

# Quanser QCar 2- Research Presentation

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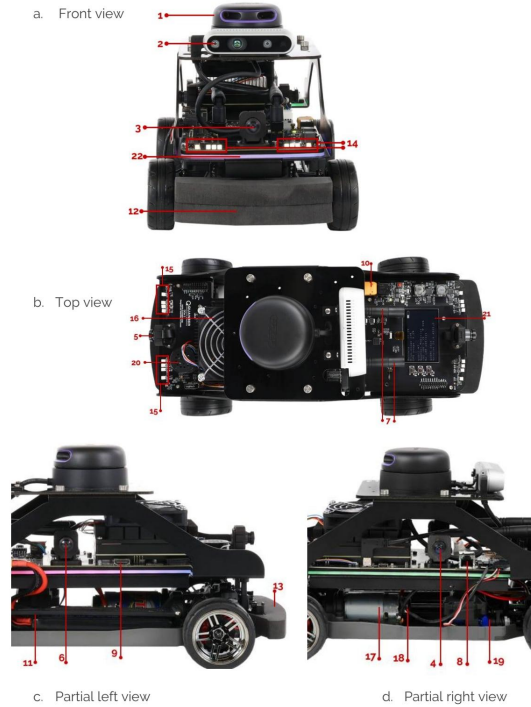
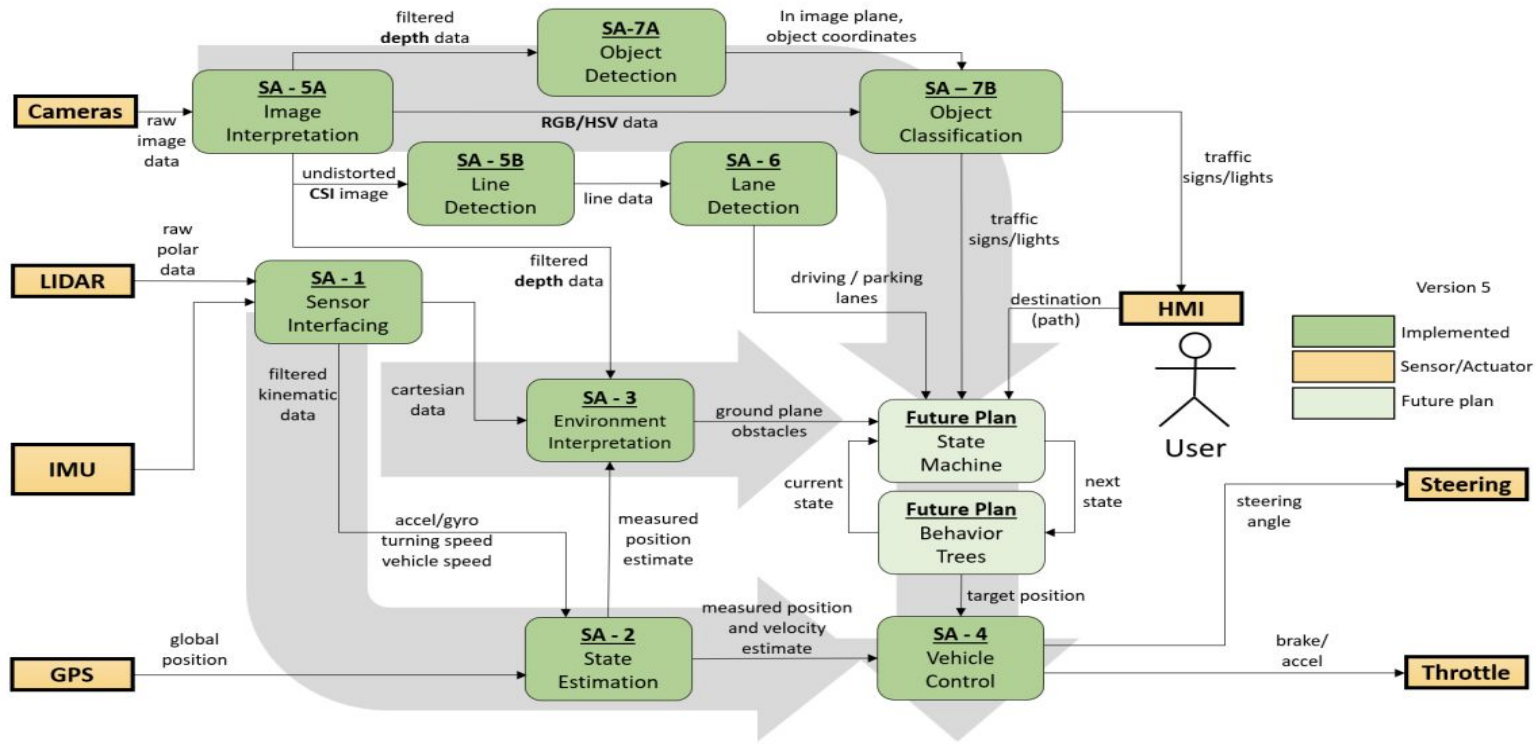


Figure 1. QCar 2 Components

Fig: The QCar 2 - Hardware components



# Road Map

# Set-Up?

1. Network Connectivity
2. Software Setups.



# Network Connectivity:

1. Keyboard, Mouse
2. Username and Password of QCar 2:
3. >> ping 192.168.2.115 -t: [Ubuntu or terminal]

GCS → Car [Ground Control Station]

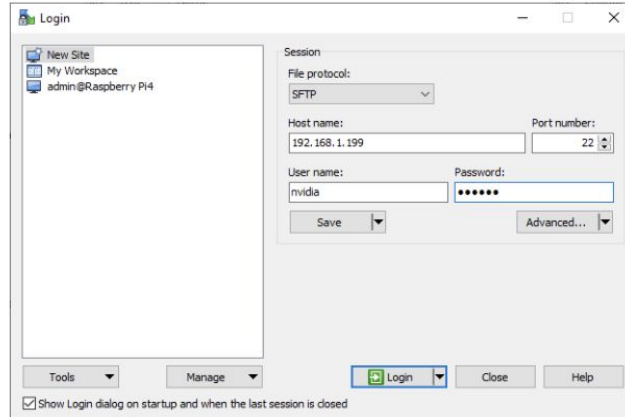
(Ethernet on QCar 2)



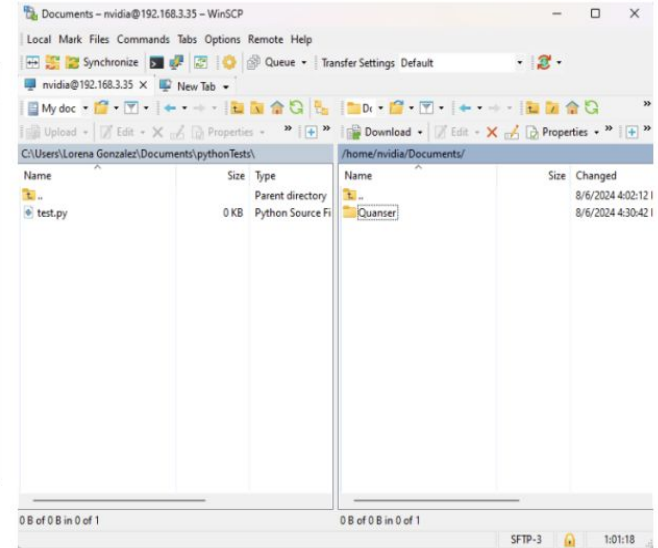
Figure 2. Wi-Fi setup with the QCar 2

# File Transfer: WinSCP

PC → ← QCar2



a. WinSCP login

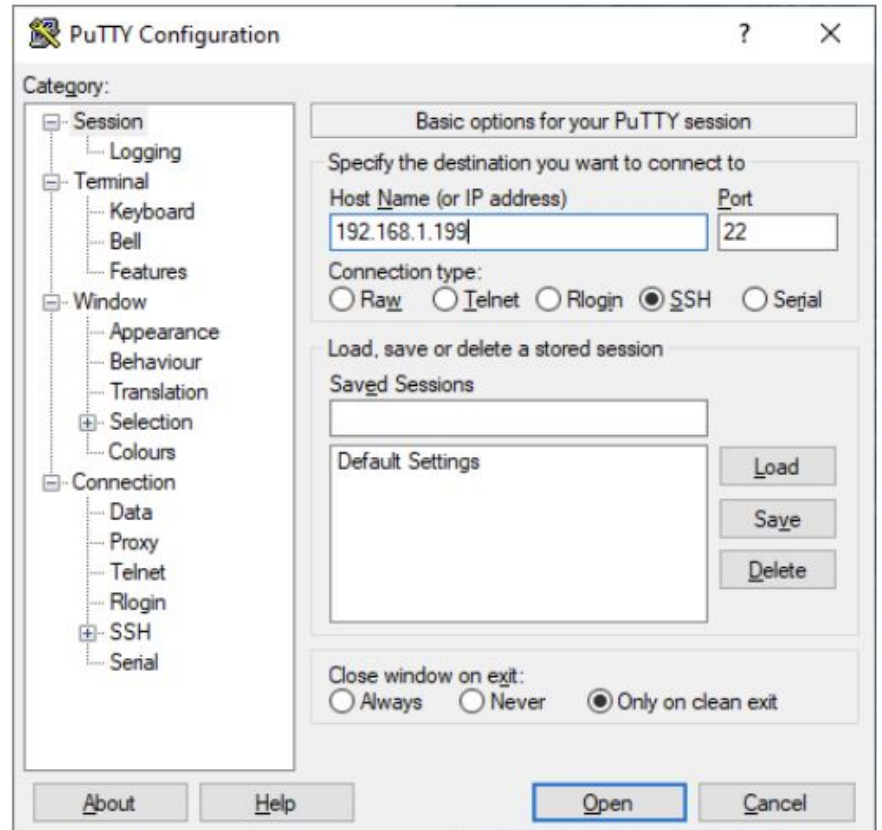


b. WinSCP browser to transfer files

Fig: File Transfer between PC and QCar2 (Drag & Drop)

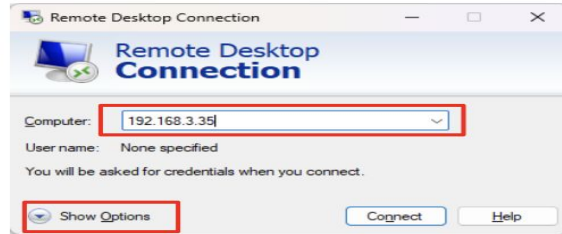
# PuTTY

Connectivity of QCar2 with PuTTY:  
Remote terminal.

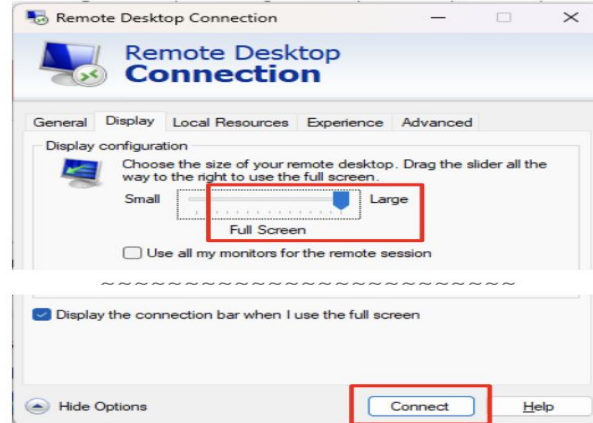


# Windows Remote Desktop:

On QCar2 without mouse and Keyboard.



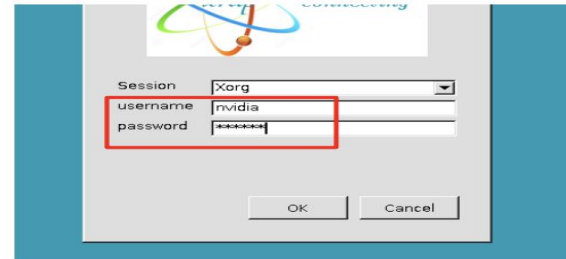
Car IP



Display Options to Full Screen



Accepting the connection



Log in screen

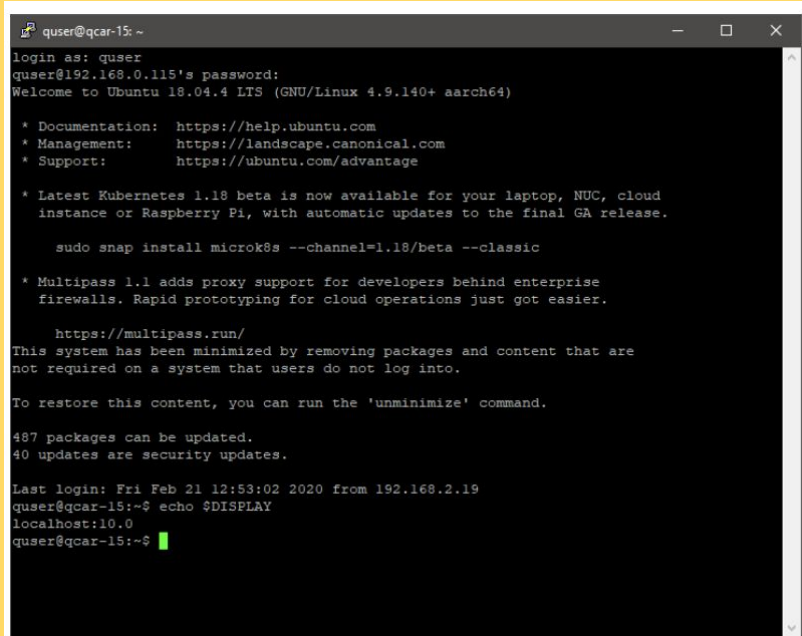
Fig: Connection of QCar2 in Windows Remote Desktop



# Confirmation:

- Remote terminal (PuTTY): >> echo \$DISPLAY

- >> chromium-browser

A terminal window titled 'quser@qcar-15: ~' showing the login process for 'quser' on a system with IP 192.168.0.115. It displays the Ubuntu 18.04.4 LTS welcome message, system documentation links, and the output of the 'echo \$DISPLAY' command, which is 'localhost:10.0'.

```
quser@qcar-15: ~  
login as: quser  
quser@192.168.0.115's password:  
Welcome to Ubuntu 18.04.4 LTS (GNU/Linux 4.9.140+ aarch64)  
  
* Documentation:  https://help.ubuntu.com  
* Management:    https://landscape.canonical.com  
* Support:       https://ubuntu.com/advantage  
  
* Latest Kubernetes 1.18 beta is now available for your laptop, NUC, cloud  
  instance or Raspberry Pi, with automatic updates to the final GA release.  
  
  sudo snap install microk8s --channel=1.18/beta --classic  
  
* Multipass 1.1 adds proxy support for developers behind enterprise  
  firewalls. Rapid prototyping for cloud operations just got easier.  
  
  https://multipass.run/  
This system has been minimized by removing packages and content that are  
not required on a system that users do not log into.  
  
To restore this content, you can run the 'unminimize' command.  
  
487 packages can be updated.  
40 updates are security updates.  
  
Last login: Fri Feb 21 12:53:02 2020 from 192.168.2.19  
quser@qcar-15:~$ echo $DISPLAY  
localhost:10.0  
quser@qcar-15:~$
```

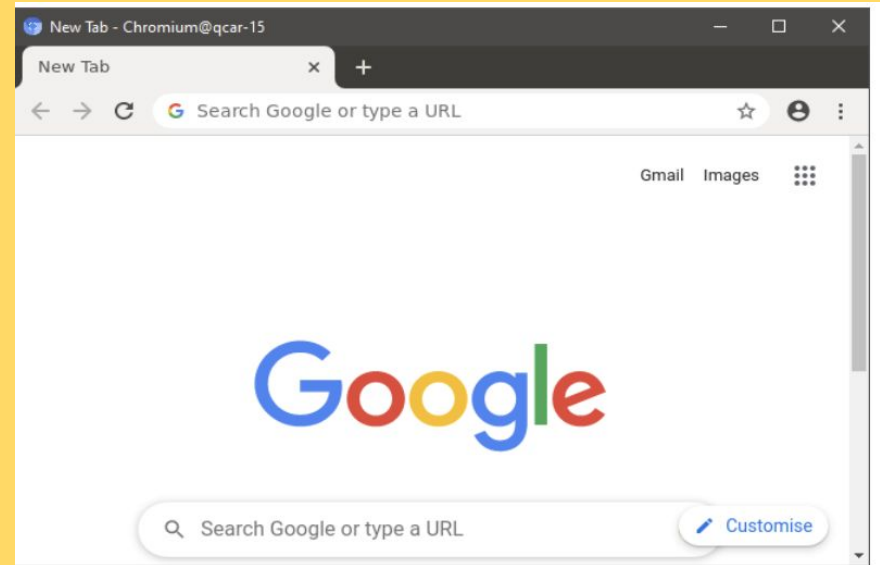


Fig: QCar2 connected successfully in a network

## Step 2:

Qcar2: User Manual Software - Python

Figure 1 below represents the workflow for developing Python applications. The next sections describe each step in more detail.

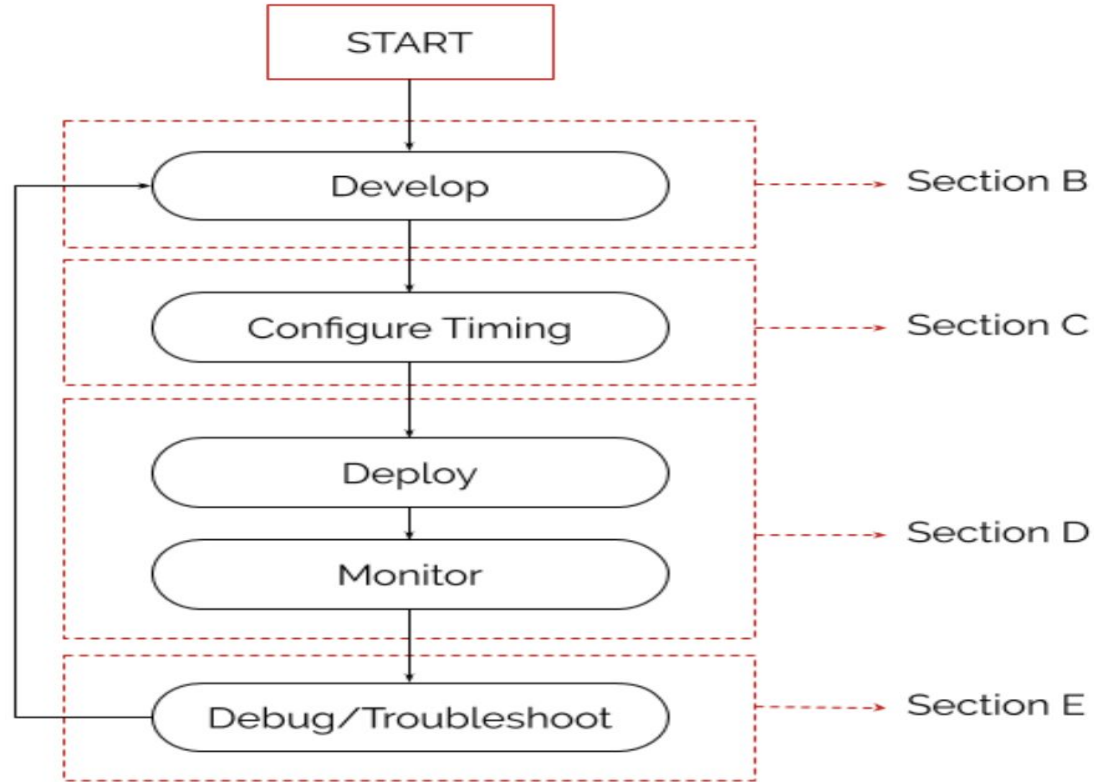
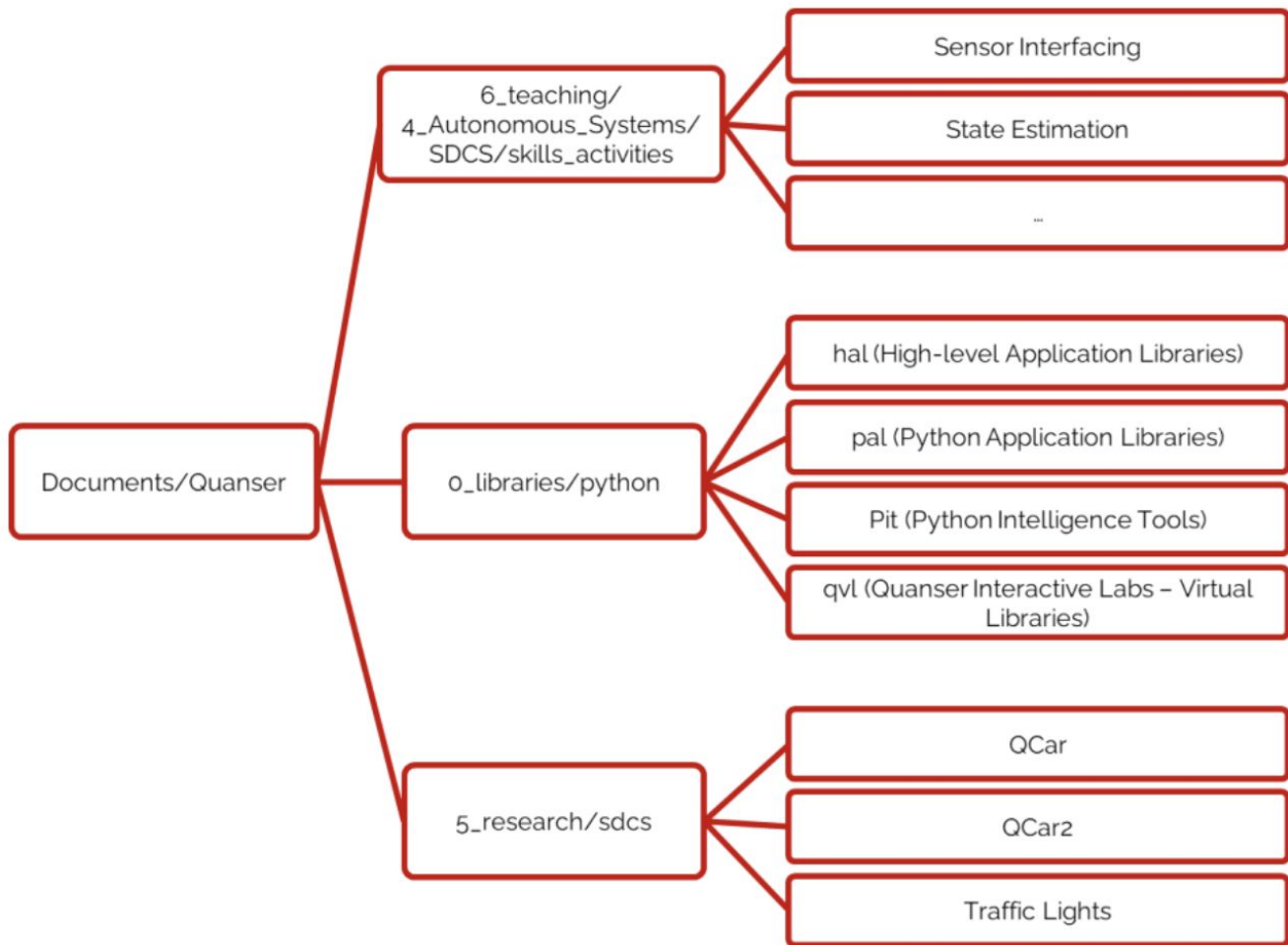


Figure 1. Process diagram for Python code deployment



hal

- LIBRARIES
  - python
    - hal
      - content
        - qcar\_functions.py
      - products
        - mats.py
        - qcar.py
      - utilities
        - control.py
        - estimation.py
        - geometry.py
        - image\_processing.py
        - mapping.py
        - path\_planning.py
        - \_init\_.py
    - pal
      - products
        - qcar.py
      - resources
        - images.py
        - rtmodels.py
      - utilities
        - gamepad.py
        - lidar.py
        - math.py
        - probe.py
        - scope.py

pal

python > hal > content > qcar\_functions.py > ...

```
11
12 > class QCarEKF: ...
148
149 > class QCarDriveController: ...
221
```

python > hal > products > qcar.py > ...

```
8 > class QCarGeometry(MobileRobotGeometry): ...
94
```

python > pal > products > qcar.py > ...

```
28
29 > class QCar(): ...
425
426 > class QCarCameras: ...
518
519 > class QCarLidar(Lidar): ...
666
667 > class QCarRealSense(Camera3D): ...
772
773 > class QCarGPS: ...
```

# Application Modules Setup

To run the pal and hal - we transfer the files here: /home/nvidia/Documents/Quanser on QCar2

- (WinSCP)In .bashrc file we make changes as below

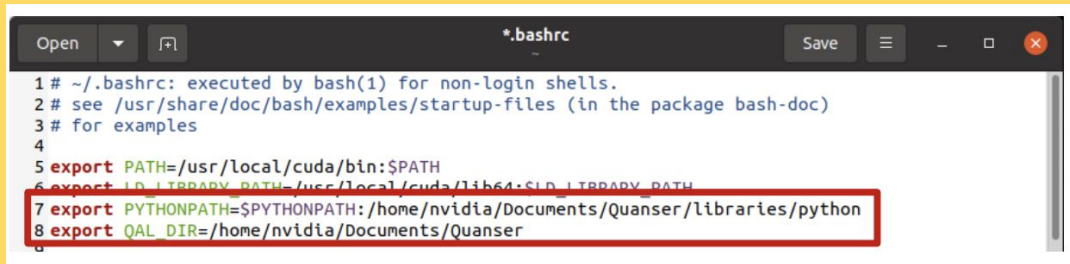
```
export PYTHONPATH=$PYTHONPATH:"<PATH TO directory of hal and pal>"
```

```
export QAL_DIR="<PATH TO Quanser Resources>"
```

To

```
export  
PYTHONPATH=$PYTHONPATH:/home/nvidia/Documents/Quanser/libraries/python
```

```
export QAL_DIR=/home/nvidia/Documents/Quanser
```

A screenshot of a text editor window titled ".bashrc" with a dark theme. The editor shows the contents of the .bashrc file. Lines 7 and 8 are highlighted with a red rectangular box. Line 7 is "export PYTHONPATH=\$PYTHONPATH:/home/nvidia/Documents/Quanser/libraries/python" and line 8 is "export QAL\_DIR=/home/nvidia/Documents/Quanser". The window has standard OS controls (Open, Save, etc.) and a scrollbar on the right.

```
1 # ~/.bashrc: executed by bash(1) for non-login shells.  
2 # see /usr/share/doc/bash/examples/startup-files (in the package bash-doc)  
3 # for examples  
4  
5 export PATH=/usr/local/cuda/bin:$PATH  
6 export LD_LIBRARY_PATH=/usr/local/cuda/lib64:$LD_LIBRARY_PATH  
7 export PYTHONPATH=$PYTHONPATH:/home/nvidia/Documents/Quanser/libraries/python  
8 export QAL_DIR=/home/nvidia/Documents/Quanser  
9
```

# Deployment and Monitoring: - |GCS→ QCar 2 or VS code |

## 6. Python Users:

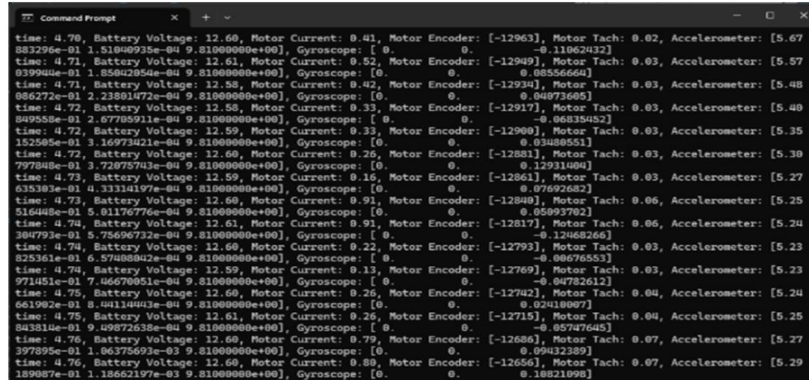
1. Run the qlabs\_setup\_applications.py Python script by typing the following in a Command Prompt:

```
python qlabs_setup_applications.py
```

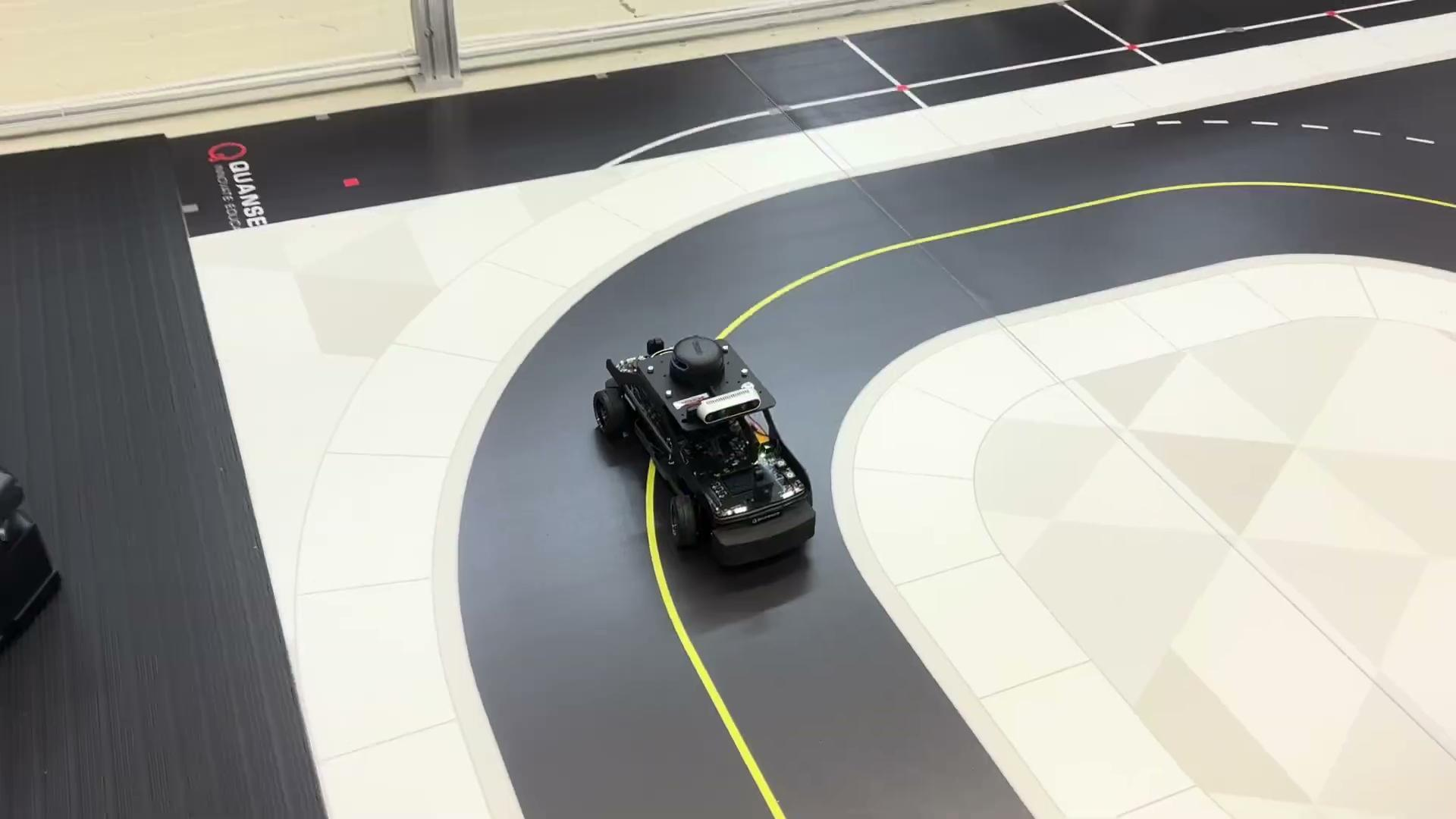
2. Run the QCar2\_hardware\_test\_basic\_io.py Python script by typing the following in a Command Prompt:

```
python QCar2_hardware_test_basic_io.py
```

The Virtual QCar 2 should move around the virtual environment and the measurements for the battery voltage & current, motor encoder & tachometer, and IMU are shown in the terminal.



```
time: 4.70, Battery Voltage: 12.60, Motor Current: 0.41, Motor Encoder: [-12963], Motor Tach: 0.62, Accelerometer: [5.67
083296e-01 1.51040935e-04 9.81000000e+00], Gyroscope: [ 0. 0. -0.11062432]
time: 4.71, Battery Voltage: 12.61, Motor Current: 0.52, Motor Encoder: [-12949], Motor Tach: 0.63, Accelerometer: [5.57
039990e-01 1.5504235e-04 9.81000000e+00], Gyroscope: [ 0. 0. 0.05565660]
time: 4.71, Battery Voltage: 12.58, Motor Current: 0.42, Motor Encoder: [-12934], Motor Tach: 0.63, Accelerometer: [5.48
086272e-01 2.23801472e-04 9.81000000e+00], Gyroscope: [ 0. 0. 0.04873605]
time: 4.72, Battery Voltage: 12.56, Motor Current: 0.33, Motor Encoder: [-12917], Motor Tach: 0.63, Accelerometer: [5.40
009335e-01 2.07705011e-04 9.81000000e+00], Gyroscope: [ 0. 0. -0.06330432]
time: 4.72, Battery Voltage: 12.59, Motor Current: 0.33, Motor Encoder: [-12900], Motor Tach: 0.63, Accelerometer: [5.35
152505e-01 3.16973421e-04 9.81000000e+00], Gyroscope: [ 0. 0. 0.03480551]
time: 4.72, Battery Voltage: 12.60, Motor Current: 0.25, Motor Encoder: [-12881], Motor Tach: 0.63, Accelerometer: [5.30
797848e-01 3.72075743e-04 9.81000000e+00], Gyroscope: [ 0. 0. 0.12931404]
time: 4.73, Battery Voltage: 12.59, Motor Current: 0.16, Motor Encoder: [-12861], Motor Tach: 0.63, Accelerometer: [5.27
635393e-01 4.33314197e-04 9.81000000e+00], Gyroscope: [ 0. 0. 0.07692682]
time: 4.73, Battery Voltage: 12.60, Motor Current: 0.91, Motor Encoder: [-12800], Motor Tach: 0.66, Accelerometer: [5.25
516448e-01 5.01176776e-04 9.81000000e+00], Gyroscope: [ 0. 0. 0.05993702]
time: 4.74, Battery Voltage: 12.61, Motor Current: 0.91, Motor Encoder: [-12817], Motor Tach: 0.66, Accelerometer: [5.24
360793e-01 5.75606732e-04 9.81000000e+00], Gyroscope: [ 0. 0. -0.12468266]
time: 4.74, Battery Voltage: 12.60, Motor Current: 0.22, Motor Encoder: [-12793], Motor Tach: 0.63, Accelerometer: [5.23
82531e-01 6.57408082e-04 9.81000000e+00], Gyroscope: [ 0. 0. -0.00676553]
time: 4.74, Battery Voltage: 12.59, Motor Current: 0.13, Motor Encoder: [-12769], Motor Tach: 0.63, Accelerometer: [5.23
971051e-01 7.06070051e-04 9.81000000e+00], Gyroscope: [ 0. 0. -0.00782612]
time: 4.75, Battery Voltage: 12.60, Motor Current: 0.26, Motor Encoder: [-12742], Motor Tach: 0.64, Accelerometer: [5.24
661902e-01 8.04114443e-04 9.81000000e+00], Gyroscope: [ 0. 0. 0.02410007]
time: 4.75, Battery Voltage: 12.61, Motor Current: 0.26, Motor Encoder: [-12715], Motor Tach: 0.64, Accelerometer: [5.25
043811e-01 9.09872038e-04 9.81000000e+00], Gyroscope: [ 0. 0. -0.05747648]
time: 4.76, Battery Voltage: 12.60, Motor Current: 0.79, Motor Encoder: [-12686], Motor Tach: 0.67, Accelerometer: [5.27
397895e-01 1.06375693e-03 9.81000000e+00], Gyroscope: [ 0. 0. 0.09432389]
time: 4.76, Battery Voltage: 12.60, Motor Current: 0.80, Motor Encoder: [-12656], Motor Tach: 0.67, Accelerometer: [5.29
189087e-01 1.18602197e-03 9.81000000e+00], Gyroscope: [ 0. 0. 0.18821990]
```

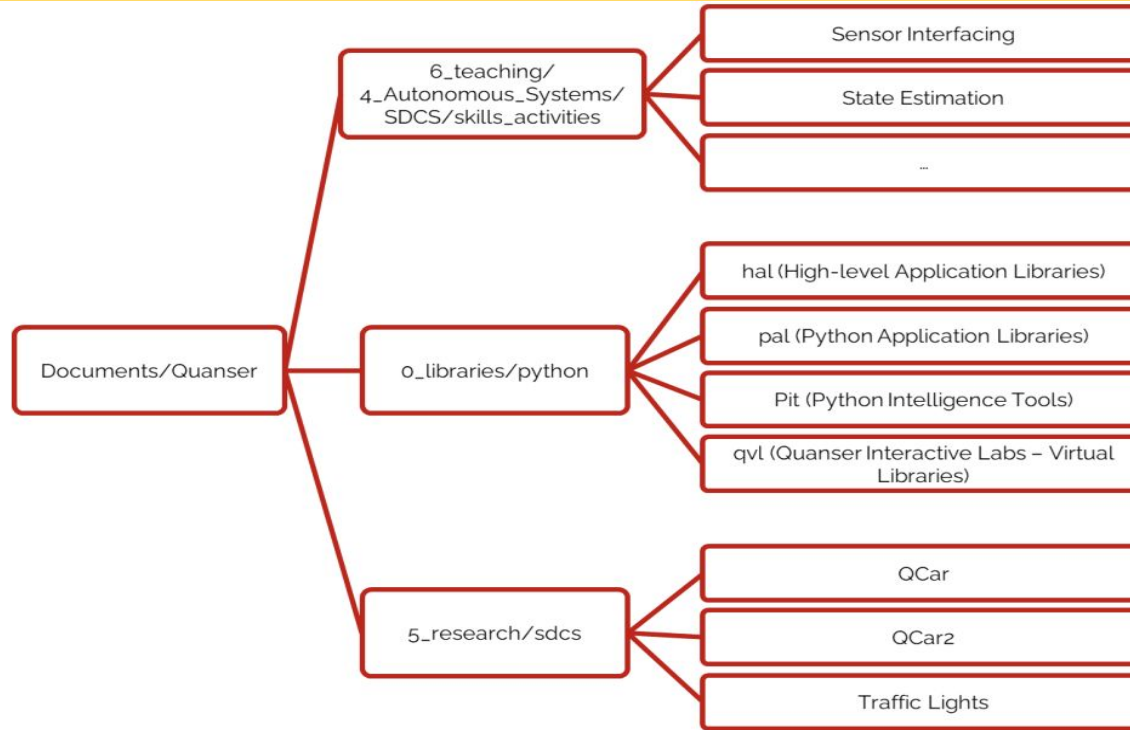


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# Short term Future Goals:

Test all these examples:



## Long Term Goals:



# Thank you so much.

I am looking forward to share my further progress in the coming days.

- Jeeban Bashyal

