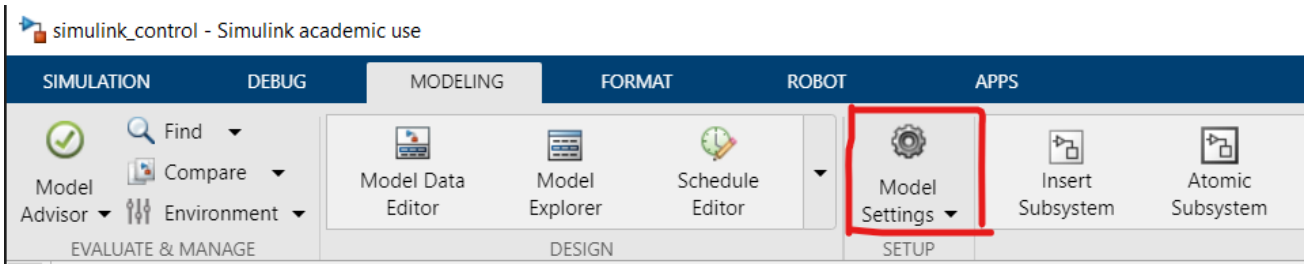
This part of the project allows you to program a controller in Simulink and compile the block diagram as a ROS node in order to run in a cloud ROS environment, which uses Gazebo to both simulate the vehicle using a dynamics model and renders 3D graphics to visualize its behaviour. You will receive an IP address of your remote VM (Virtual Machine), the VNC port, the SSH port, and the ROS master port to be able to use it with your local Simulink. The following is brought to you by the Engineering IDEAs Clinic.

Prerequisite Software

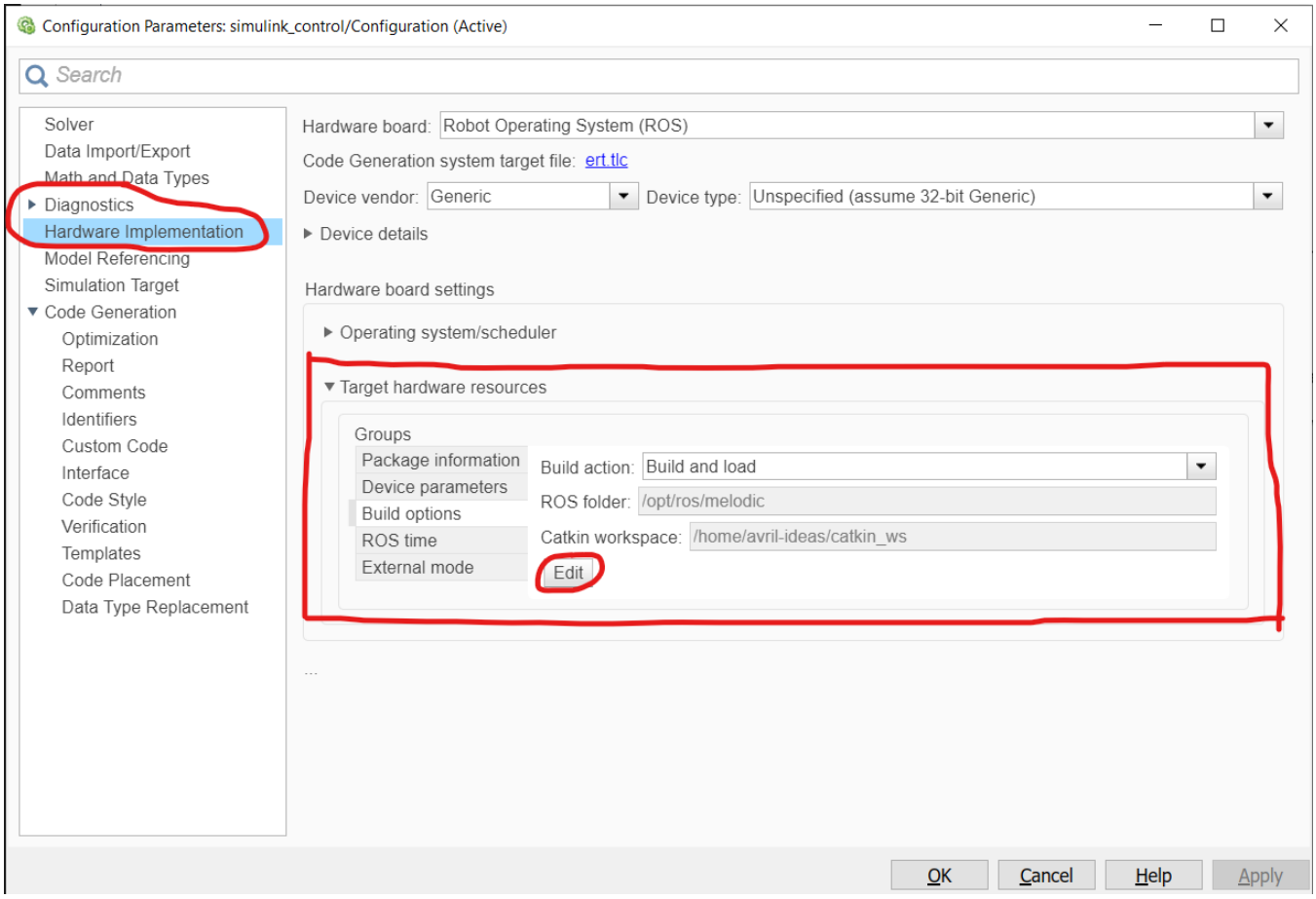
First, install **MATLAB 2019b or later** locally, along with **Simulink Coder**, **Embedded Coder**, and **ROS Toolbox** (either during installation or using the Add-on Explorer). Then install a VNC client, TurboVNC recommended. Finally, download the block diagram.

Simulink Setup

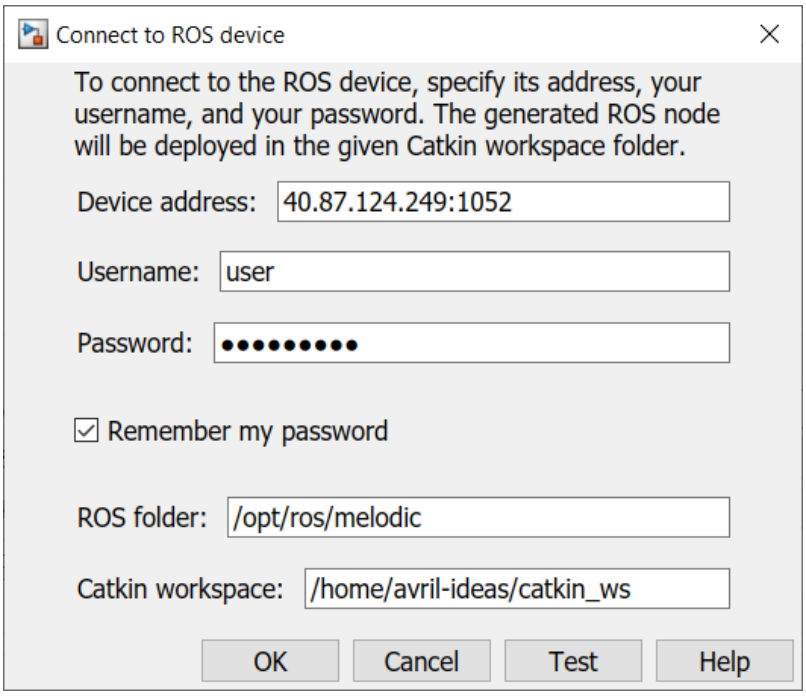
Open `simulink_control.slx` and modify `compute_control` under the `Your Controller` subsystem to compose your control algorithm, then go to MODELING Model Settings:



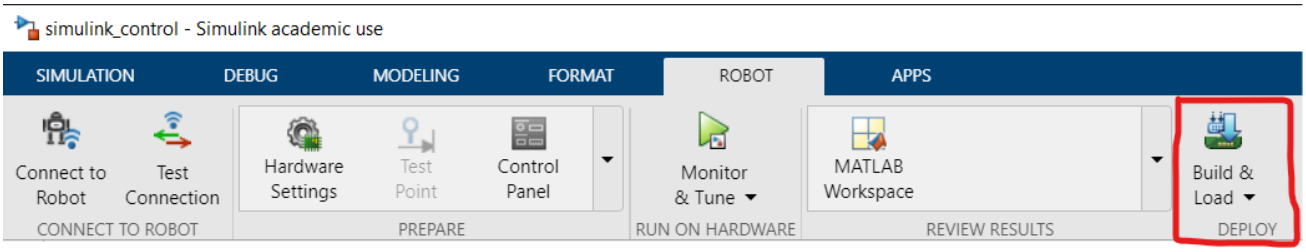
Hardware Implementation Target hardware resources Build options Edit:



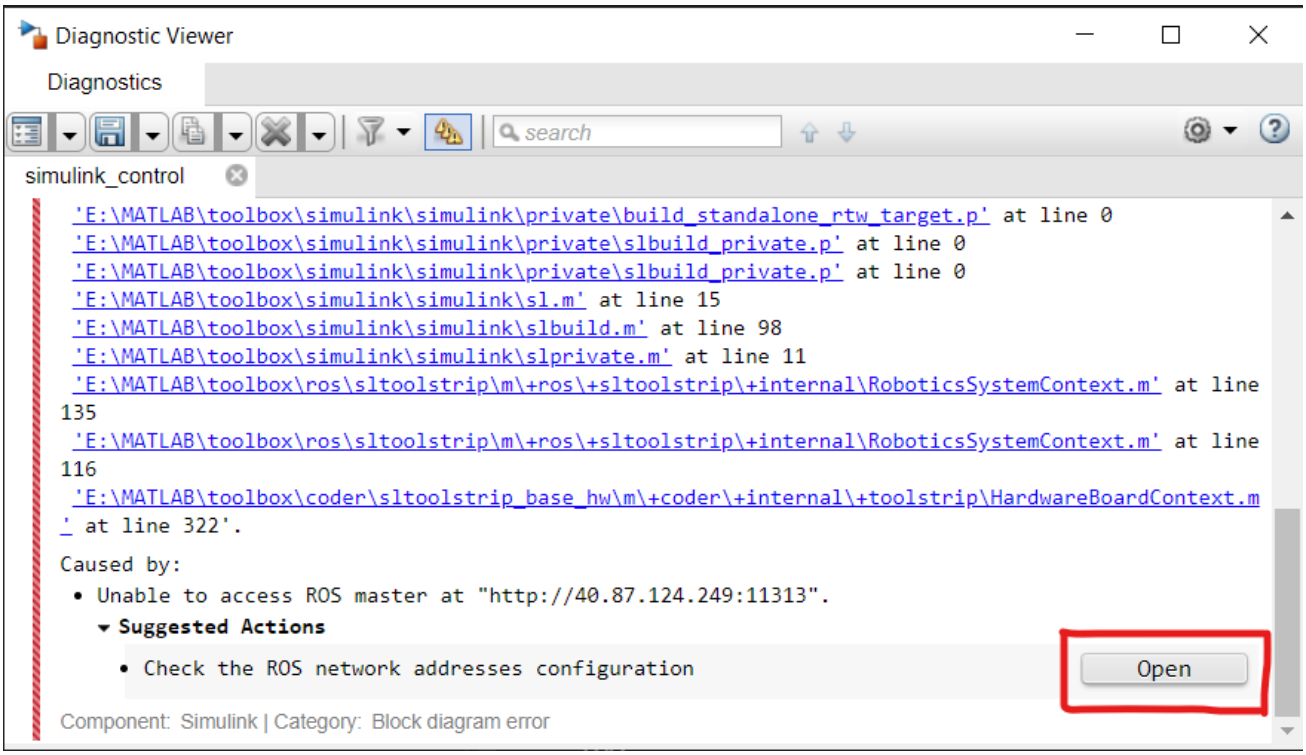
Fill in the Device address in the form `IP_ADDRESS:SSH_PORT`, the Username is `user`, the Password is `container`, check Remember my password, the ROS folder is `/opt/ros/melodic`, and the Catkin workspace is `/home/syde-ideas/catkin_ws`:



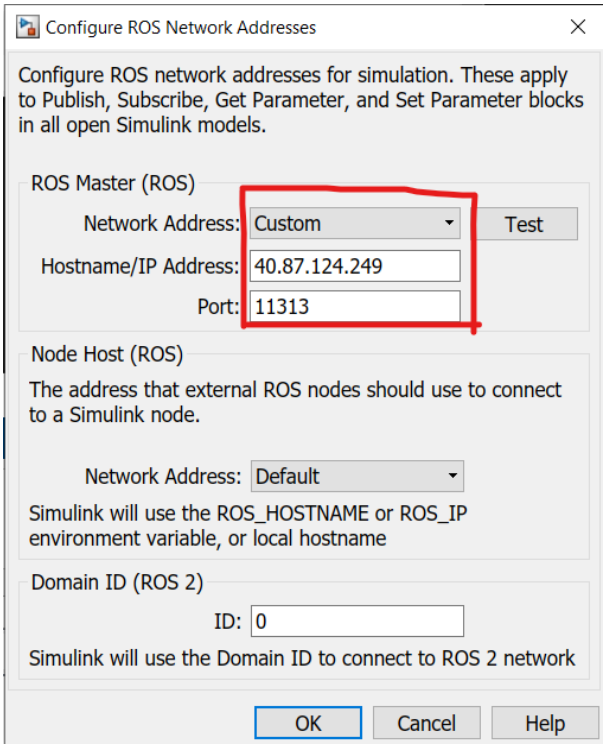
Click Test to ensure the connection can be made. If the diagnostics screen say that the catkin workspace is not initialized, simply press the fix button and wait for about 10 seconds. Next go to ROBOT Build & Load (toggle the dropdown menu if you don't see it):



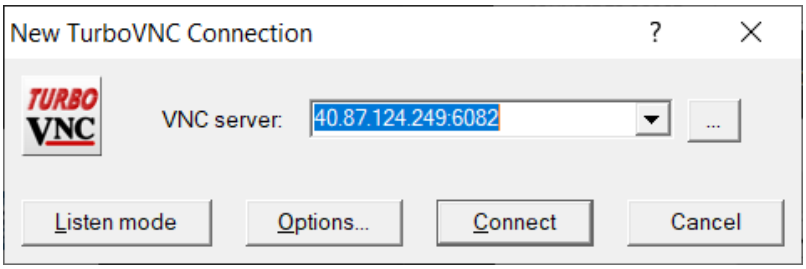
It may fail the first time but fret not, you simply have to click on Open:



Toggle the Network Address to be Custom, Fill in the Hostname/IP Address with the one given, and Port with the given ROS master port then click OK:



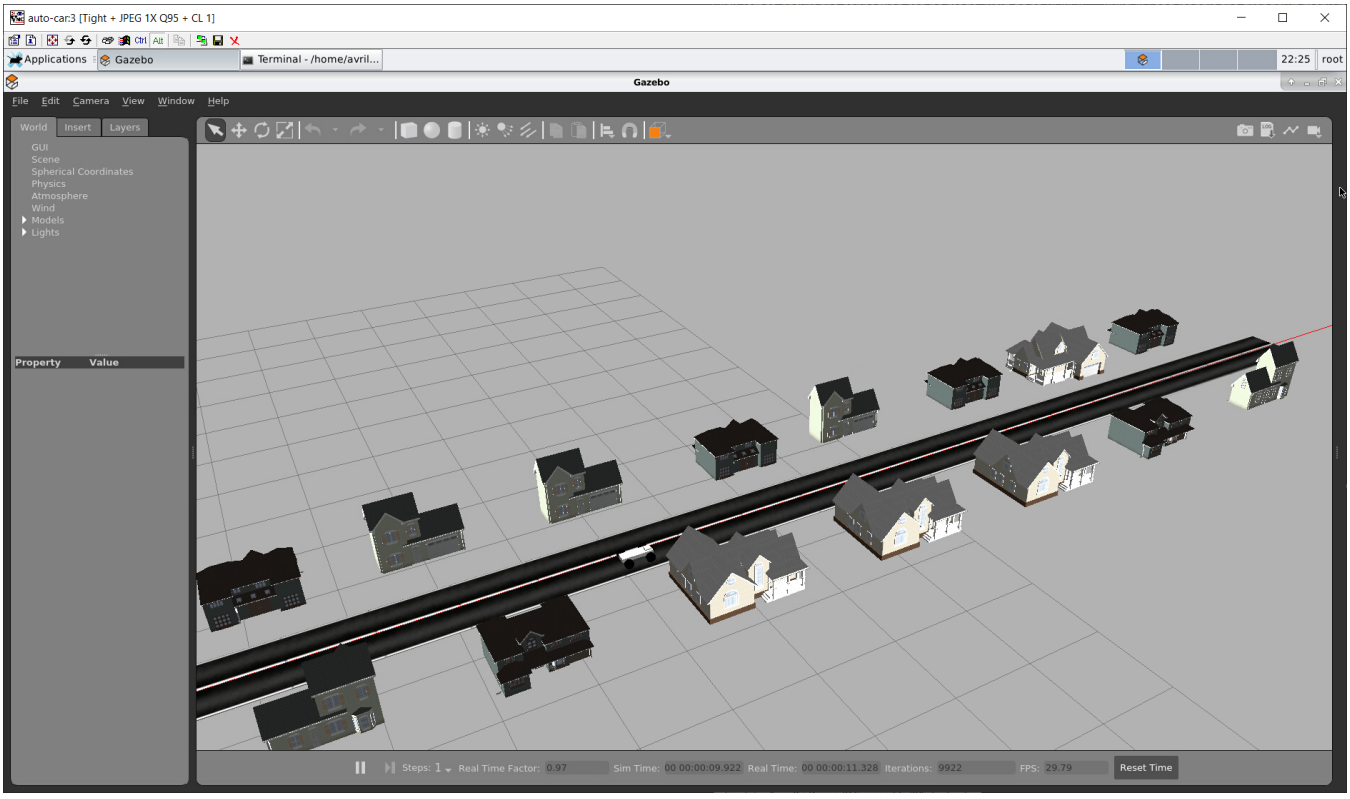
Now you can go back to ROBOT Build & Load and it should build all in one click! You don't need to go through this process again for the remainder of this project. To view the simulation, launch your VNC viewer of choice and enter the IP address + the given VNC port. Here I'll demonstrate with TurboVNC:



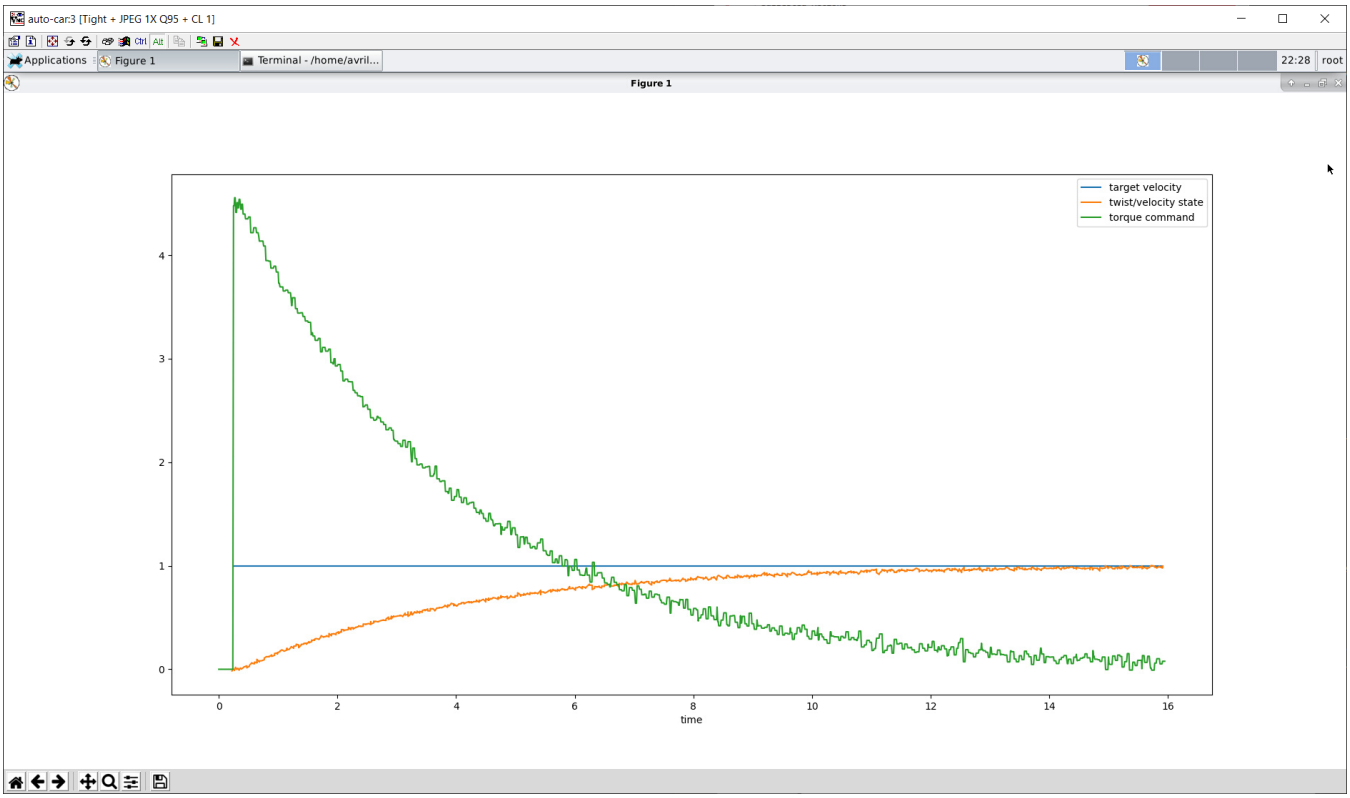
The password is ideas. Next you should see the XFCE DE(Desktop Environment). The terminal window should be present but you can find it under the Applications menu on the top left corner of the screen if it's closed.

Execute and Simulate

Enter `runsim` in the terminal to run the simulation. This will open Gazebo so you can inspect the vehicle in motion by using middle click to orbit and left click to pan. The simulation results will be logged in a ROS bag. You can find that `.bag` file that starts with `syde-lab` using `ls` after the simulation is finished. The simulation will run indefinitely so hit `CTRL+C` on your keyboard while the terminal window is focused when your test is done.



Enter `visualize BAG_NAME` in the terminal to see the vehicle velocity state, torque command, and the target velocity in past simulation(s) where `BAG_NAME` is the name of the ROS bag. Pro tip: press `TAB` on your keyboard as you type the file name to let bash auto-complete the filename for you. Double `TAB` if there are multiple files that begins with the same letters.



Have fun controlling!