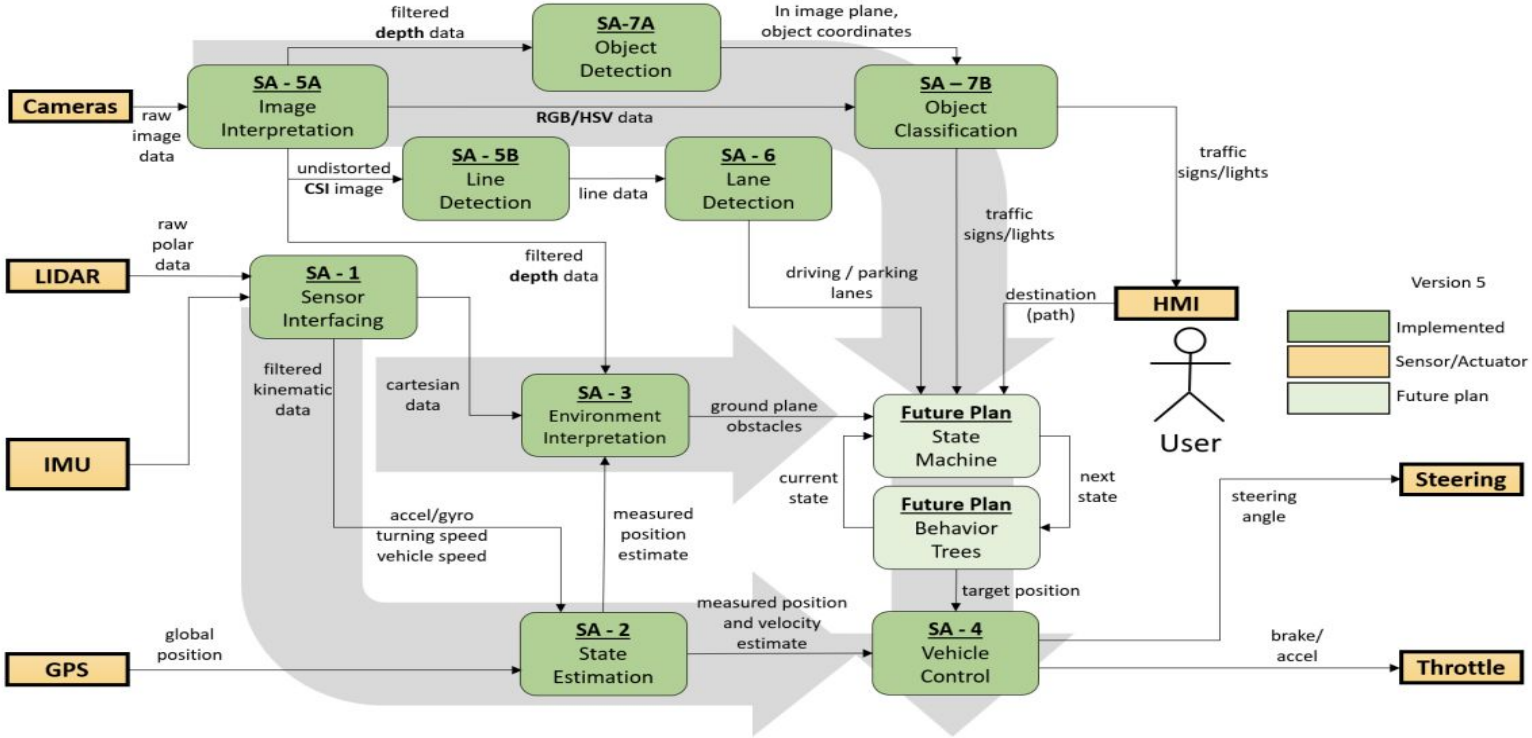
Quanser QCar 2- Research Presentation

Presented By: Jeeban Bashyal
Under the supervision of Professor Dr. Yujian Fu.

Figure 1. QCar 2 Components

Fig: The QCar 2 - Hardware components


filtered depth data
SA-7A Object Detection
In image plane, object coordinates
Cameras
raw image data
SA - 5A Image Interpretation
RGB/HSV data
SA – 7B Object Classification
traffic signs/lights
undistorted CSI image
SA - 5B Line Detection
line data
SA - 6 Lane Detection
traffic signs/lights
raw polar data
LIDAR
SA - 1 Sensor Interfacing
filtered depth data
driving / parking lanes
destination (path)
HMI
Version 5
Implemented
Sensor/Actuator
Future plan
filtered kinematic data
cartesian data
SA - 3 Environment Interpretation
ground plane obstacles
Future Plan State Machine
User
IMU
current state
next state
Future Plan Behavior Trees
Steering
steering angle
accel/gyro turning speed vehicle speed
measured position estimate
target position
measured position and velocity estimate
global position
GPS
SA - 2 State Estimation
SA - 4 Vehicle Control
brake/ accel
Throttle

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)

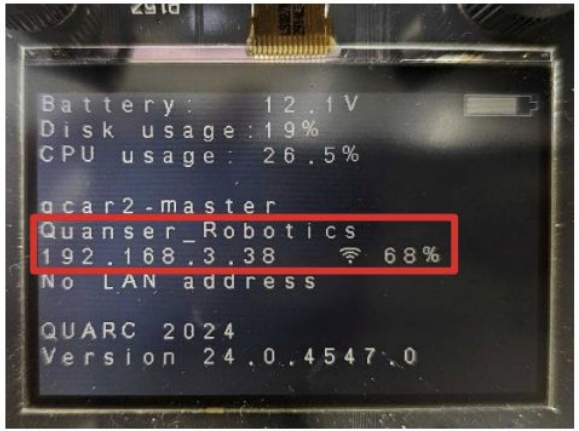
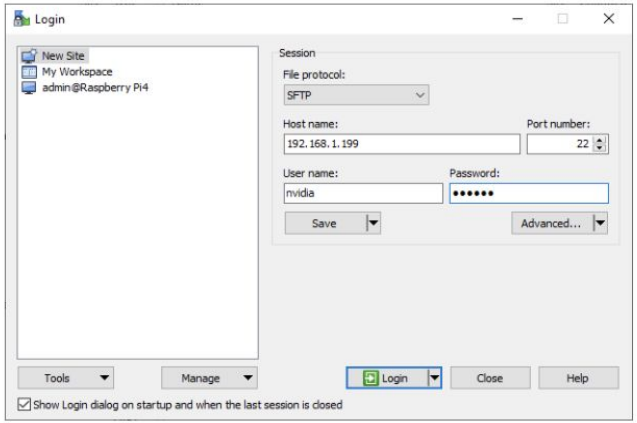


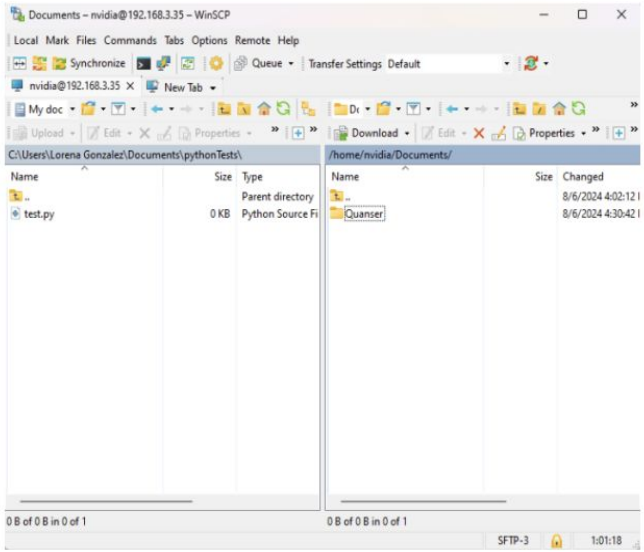
Figure 2. Wi-Fi setup with the QCar 2

File Transfer: WinSCP

PC→← QCar2



a. WinSCP login



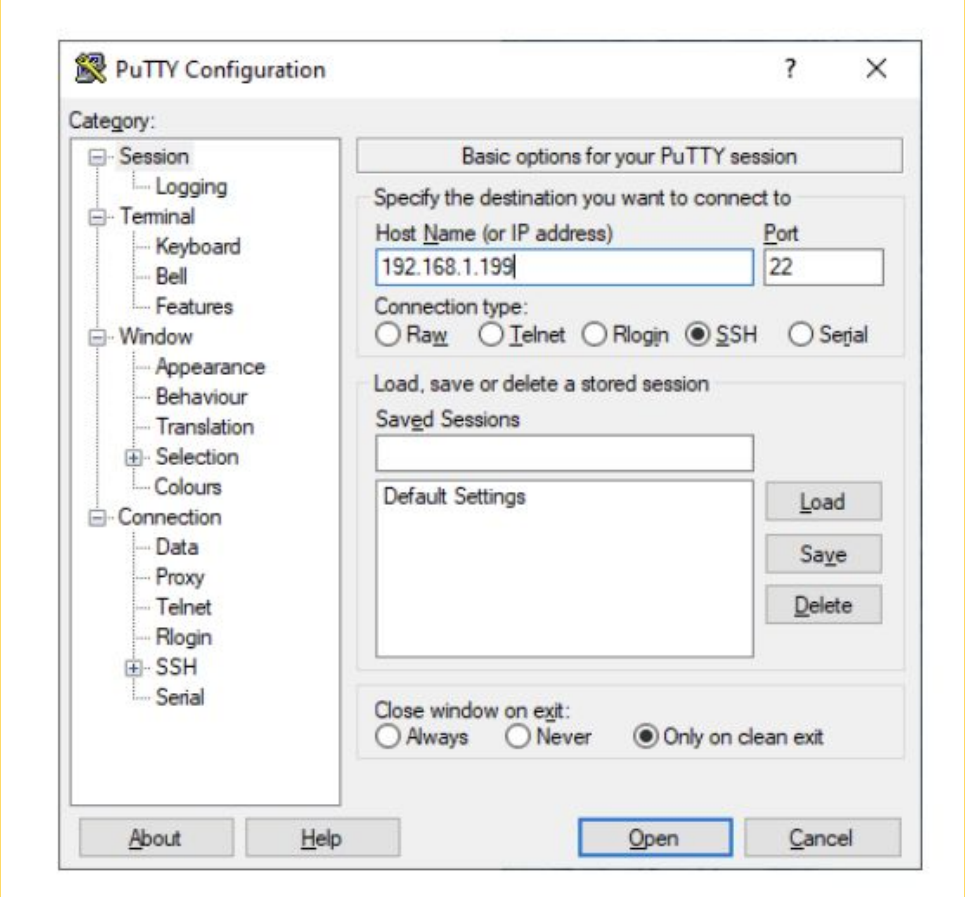
b. WinSCP browser to transfer files

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.

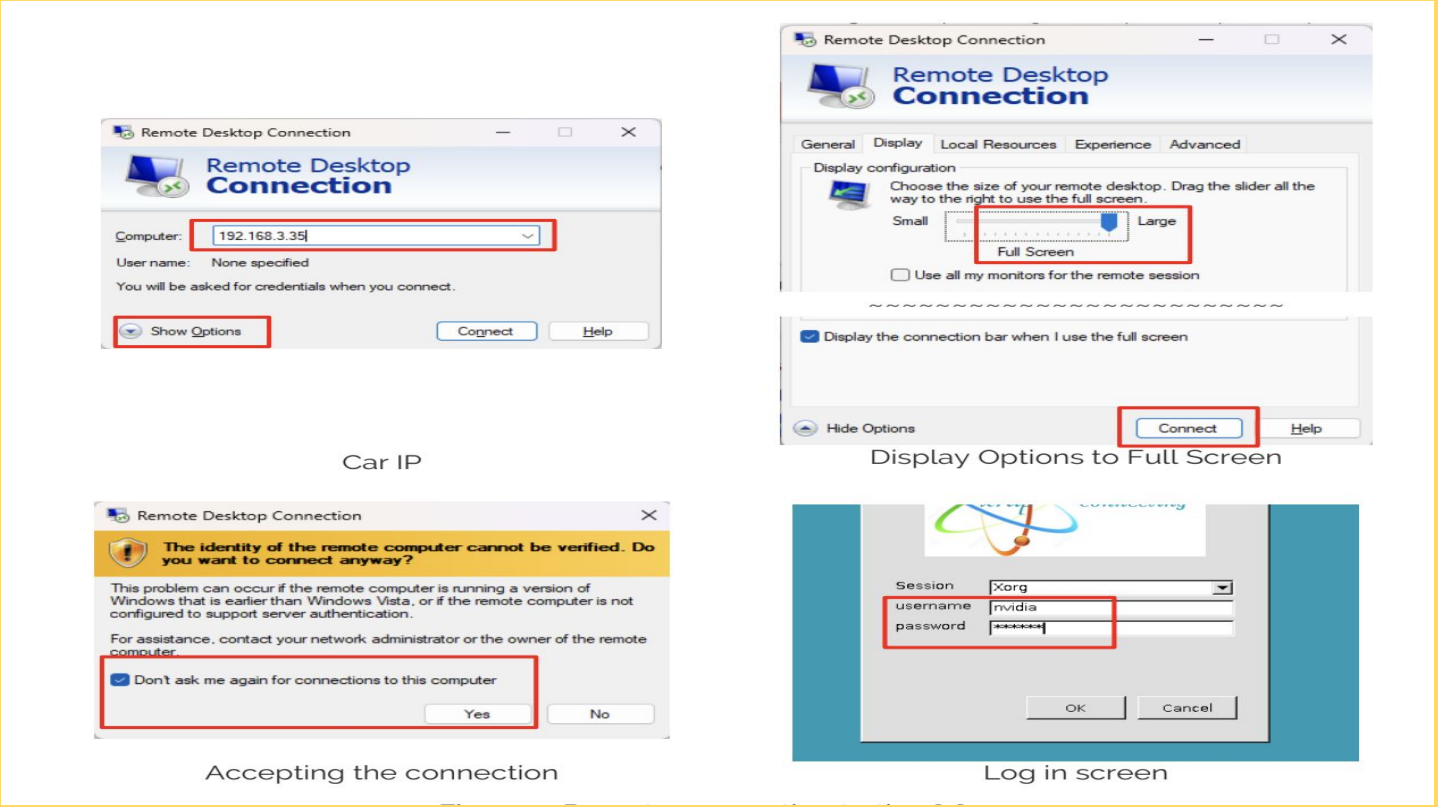
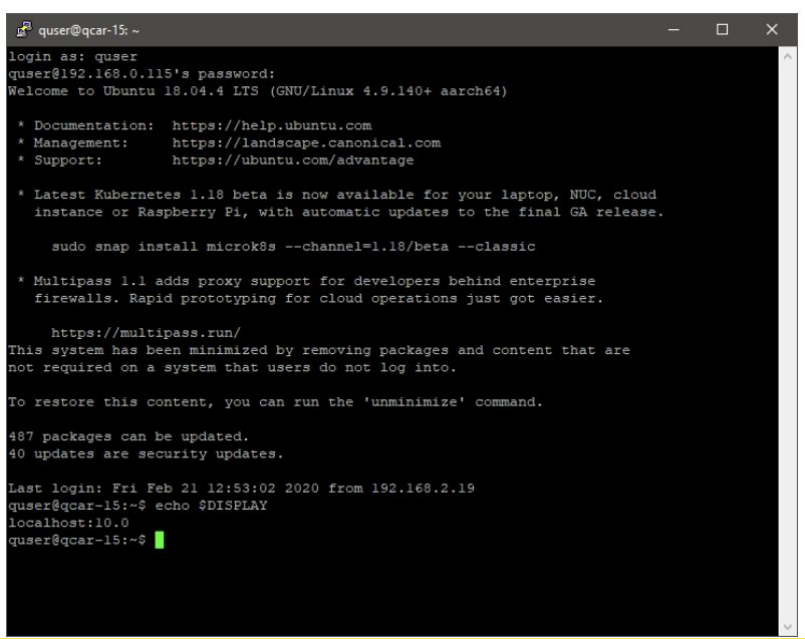


Fig: Connection of QCar2 in Windows Remote Desktop

Confirmation:

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



- >> chromium-browser

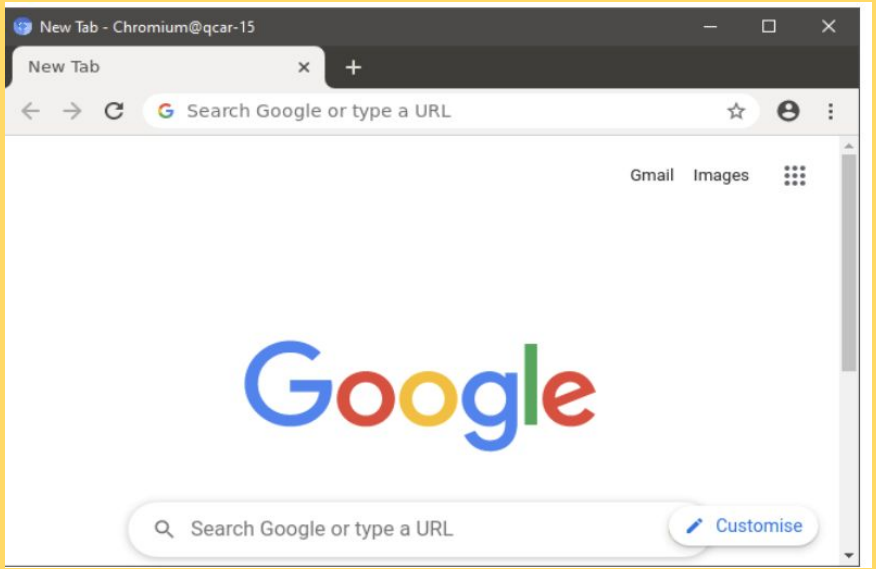


Fig: QCar2 connected successfully in a network

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.

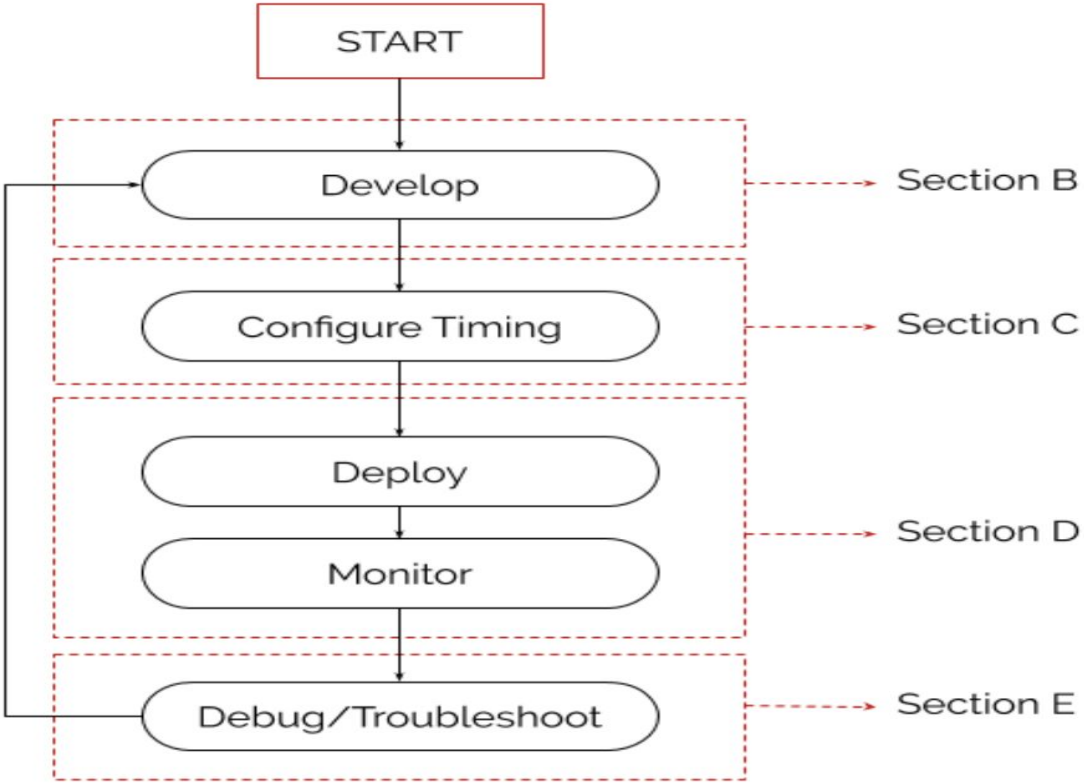
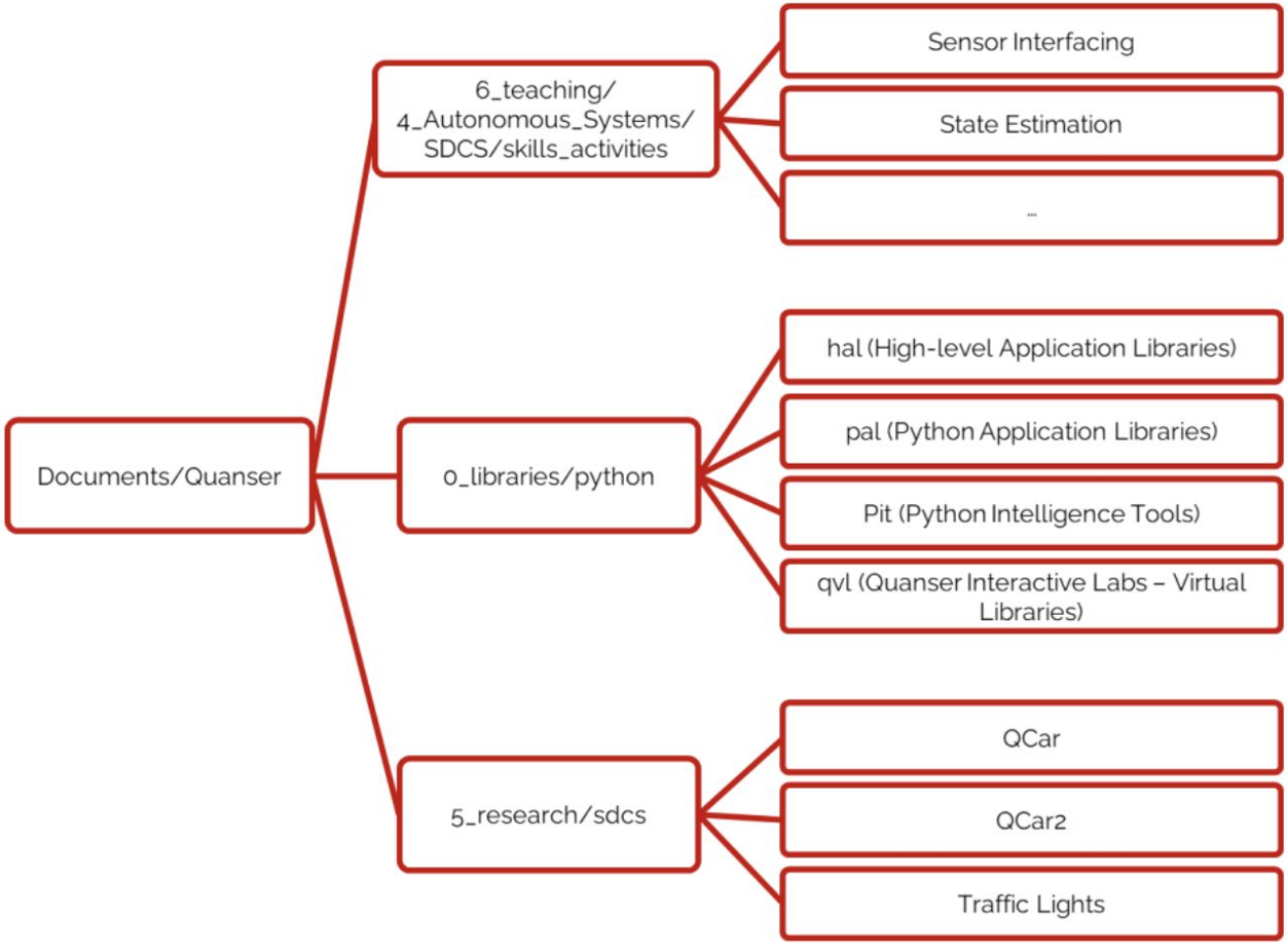
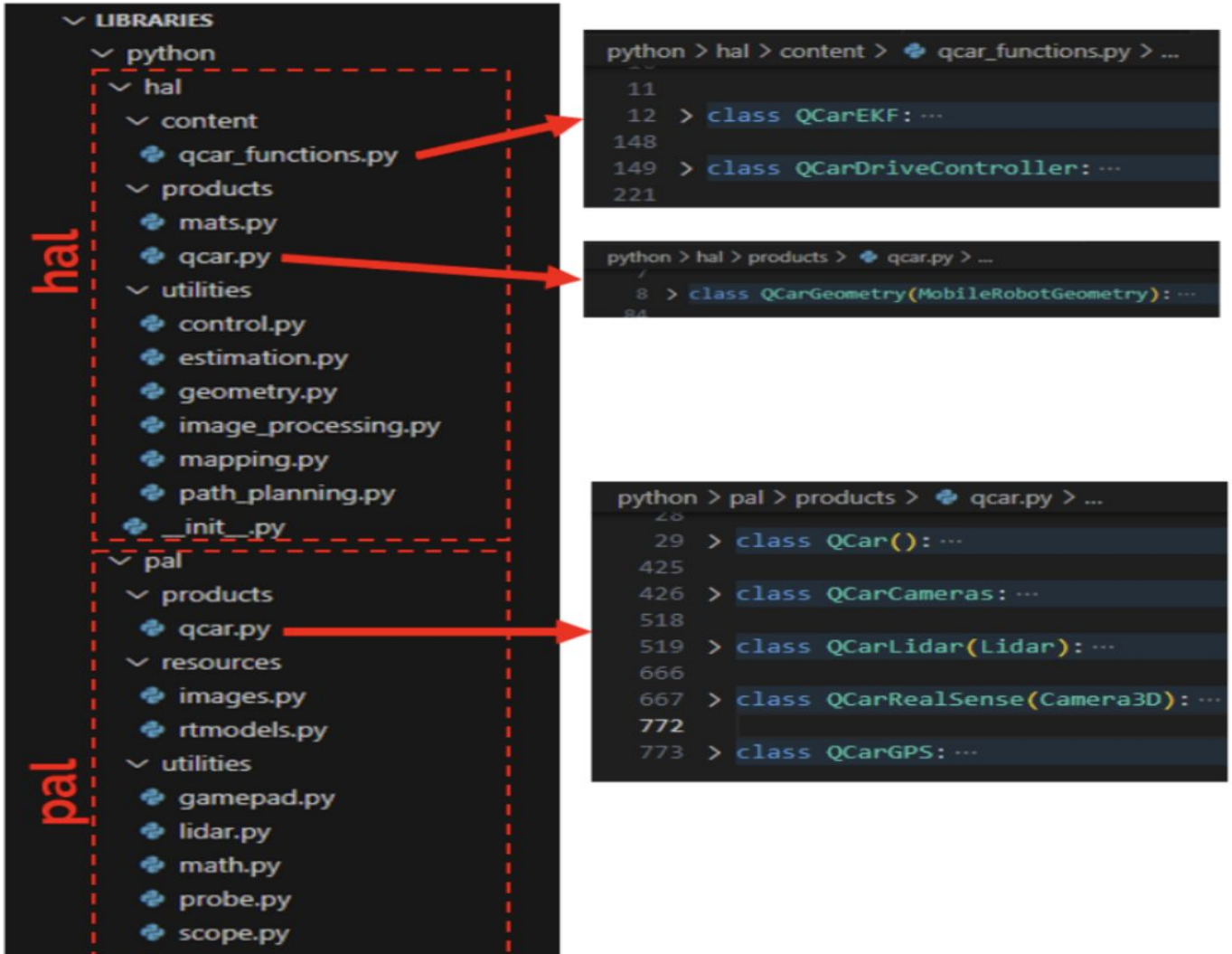


Figure 1. Process diagram for Python code deployment


Documents/Quanser
6_teaching/
4_Autonomous_Systems/
SDCS/skills_activities
Sensor Interfacing
State Estimation
...
0_libraries/python
hal (High-level Application Libraries)
pal (Python Application Libraries)
Pit (Python Intelligence Tools)
qvl (Quanser Interactive Labs – Virtual Libraries)
5_research/sdcs
QCar
QCar2
Traffic Lights


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
hal
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): ···
python > pal > products > qcar.py > ...
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

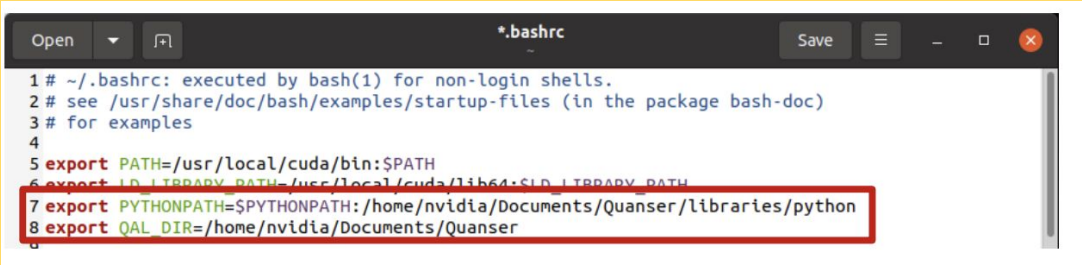
  export PYTHONPATH=$PYTHONPATH:“<PATH TO directory of hal and pal>”

  export QAL_DIR=“<PATH TO Quanser Resources>”

  To

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

  export QAL_DIR=/home/nvidia/Documents/Quanser



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

6. **Python Users:**

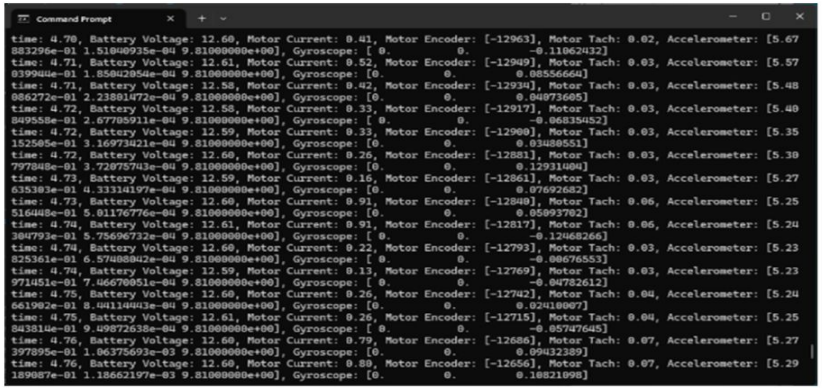
   1. Run the qlabs_setup_applications.py Python script by typing the following in a Command Prompt:

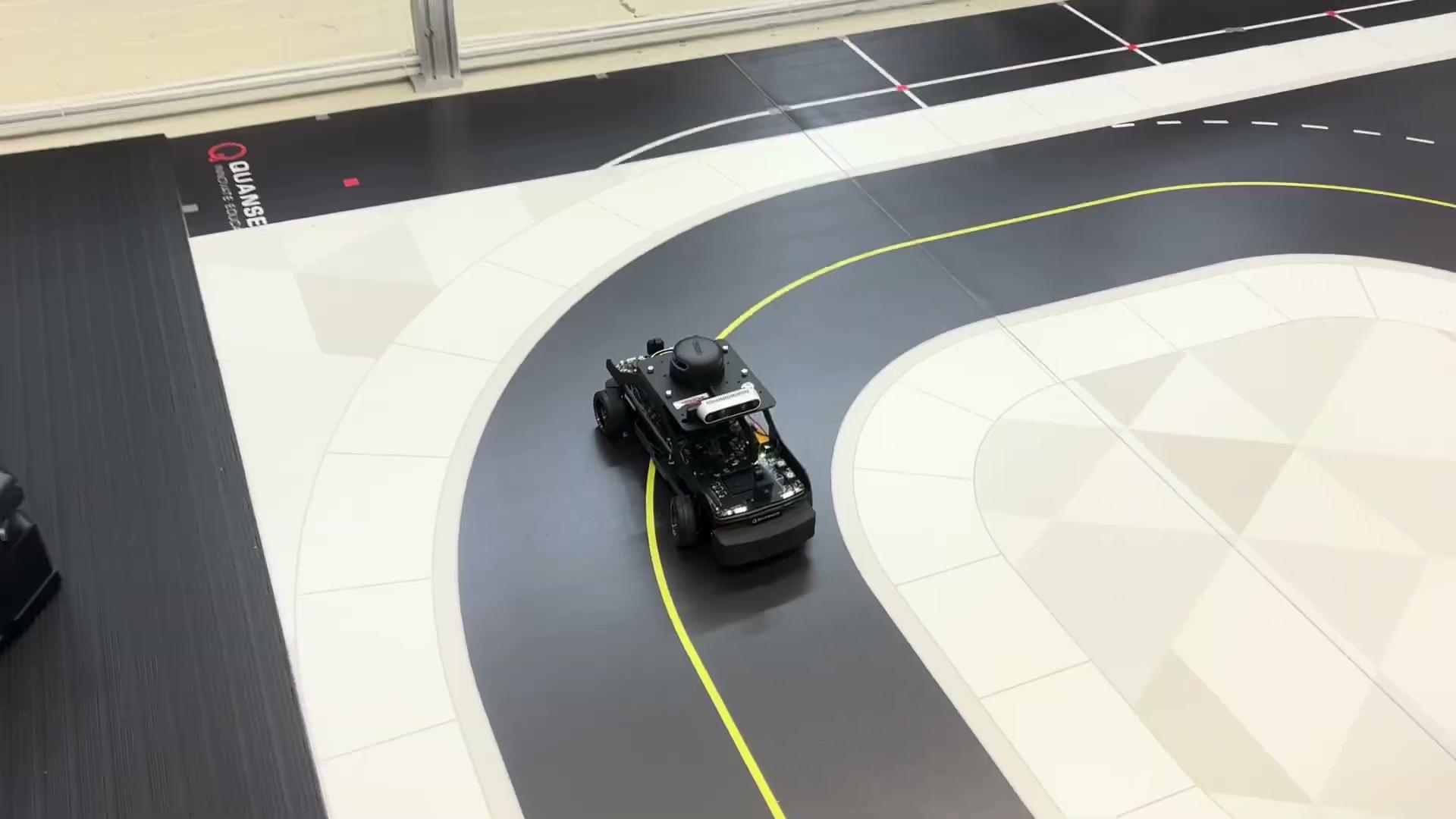
```
python qlabs_setup_applications.py
```

   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
```

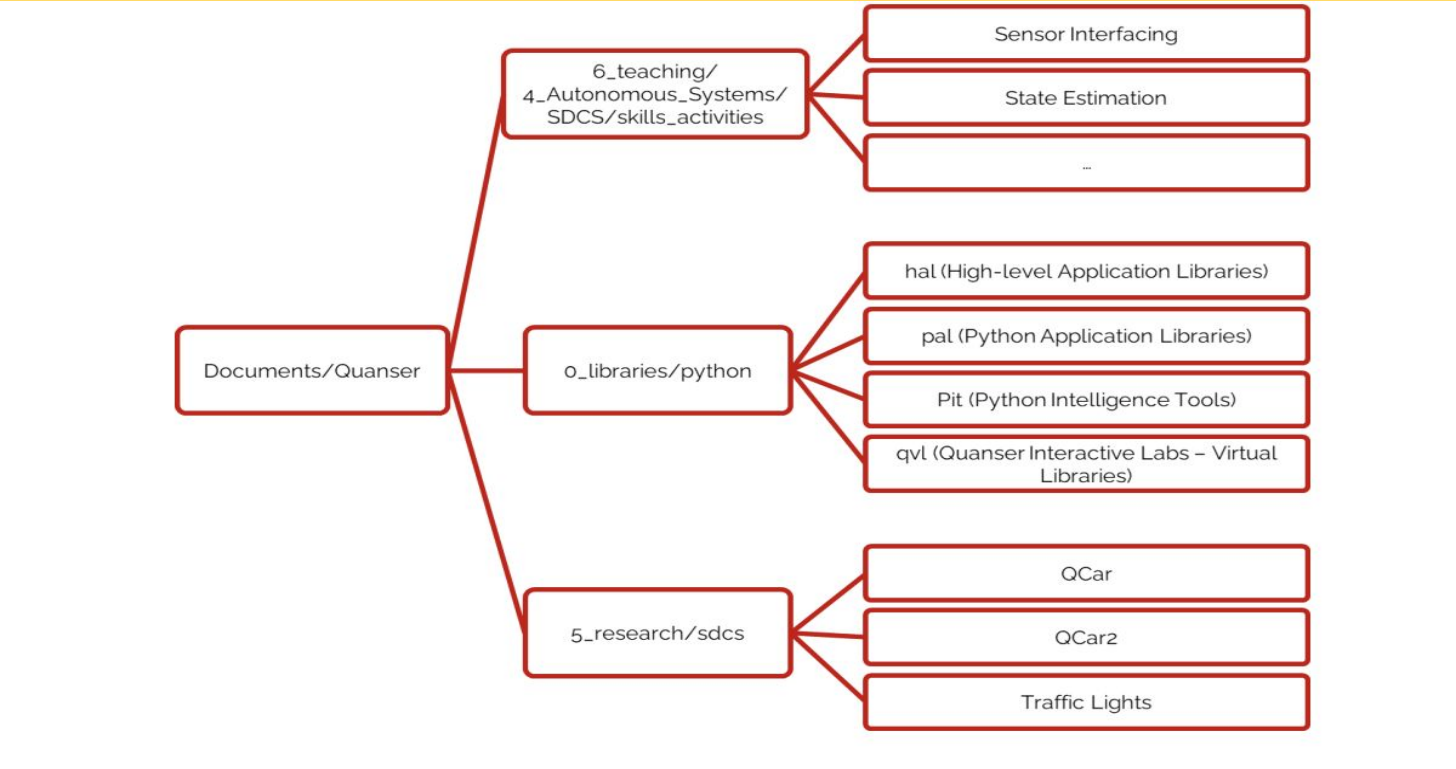
The Virtual QCar 2 should move around the virtual environment and the measurements for the battery voltage & current, motor encoder & tachometer, and IMU are shown in the terminal.





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