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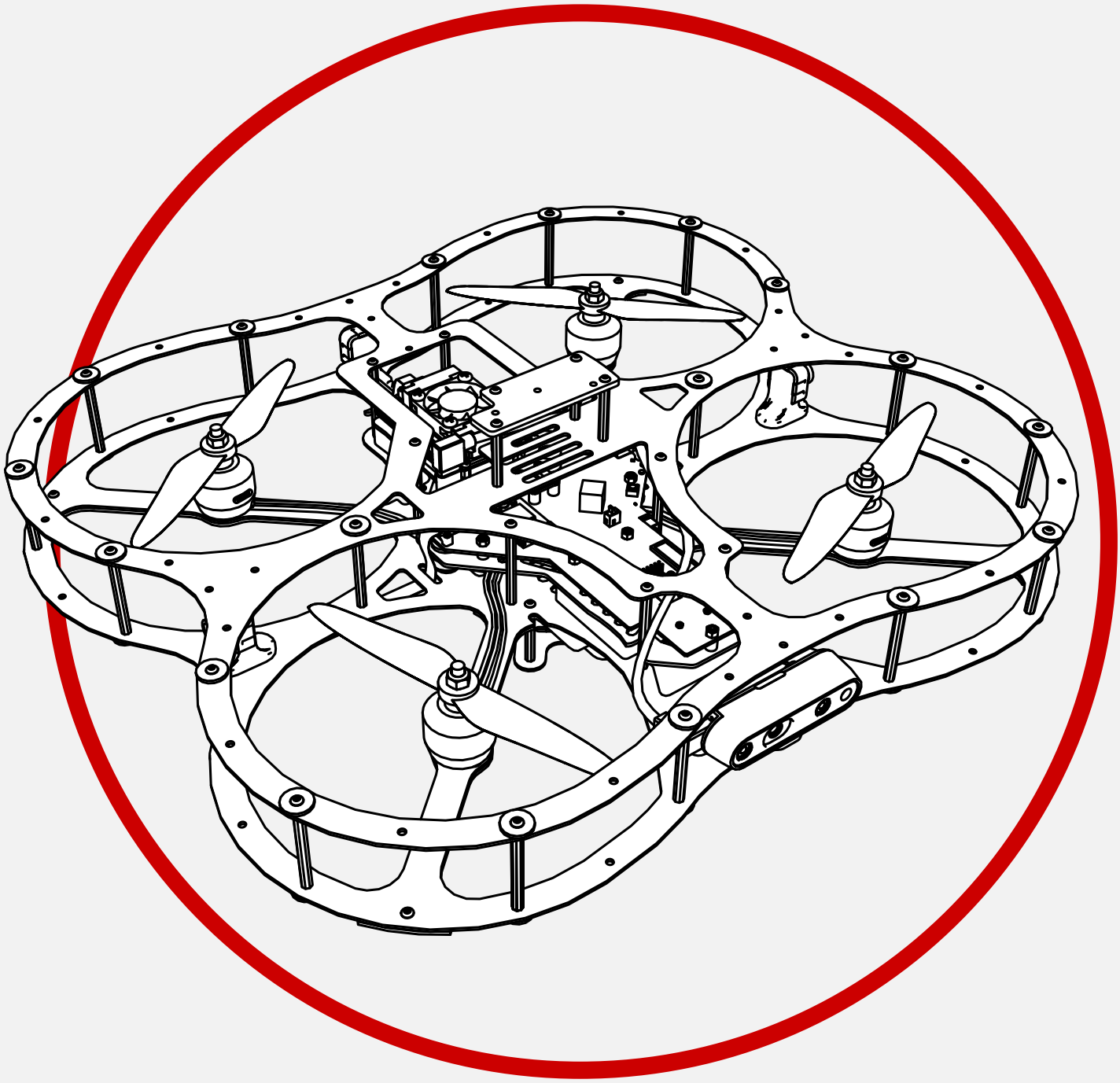

QDrone 2

User Manual – Connectivity

v 1.1 — 6*th February* 2025

For more information on the solutions Quanser offers,
please visit the web site at: http://www.quanser.com

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Caution

This equipment is designed to be used for educational and research purposes and is not intended for use by the public. The user is responsible for ensuring that the equipment will be used by technically qualified personnel only. **NOTE:** While the GPIO, and USB ports provides connections for external user devices, users are responsible for certifying any modifications or additions they make to the default configuration.

FCC Notice This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
Contains FCC ID: SQG-60SIPT

Industry Canada Notice This Class A digital apparatus complies with CAN ICES-3 (A). Cet appareil numérique de la classe A est conforme à la norme NMB-3 (A) du Canada.
Contains IC: 3147A-602230C

Waste Electrical and Electronic Equipment (WEEE)

This symbol indicates that waste products must be disposed of separately from municipal household waste, according to Directive 2012/19/EU of the European Parliament and the Council on waste electrical and electronic equipment (WEEE). All products at the end of their life cycle must be sent to a WEEE collection and recycling center. Proper WEEE disposal reduces the environmental impact and the risk to human health due to potentially hazardous substances used in such equipment. Your cooperation in proper WEEE disposal will contribute to the effective usage of natural resources.

CE Compliance CE

This product meets the essential requirements of applicable European Directives as follows:

- 2014/35/EU; Low-Voltage Directive (safety)
- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)
- 2014/53/EU; Radio Equipment Directive (RED)

Warning: This is a Class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures.

Caution

During flight QDrone 2 sound pressure level has been measured at 92 dBA at 1m away from the QDrone 2 and it is considered hazardous. Users shall ensure that they are not exposed to a sound level greater than the hazardous level as defined by the local authority. Use protective earpieces during operation.

Caution

The Intel RealSense D435 RGB-D camera is classified as a Class 1 Laser Product under the IEC 60825-1, Edition 3 (2014) internationally and EN 60825-1:2014+A11:2021 in Europe. The camera complies with FDA performance standards for laser products except for conformance with IEC 60825-1 Ed. 3 as described in Laser Notice No. 56, dated May 8, 2019.
Do not power on the product if any external damage is observed. Do not open or modify any portion of any laser product as it may cause the emissions to exceed Class 1. Invisible laser radiation when opened. Do not look directly at the transmitting laser through optical instruments such as a magnifying glass or microscope. Do not update laser product firmware unless instructed by Quanser.

Regular maintenance of QDrone 2:

- Inspect the propellers before flight to confirm they are not damaged or loose (able to move while the motor is not moving).
- Prior to using the QDrone 2, visually inspect the LiPo battery for damage (e.g., bloating). **DO NOT USE** the battery if damaged.
- Ensure that the battery and its cables are secured using the provided straps to avoid movement or damage during flight.
- Inspect the QDrone 2 frame before and after each flight to confirm that no major structural damage exists. Repair if needed.

Table of Contents

A. Network Setup

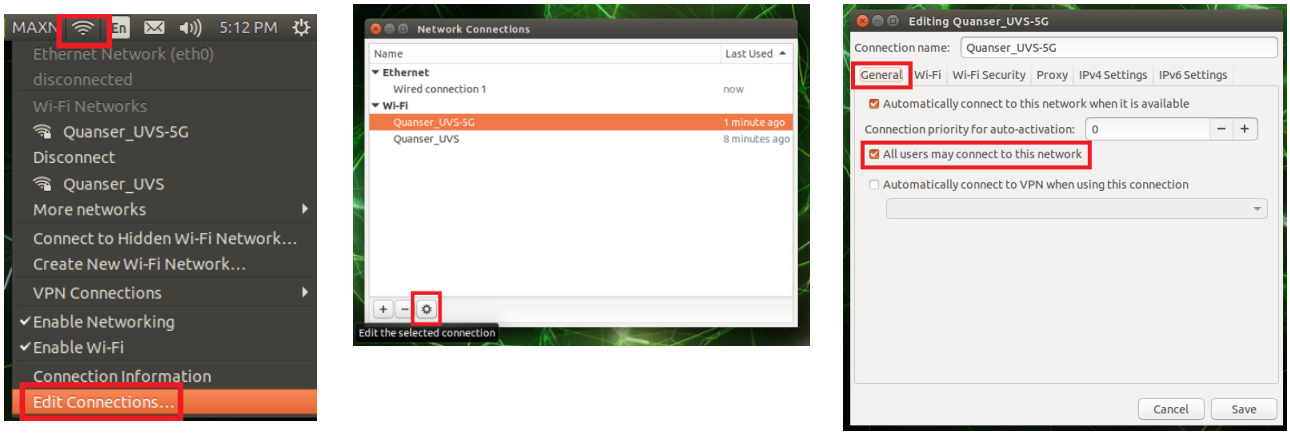
i. Wireless

The QDrone 2 is configured to automatically connect to the router provided with the Autonomous Vehicles Research Studio. The wireless access point (AP) settings for the network with the provided router are,

SSID	-	**Quanser_UVS** (2.4GHz) or **Quanser_UVS-5G** (5 GHz)
Password	-	**UVS_wifi**

If the QDrone 2 was not purchased as part of the studio package or if you choose to set up your own network, you will need to manually configure the Wi-Fi. Please keep the following considerations in mind:

1. The QDrone 2 can use either the 2.4GHz (full spectrum) or 5GHz (limited spectrum) bands. The 5GHz band at higher frequencies is disabled on the platform. Ensure that your 5GHz network is broadcasted over the channels in the range 36 to 60 and not higher.
   Note: The 2.4GHz band offers coverage over farther distances but performs at slower speeds. The 5GHz network offers higher bandwidth and data rates over shorter distances. For the QDrone 2, we usually prefer the 5GHz network due to the fast rate of sending data over a short distance.
2. Ensure that your router has the Dynamic Host Configuration Protocol (DHCP) server enabled. This will ensure that the router automatically assigns an IP address to the platform when it connects.
3. To have the QDrone 2 connect to your network, connect the drone directly as shown in section B. i. and use the Ubuntu Wifi configuration menu to connect to the desired network of your choice.
4. After connecting to your network, follow these steps to ensure that the platform can connect to the network when a user is not logged in (See Figure 2 for details).
   a. While the QDrone 2 is still connected directly as in section B. i, go to Wi-Fi Configuration > Edit Connections.,.. > Select your new network
   b. Click on the gear at the bottom of the screen
   c. Navigate to the General Tab and check the box that reads “All users may connect to this network”.



a. edit connections b. edit network configuration c. allow all users to connect

Figure 1. Allowing the QDrone 2 to connect to a network when not logged in

In this case, the LCD will show a wireless symbol highlighted in Figure 2, as well as the IPv4 address of the platform dynamically assigned by the provided router or the network of your choice.

Figure 2. Wi-Fi setup with the QDrone 2 platform

B. User Interface

i. Direct

The QDrone 2 platform can be used directly as a computer, complete with a 6-core CPU, an NVIDIA GPU, a built-in speaker, microphones and an extensive sensor suite.

Connect a keyboard/mouse combo using the provided USB port where the Intel RealSense Camera is connected to, and connect a monitor using the micro HDMI port on board with the provided micro HDMI to HDMI cable provided. The network can be set up using a wireless connection as described in section A. i.

Username: **nvidia**
Password: **nvidia**

Table 1. Login credentials for QDrone 2

This setup will typically be used when developing applications using Python/ROS directly on the QDrone 2 platform. Examples include: viewing collected datasets, training neural networks on-board, post processing collected data during an experiment, or developing image processing algorithms where fluid motion is required by the user.

ii. Remote

For applications that require the platform to be moving/flying or require remote access, a direct setup is not feasible. In such cases, a wireless setup may be used, with the provided Ground Control Station (GCS) (if the QDrone 2 was purchased as part of the Autonomous Vehicles Research Studio) or a machine of your choice. The PC must be connected to the same network as the QDrone 2.

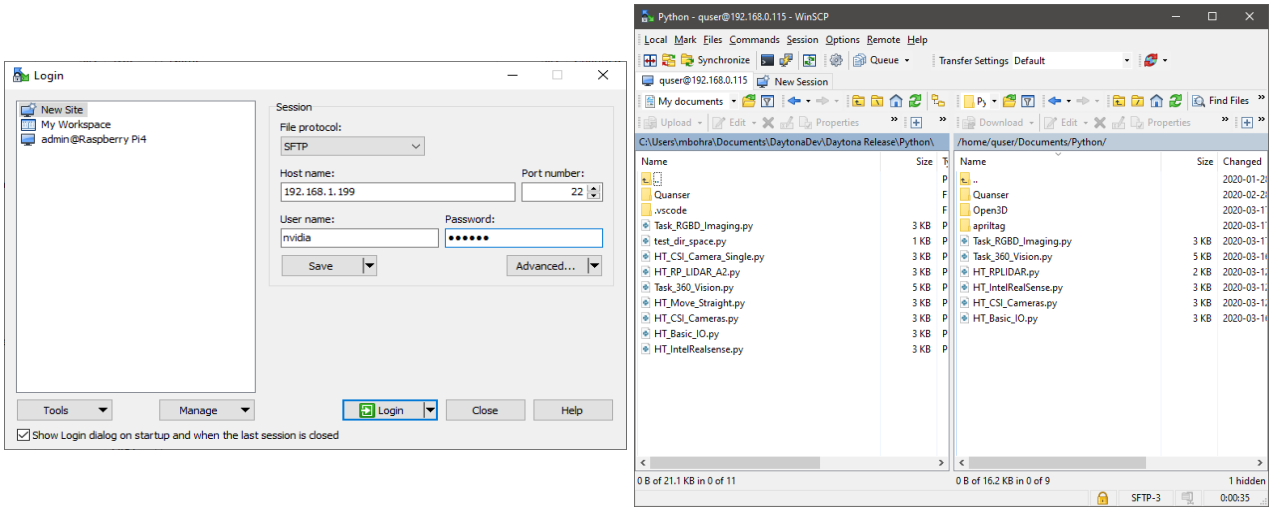
To ensure that your PC is connected to the same network as the platform. Use **`ipconfig`** (in a Windows command prompt) or **`ifconfig`** (in Ubuntu terminal) to check your current connectivity. You can also use the **`ping`** command in the console in both Windows and Ubuntu to check your connection to the QDone 2 by pinging the IP shown in the display of the QDrone 2, eg. If your drone was showing the IP in figure 2, this is what you would type on your console.

```
>> ping 192.168.2.19 -t
```

File Transfer

To transfer files between the GCS and the platform manually, a software tool **WinSCP** can be used, and is installed by default on the provided GCS. Find more information on WinSCP here. This can be used for one-time transfers of files, or you can navigate to a file onboard the QDrone 2, double click on it in WinSCP, and it will open in your default text editor in Windows. When the file is saved, it will automatically be transferred back to the drone.

To use WinSCP, enter the QDrone IP address as the host name, **`nvidia`** as the username, and **`nvidia`** as the password, as shown in Figure 3a. You can now use the WinSCP browsers to transfer files from the GCS (left browser) to the drone (right browser), shown in Figure 5b. Double clicking a file on the right will automatically transfer a copy of the file to your PC and open it in your default editor. You can also drag and drop files from one side to the next. Clicking save in your editor will automatically transfer the saved version back to the drone.



a. WinSCP login

b. WinSCP browser to transfer files

Figure 3. WinSCP usage for file transfer

PuTTY

Once your files are transferred, you can deploy them via remote terminal using a tool - **PuTTY**, which is also installed on the provided GCS. Find more information on PuTTY here. If you are familiar with Linux command-line text editors, you can also edit code on the QDrone 2 via PuTTY. PuTTY by itself is sufficient to access the file system and execute code that does not require any graphical feedback display.

If you have installed PuTTY and are using WinSCP, you could open a PuTTY terminal directly from the application clicking the button highlighted in figure 4.

Figure 4. Opening a PuTTY terminal through WinSCP

To use PuTTY as a standalone, open the application and enter the hostname or IP address of the QDrone 2 in the hostname field as shown in Figure 5 then click Open. You will be prompted to login (username **`nvidia`**, and password **`nvidia`**). Note that you can open more than one PuTTY terminal to the QDrone 2 if you need to.

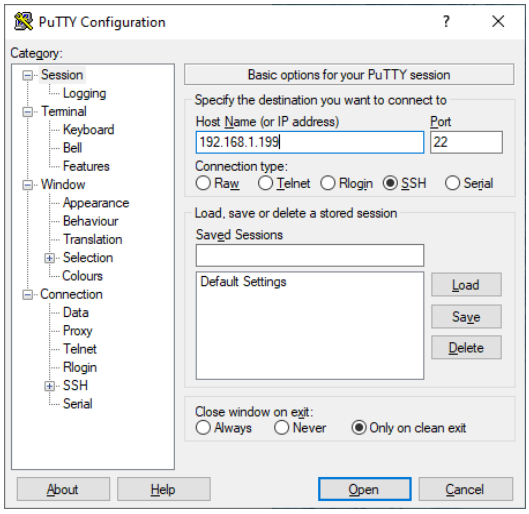


Figure 5. Connecting to the QDrone 2 with PuTTY

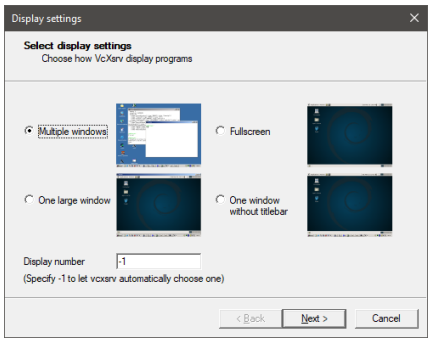
VcXsrv/XLaunch

If your code requires graphical feedback such as displaying image processing results, an X11 server can be used. This approach works well for plots, indicators, and low-frequency image displays, but since it sends uncompressed data over the WiFi, large image displays will have very slow frame rates. If you need to see image processing results in real-time, the **VNC** method is recommended instead. The advantage of the X11 interface is that it can be connected to the QDrone 2 from a cold boot (see the next section regarding VNC limitations).

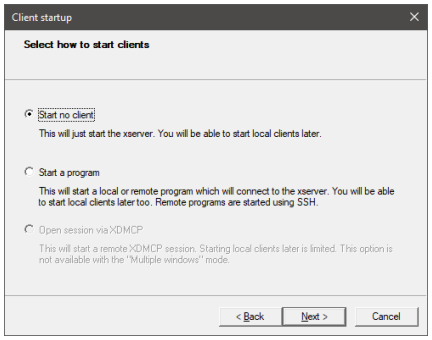
A PuTTY terminal is used to provide X11 forwarding but a display server must be present on the GCS. A tool - **VcXsrv** (under the name **XLaunch** in the start menu), has also been installed on the GCS by default for this purpose. Find more information on VcXsrv here. The basics steps are summarized below:

1. Launch **XLaunch** (VcXsrv server application).

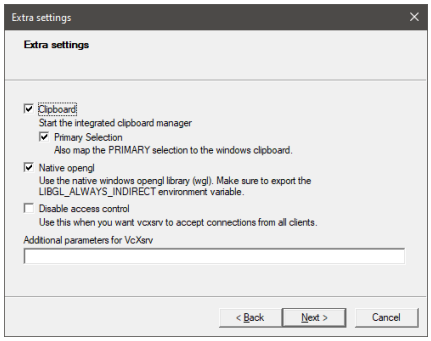
2. Pass through all four tabs with default options or set up your own configuration as in Figure 6 (as long as the 'start no client' option is selected as in Figure 6b) and click Finish.



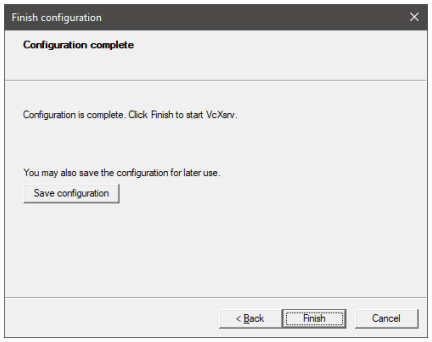
a. Multiple windows default



b. Ensure 'Start no Client' is selected



c. Start the clipboard manager and opengl



d. Save configuration if desired

Figure 6. XLaunch to start a display server on the GCS

3. An XLaunch display server should now be visible in your toolbar as shown in Figure 7.

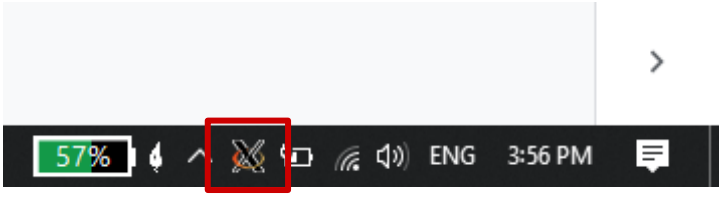
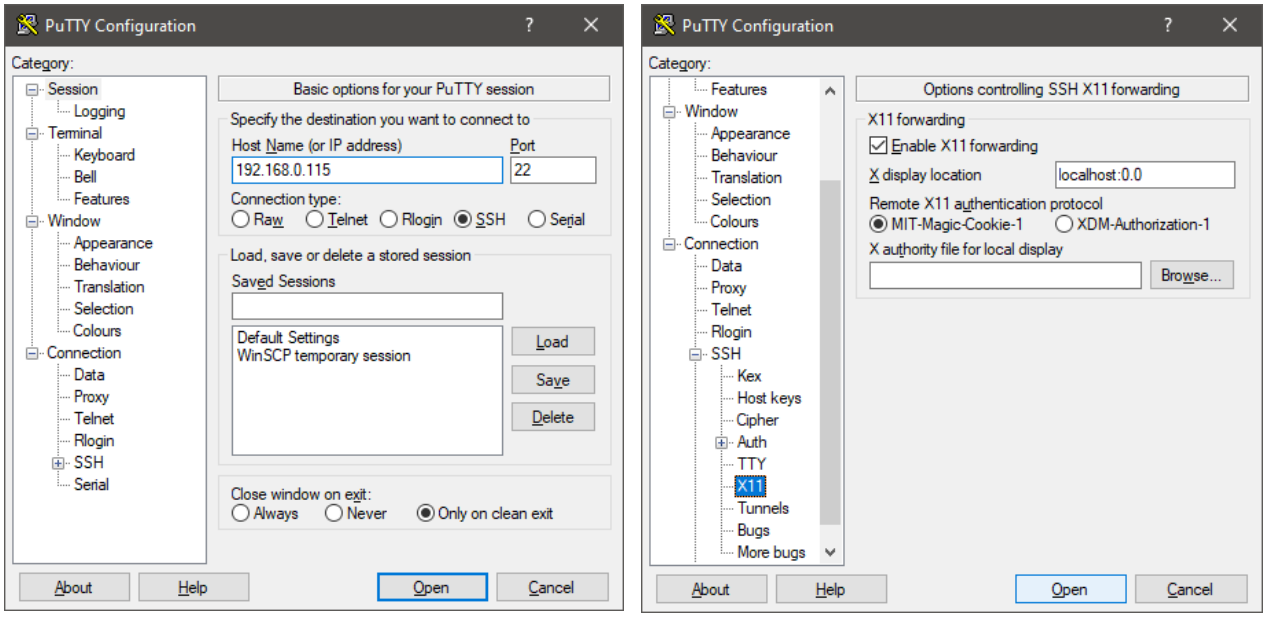


Figure 7. XLaunch display server

4. Launch **PuTTY**.
NOTE: A PuTTY terminal can be launched from WinSCP, but this will not allow you to

conveniently set up X11 forwarding. Launch Putty directly for additional set up capabilities.

5. Enter the IP address of the QDrone 2 under the Host Name field as shown in Figure 8a. Navigate to the **Connection/SSH/X11** tab as shown in Figure 8b. Check ON the **Enable X11 forwarding** option, and enter **`localhost:0.0`** in the **X display location** field. Click on Open.



a. PuTTY login b. X11 forward

Figure 8. PuTTY usage to setup a remote terminal

6. Login using the QDrone 2 credentials (username **`nvidia`**, and password **`nvidia`**).

7. Type the following command to ensure that the display server is set up.

```
>> echo $DISPLAY
```

This should return an output similar to the one shown in Figure 9.

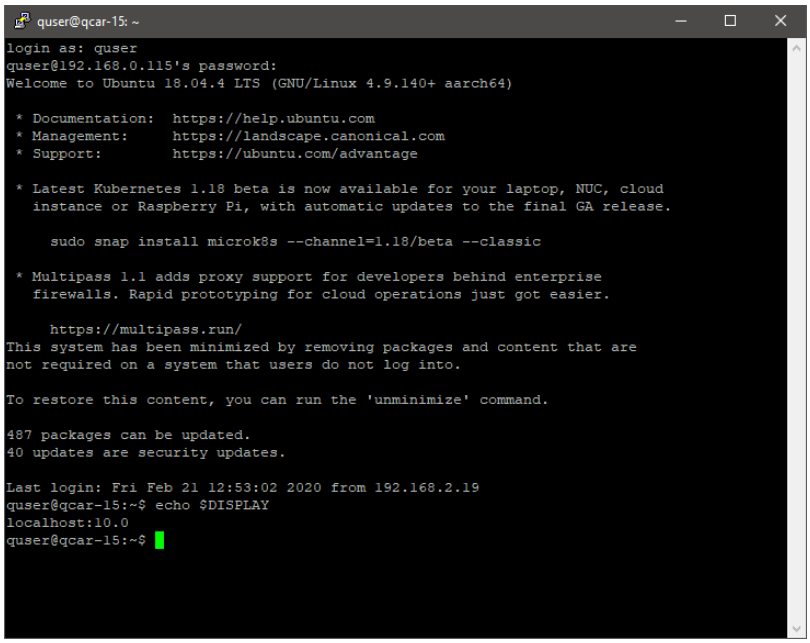


Figure 9. PuTTY remote terminal connected to a display server

8. Type in a test command,

   `>> chromium-browser`

   And the chromium application from the QDrone 2 should display on your GCS display server in Windows. Applications such as python scripts now deployed via the remote PuTTY terminal will forward their display outputs (if any) to the GCS.

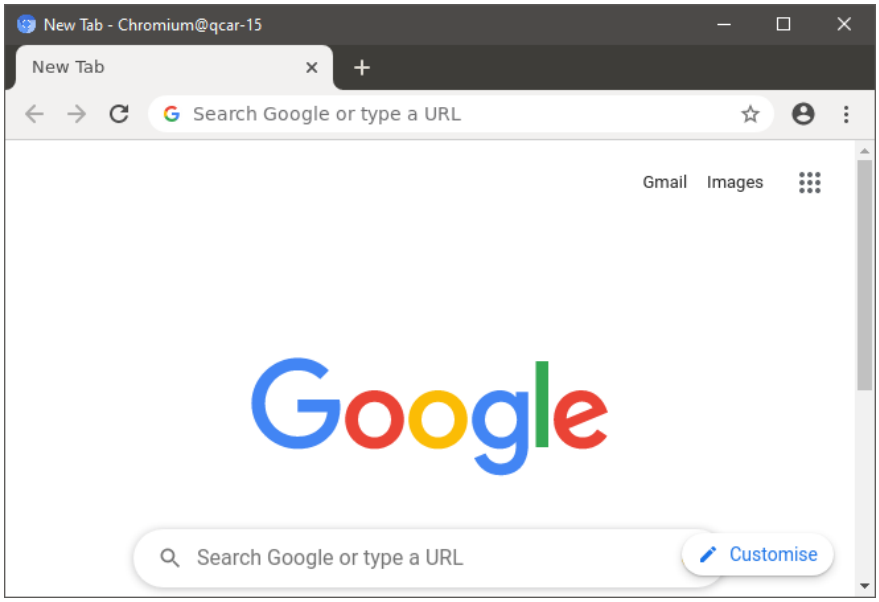


Figure 10. Chromium application launched on GCS

VNC Viewer

The final method of remote access with the QDrone 2 is to use a remote desktop application such as VNC Viewer (if you do not have VNC Viewer installed you may download the application by going here). The advantage of this approach compared to using VcXsrv/XLaunch is that the QDrone's desktop VNC server sends compressed image data to the remote desktop which allows for higher frame rates (though not as high as the direct connection method). This is useful for remotely monitoring image processing outputs. This approach also gives you the full graphical desktop which may be easier for users less familiar with Linux commands. The disadvantage of this approach is that the QDrone 2 must be first powered up with an HDMI monitor before a VNC connection can be established.

A VNC server has been pre-installed on the QDrone 2. To connect from the GCS you will need to perform the following steps:

For the QDrone 2

1. Connect a monitor to the micro HDMI port on the drone
2. Make sure the drone has a charged battery to stay on while you do this
3. Power **ON** the drone.
4. Switch the ESC disable switch so that the LED next to it appears red. This will disable the props for safety.
5. Once you log into the QDrone 2's desktop, you may remove the HDMI cable from the drone.

   Note: If it does not automatically log into the desktop, you will need to connect a keyboard to enter the password (**nvidia**). You may optionally follow the steps in the User Manual - Troubleshooting **Section C Connectivity** to enable auto-login.

For the Ground station:

1. Open VNC viewer
2. In the VNC connect window enter the IP address of the QDrone 2 which can be found on the LCD screen shown in the section A.

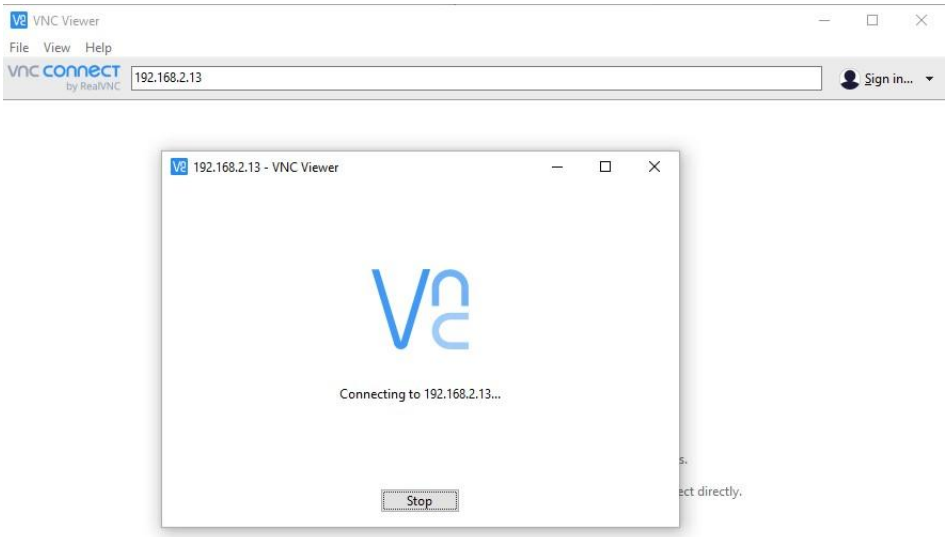


Figure 11. VNC Viewer connection screen.

3. When prompted to allow the remote desktop connection click on yes.

4. You will be asked for the user password for the QDrone in order to start the remote desktop connection. You may optionally check the box to 'Remember password'.

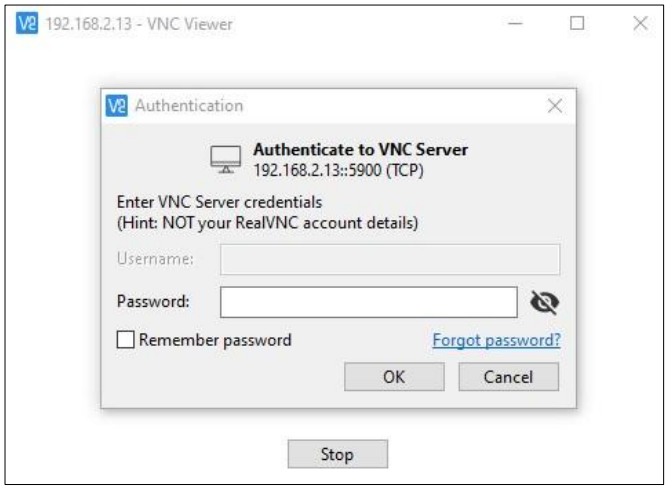


Figure 12 VNC Viewer credential screen.

5. A successful connection will take you to the main user desktop.

Figure 13. QDrone 2 Ubuntu user screen

Note, you can also try reducing the desktop resolution, and Appearance Behavior from High visual effects to Low visual effects. You can select which combination of features, desktop space, and interface responsiveness work best for your workflow. A resolution of 800x600 should produce a very responsive display over WiFi.

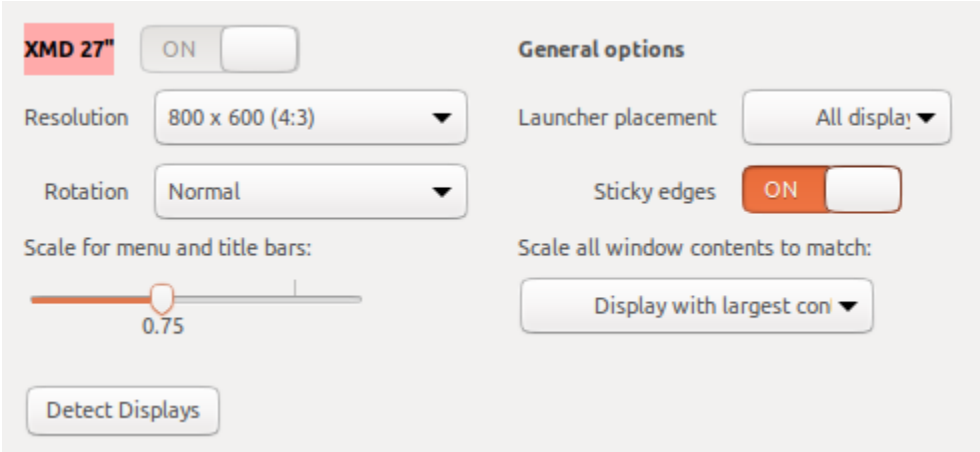


Figure 14. Setting the display settings in Ubuntu to 800 x 600 will produce a responsive display.

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