KENTECH
Korea Institute of Energy Technology

Visionary Course – Energy AI
Lecture 07

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Assemble Your JetRacer Hardware

Materials

Visit the followings:

- https://www.waveshare.com/wiki/JetRacer_Pro_AI_Kit
- https://www.waveshare.com/w/upload/f/fa/Jetracer_pro_Assembly_EN.pdf

WAVESHARE
share awesome hardware

JetRacer Pro AI Kit

Assembly Manual

Package Content

Assembly Manual

User Guide

CONTACT US

Sales		Supports	
Email: sales@waveshare.com		Email: service@waveshare.com	
Skype: sales@waveshare		Skype: service@waveshre	
Time(GMT+8)			
9:00-12:00	14:00-18:00	(Mon.To Fri.)	
9:00-12:00	14:00-17:00	(Sat.)	

1. Jetson Nano (B01) (Optional)
2. Micro SD Card 64GB (Optional)
3. On-road chassis
4. JetRacer Pro expansion board
5. Wireless-AC8265 with antennas
6. IMX219-160 Camera
7. Acrylic camera spacer
8. Camera holders
9. Wireless gamepad
10. Cooling fan
11. 6Pin cable
12. Micro SD card reader
13. Spanner
14. Screwdrvier × 2
15. 8.4V battery charger + EU head
16. Screws pack
17. Track map

[Note] The components with (Optional) suffix are not included in Acco Kit. We do not provide 18650 batteries, you need to purchase them separately.

Screws/standoffs diagram

The screws of cooling fan are not listed here.

1. Set camera holder and antenna on Jetracer Pro Expansion board.
2. Connect the cables of motor, servo and the DEH to the expansion board according to the picture below.
3. Fix JetRacer Pro Expansion board on chassis.
4. Put the Jetson Nano Developer Kit and fix it.
5. Remove the Jetson Nano board, connect the wireless card and connect the antenna.
6. Replace Jetson Nano. Assemble cooling fan by its own screws. Connect the wires to the fan interface. Connect the Jetson Nano Developer Kit to JetRacer Expansion board by 6PIN wires.
7. Mount camera on its holder by nylon screws. Note that the Acrylic board should be put between camera and the metal holder to avoid shorting. Finally, assemble the antenna.

1. Install Image

Go to the Wiki page of JetRacer Pro, download the image from the link provided. Unzip it and write the .img file to TF card by DiskImager software.

2. Update codes

To dispaly voltage/current and drive the JetRacer Pro normally, you need to download and install our codes, please refer to Waveshare WIKI.

3. Use the Gamepad

You should connect the Adapter to host PC. The Gamepad has three modes, it is in MODE 1 by default, you can press the HOME button to switch it to MODE 2 and long-press it for 7s to switch it to MODE 3. We recommend you to use MODE 2 or MODE 3.

4. Test motors

When testing motors and gear servo by codes, you can adjust the value of throttle and gear for smoothly moving.

FAQ

1. What batteries does JetRacer Pro AI Kit use?

3.7V, 18650 battery × 4 (two in parallel, two in series)

2. How to charge batteries?

The 8.4V power adapter provided is used to charge batteries on board, you can connect it to the 8.4V port of expansion board to charge batteries when working. We still recommend you charge batteries at freetime for longer battery lifetime. At the first time you assemble the batteries, please charge them on board for a while to make them work.

3. It seems that the Gamepad doesn't work?

Please check if you turn on the power switch first.Before you use it, we recommend you long-press HOME button for about 7s to set the Gamepad to XBOX mode. XBOX mode is the exact working mode used by NVIDIA example.

DO NOT reverse batteries poles to avoid damaging product

Waveshare Website

Waveshare WIKI

Waveshare Electronics

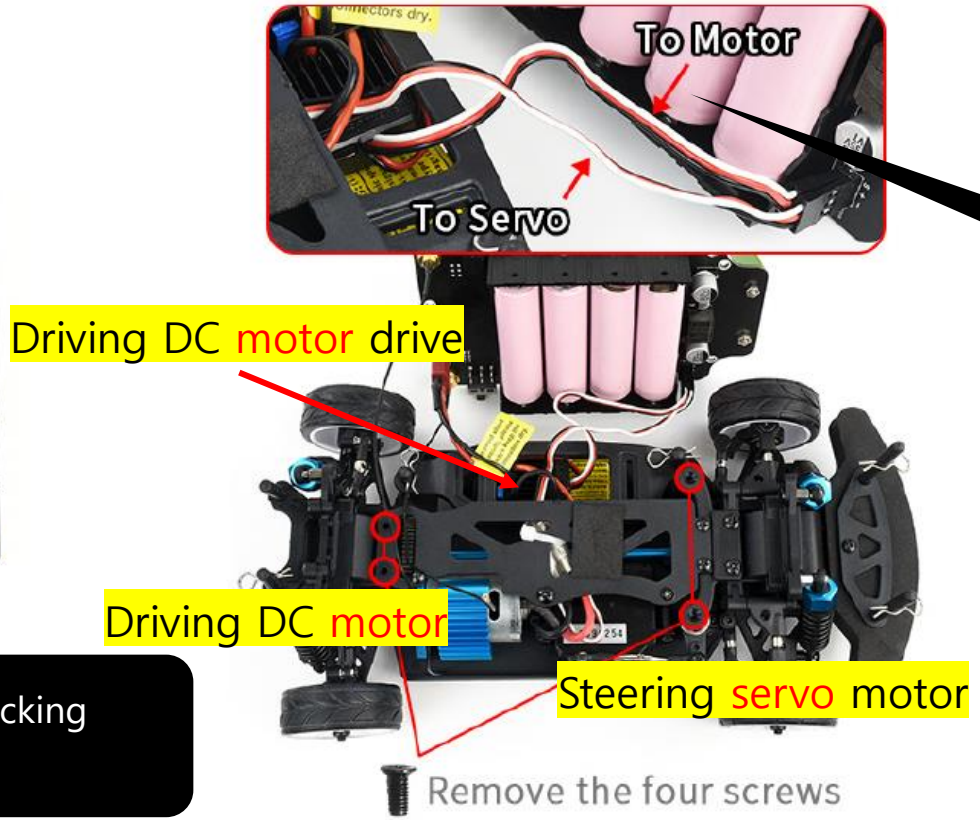
10F,International Science & Technology Building, Fuhong Rd, Futian District, Shenzhen, China

Assembly Steps 1-2

1. Set camera holder and antenna on Jetracer Pro Expansion board.

Please, double check the stacking order of the components.

2. Connect the cables of motor, servo and the DEH to the exapension board according to the picture below.



2-1. Power line connection is needed from the battery pack on the expansion board to the driving motor

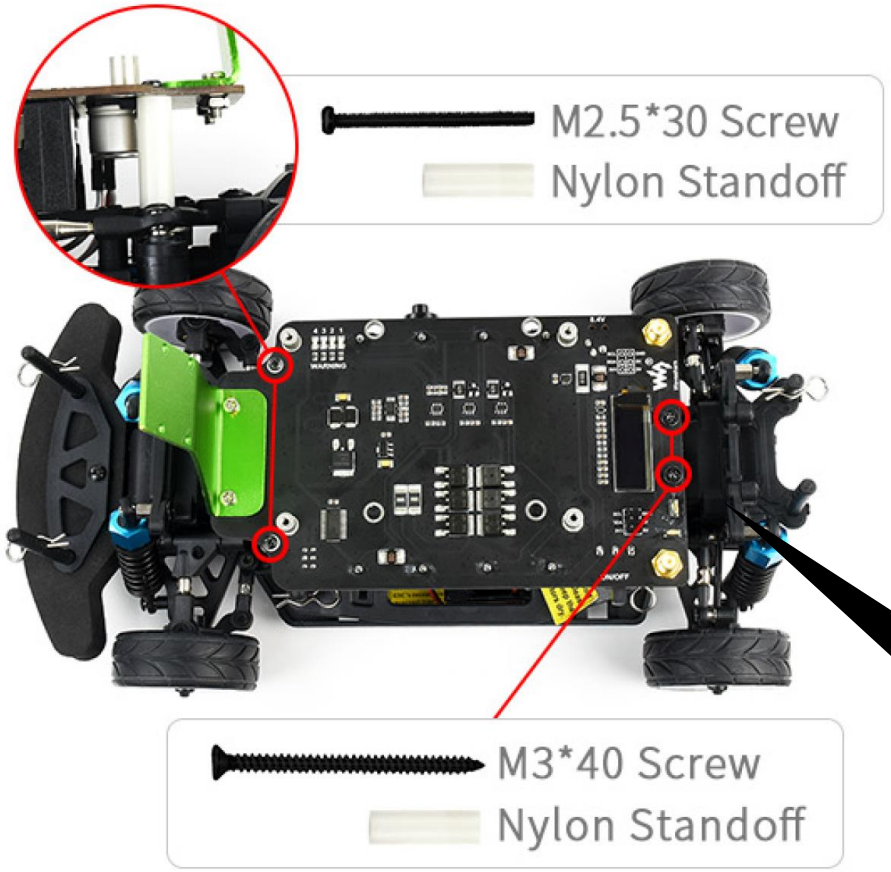
Please, double check whether the lines are connected to right pin header.

Color Convention:

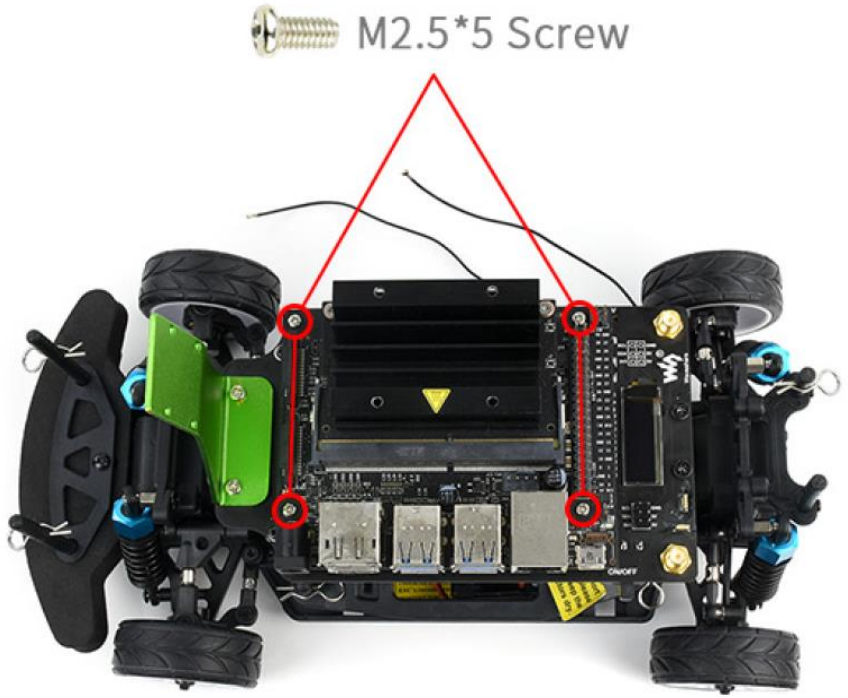
- White – Signal
- Red – Power/Ref (+ Voltage)
- Black – Ground (0 Voltage)

Assembly Steps 3-4

3. Fix JetRacer Pro Expansion board on chassis.

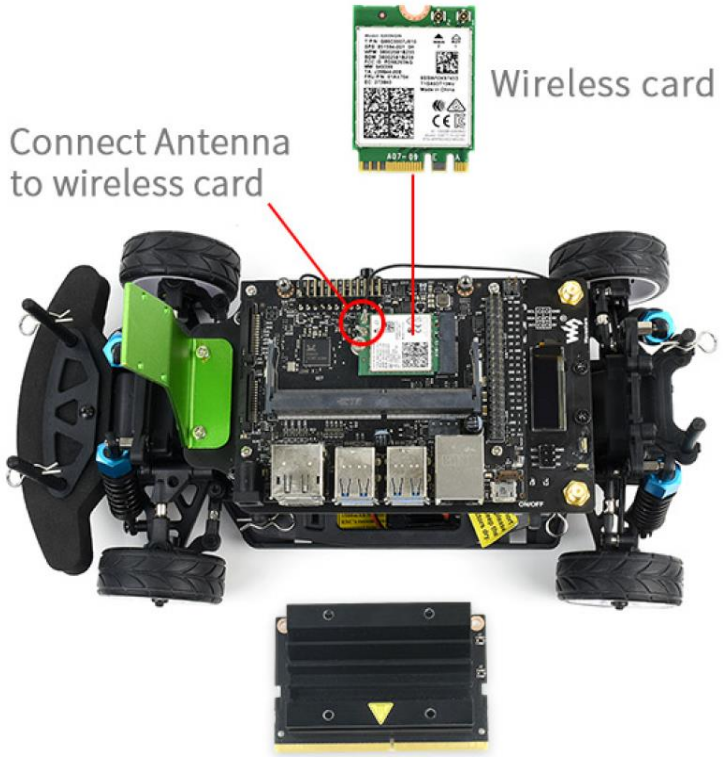


4. Put the Jetson Nano Developer Kit and fix it.



Assembly Steps 5-6

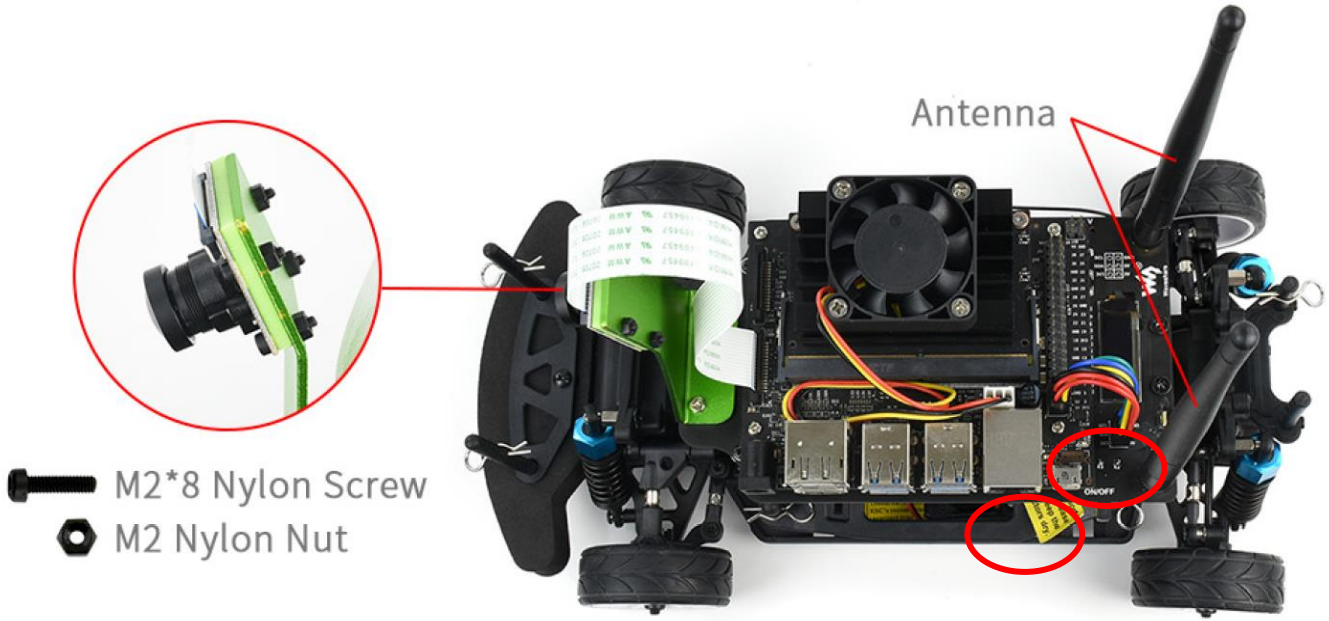
5. Remove the Jetson Nano board, connect the wireless card and connect the antenna.



6. Replace Jetson Nano. Assemble cooling fan by its own screws. Connect the wires to the fan interface. Connect the Jestson Nano Developer Kit to JetRacer Expansion board by 6PIN wires.

Assembly Step 7

7. Mount camera on its holder by nylon screws. Note that the Acrylic board should be put between camera and the metal holder to avoid shorting. Finally, assemble the antenna.



Turn on two power switches
for Jetson nano & DC motor drive

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Configure Your JetRacer Software

Software Setup

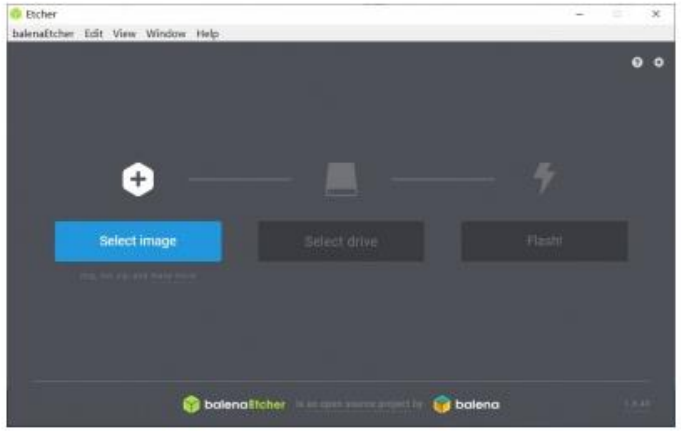
Step 1. Write JetRacer image to SD card

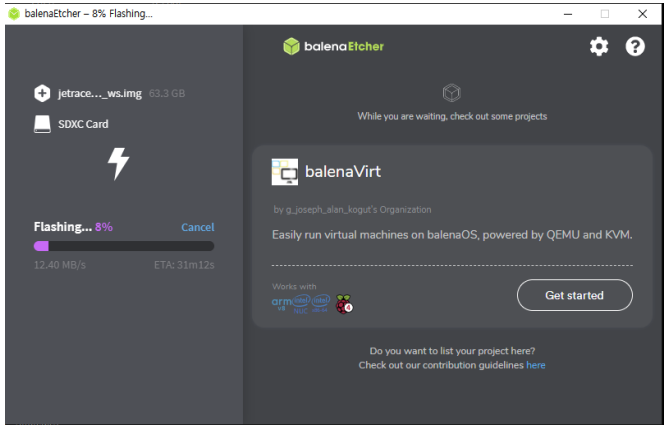
1. Go to the JetRacer page, and download the Ubuntu image file.

   → JetRacer Pro AI Kit - Waveshare Wiki (Google search)

2. Install OS image on the SD card.

- Connect the SD card to PC via a card reader
- User Etcher software to write the image (unzip above) to SD card.Click here to download Etcher software





- After writing, eject the SD card

- `jetracer_pro_ws.img`
- Balena Etcher (link)

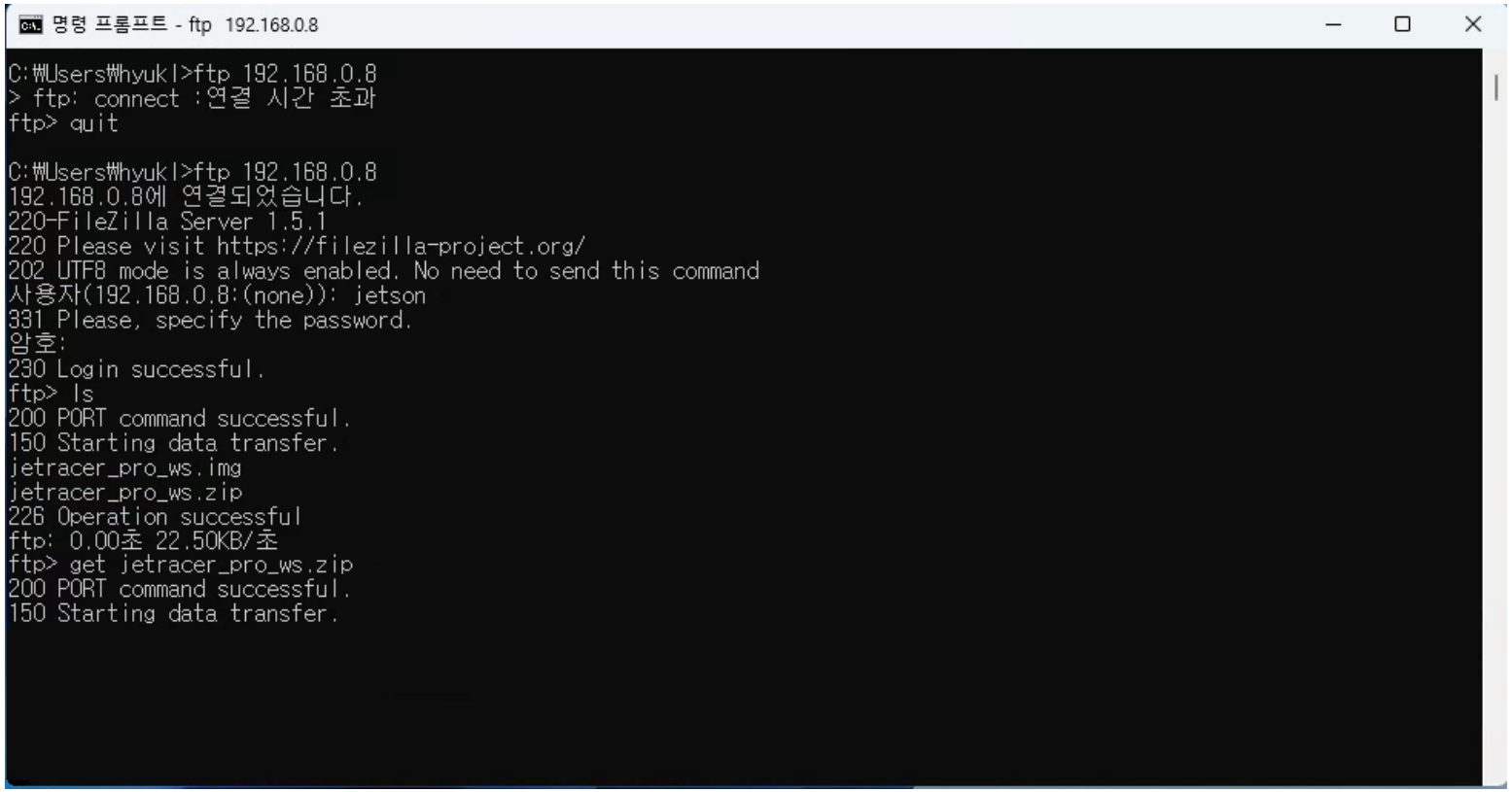
https://www.waveshare.com/wiki/JetRacer_Pro_AI_Kit

Software Setup

https://filezilla-project.org/

If it is too slow to download the Ubuntu image file, download it locally.

How: Use a local ftp server (FileZilla Server), which is setup on the lecturer's PC.



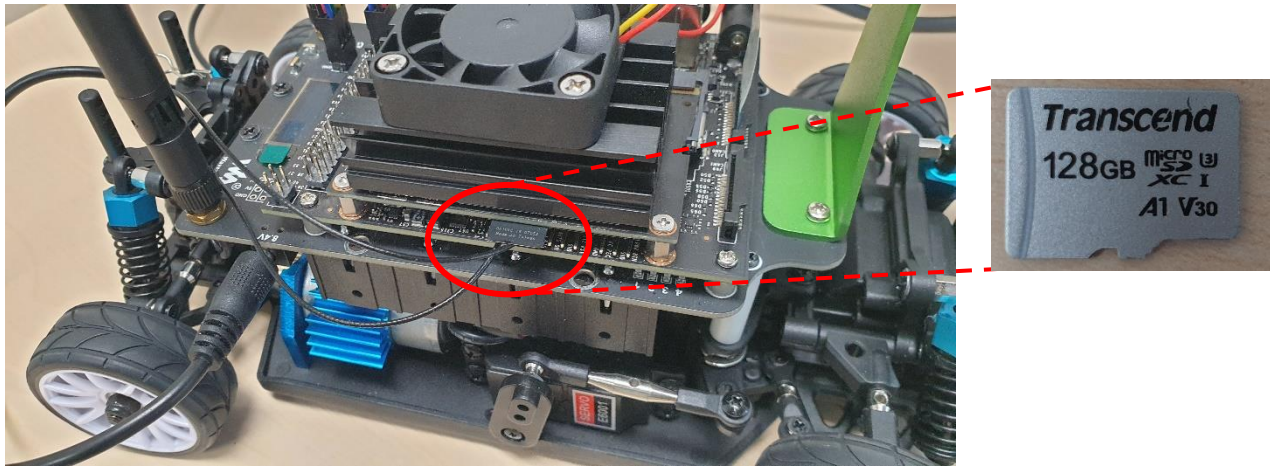

```
IP: 217.xxx
ID: jetson
PW: jetson
```

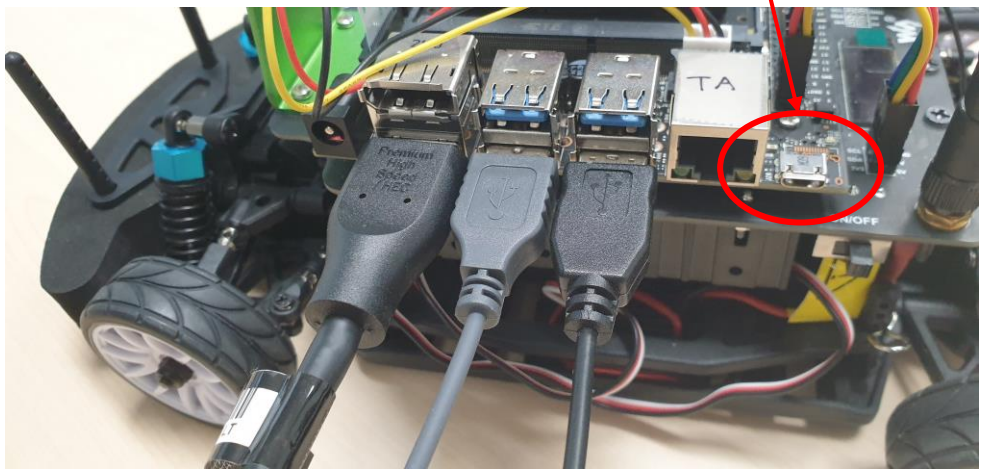
Software Setup

Step 2. Startup Jetson Nano Developer Kit

USB Micro B Type Connector
for Jetson nano Power

1. Insert SD card to SD card slot of Jetson Nano (slot is under Jetson Nano board)



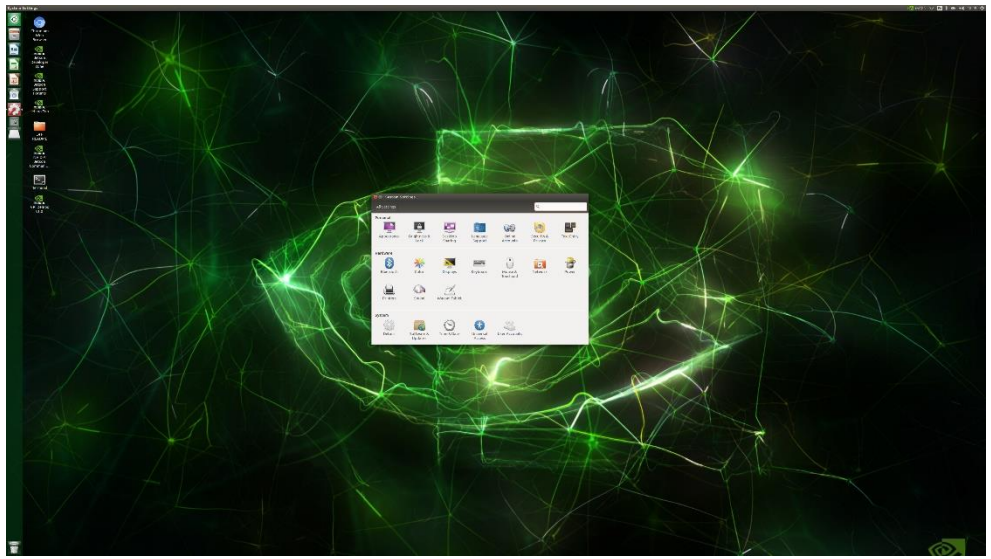


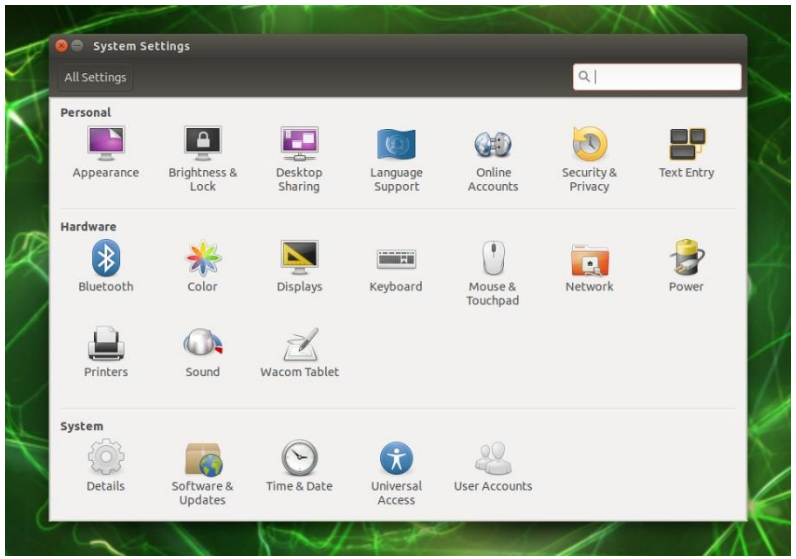
2. Connect your KVM (keyboard, video, and mouse) cables to Jetson Nano
3. Turn on the power switch to start the Jetson Nano.
4. Login your Jetson Nano Ubuntu OS. The default ID/password is **jetson/jetson**.

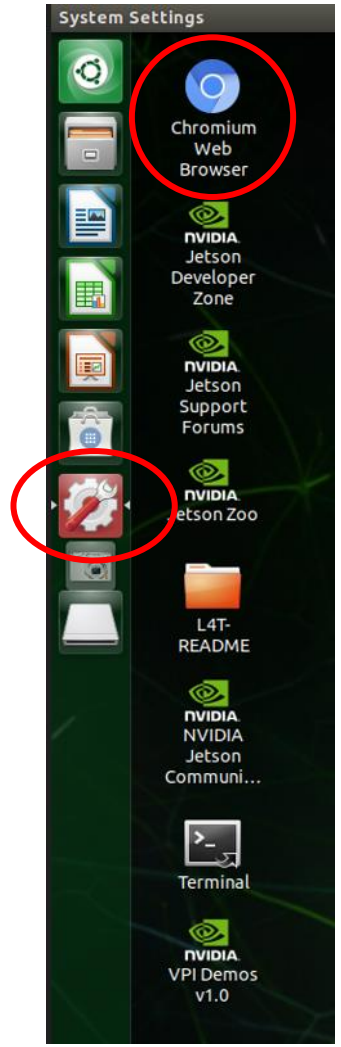
Software Setup

Step 3. Connect JeRacer to WIFI

1. Click ***System Settings*** icon → ***Network*** incon







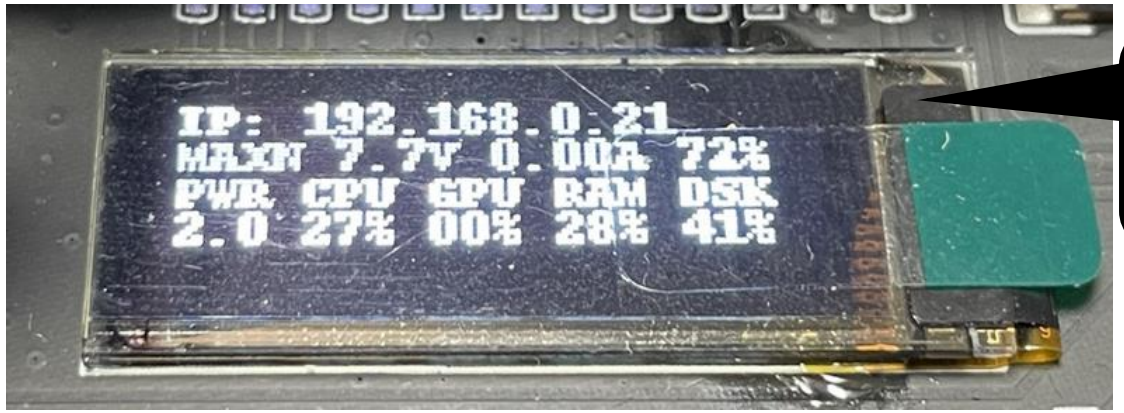
2. Configure WiFi network using KENTECH Guest SSID!
3. Test whether you can access Internet via the WiFi network using Chrome Web Browser.

Software Setup

+ How to connect WiFi:

→ Connect display via HDMI → SSID: **`KENTECH Guest`**

→ You can check the IP address in your board.




```
IP: 192.168.***.***
Battery: 7.7 V (72 %)
CPU/GPU/RAM/DSK usage
```

*Batteries will be distributed for the JetRacer Project.

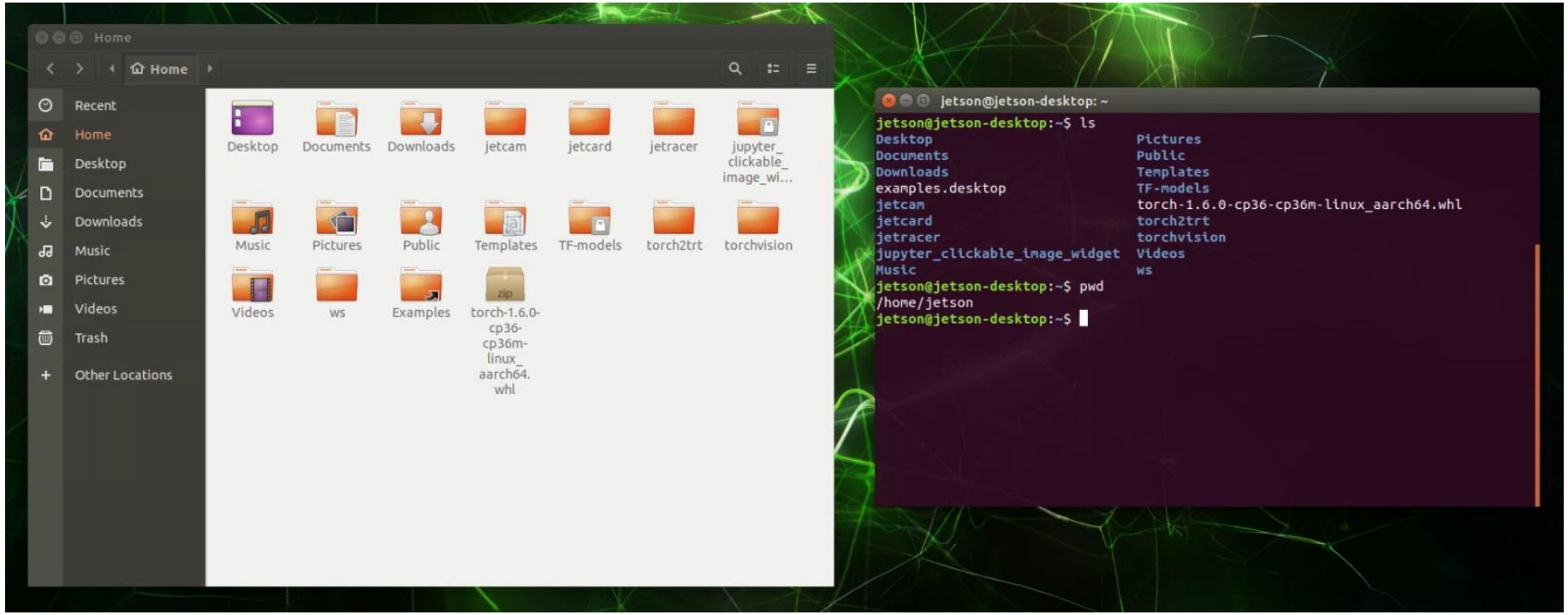
*Charge cut-off voltage **4.2V**, discharge cut-off voltage is **3.0V**.

→ For teams who didn't/can't connect WiFi, please get helps from TA.

Software on Ubuntu OS

Step 1. Open my home folder

1. Click ***Files*** icon
2. Click ***Terminal*** icon → type *ls* & enter → type *pwd* & enter
3. **List the folders and files on my home folder.**



Software on Ubuntu OS

Step 2. Create a folder on the terminal

1. Type *mkdir myfolder* & enter to create a folder
2. Type *mv myfolder ourfolder* & enter to change the name
3. Type *cd ourfolder* & enter to change the current folder
4. Type *ls* & enter to see the files and folders on the current folder

   (currently, it is empty.)
5. Type *touch empty.txt* & enter to create an empty text file
6. Type *ls -l* & enter to see the files and folders on the current folder
7. Type *cd ..* & enter to go up a folder

For more information, https://www.youtube.com/watch?v=-BQtLkZMXnA

Examples of Linux Commands

jetson@jetson-desktop: ~

```
jetson@jetson-desktop:~$ pwd
/home/jetson
jetson@jetson-desktop:~$ ls
Desktop    examples.desktop  jetracer                      Pictures   TF-models                                  torchvision
Documents  jetcam            jupyter_clickable_image_widget Public     torch-1.6.0-cp36-cp36m-linux_aarch64.whl  Videos
Downloads  jetcard           Music                         Templates  torch2trt                                  ws
jetson@jetson-desktop:~$ python -V
Python 2.7.17
jetson@jetson-desktop:~$ python3 -V
Python 3.6.9
jetson@jetson-desktop:~$ ll
total 262928
drwxr-xr-x 30 jetson jetson      4096 3月  27 17:44 ./
drwxr-xr-x  3 root   root        4096 3月   9  2021 ../
-rw-------  1 jetson jetson      8973 3月  27 18:48 .bash_history
-rw-r--r--  1 jetson jetson       220 3月   9  2021 .bash_logout
-rw-r--r--  1 jetson jetson      3771 3月   9  2021 .bashrc
drwx------ 14 jetson jetson      4096 3月  11  2021 .cache/
drwx------  3 jetson jetson      4096 3月  10  2021 .compiz/
drwx------ 16 jetson jetson      4096 3月  11  2021 .config/
drwxr-xr-x  2 jetson jetson      4096 3月   9  2021 Desktop/
drwxr-xr-x  2 jetson jetson      4096 3月   9  2021 Documents/
drwxr-xr-x  2 jetson jetson      4096 3月   9  2021 Downloads/
```

```
$ pwd
$ ls
$ python -V
$ python3 -V
```

```
jetson@jetson-desktop:~$ sudo adduser slee
[sudo] password for jetson:
Adding user `slee' ...
Adding new group `slee' (1002) ...
Adding new user `slee' (1001) with group `slee' ...
Creating home directory `/home/slee' ...
Copying files from `/etc/skel' ...
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
Changing the user information for slee
Enter the new value, or press ENTER for the default
        Full Name []:
        Room Number []:
        Work Phone []:
        Home Phone []:
        Other []:
Is the information correct? [Y/n]
Adding new user `slee' to extra groups ...
Adding user `slee' to group `audio' ...
Adding user `slee' to group `gdm' ...
Adding user `slee' to group `gpio' ...
Adding user `slee' to group `i2c' ...
Adding user `slee' to group `lightdm' ...
Adding user `slee' to group `video' ...
Adding user `slee' to group `weston-launch' ...
jetson@jetson-desktop:~$ sudo usermod -aG sudo slee
jetson@jetson-desktop:~$
```

User ID: “Your-Email-ID”
Passwd: “Your-Student-ID”

jetson@jetson-desktop: ~

```
jetson@jetson-desktop:~$ ifconfig
eth0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        ether 48:b0:2d:5b:c1:d1  txqueuelen 1000  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device interrupt 150  base 0xe000

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1  (Local Loopback)
        RX packets 1137  bytes 183842 (183.8 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 1137  bytes 183842 (183.8 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

rndis0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        inet6 fe80::f402:a6ff:fe86:e36d  prefixlen 64  scopeid 0x20<link>
        ether f6:02:a6:86:e3:6d  txqueuelen 1000  (Ethernet)
        RX packets 17806  bytes 1048774 (1.0 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 28535  bytes 43428645 (43.4 MB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

usb0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        ether f6:02:a6:86:e3:6f  txqueuelen 1000  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.0.21  netmask 255.255.255.0  broadcast 192.168.0.255
        inet6 fe80::1e95:b92e:ee1:fc21  prefixlen 64  scopeid 0x20<link>
        ether e8:84:a5:f5:e7:a4  txqueuelen 1000  (Ethernet)
        RX packets 149757  bytes 25076894 (25.0 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 228865  bytes 138651377 (138.6 MB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

```
$ ifconfig
→ What is your IP?
→ What is wlan?
```

***Please create an account for each team member following below commands.**

```
$ sudo adduser [your_student_id]
$ sudo usermod -aG sudo [your_student_id]
$ cat /etc/passwd
$ cat /etc/group
```

Software on Ubuntu OS

Step 3. Edit your text file using GUI editor

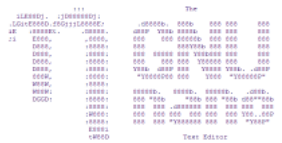
1. Click **Search your computer** or **Software**
2. Execute gedit Text Editor
3. Open the empty.txt
4. Write your team members' names
5. Save it
6. Close it
7. On the terminal, type *cat empty.txt* & enter

   (try more, less, head, tail commands)

If you want to how to use a Linux command, type the *command --help* & enter.

Software on Ubuntu OS

Step 3. Edit your text file in your terminal



1. Install nano by typing *sudo apt-get install nano* & enter
2. Move to the ***ourfolder***
3. Type *nano hello.py* & enter
4. Write a simple Python code such print(‘Hello, world!’)
5. Save and exit
6. Type *python3 hello.py* & enter

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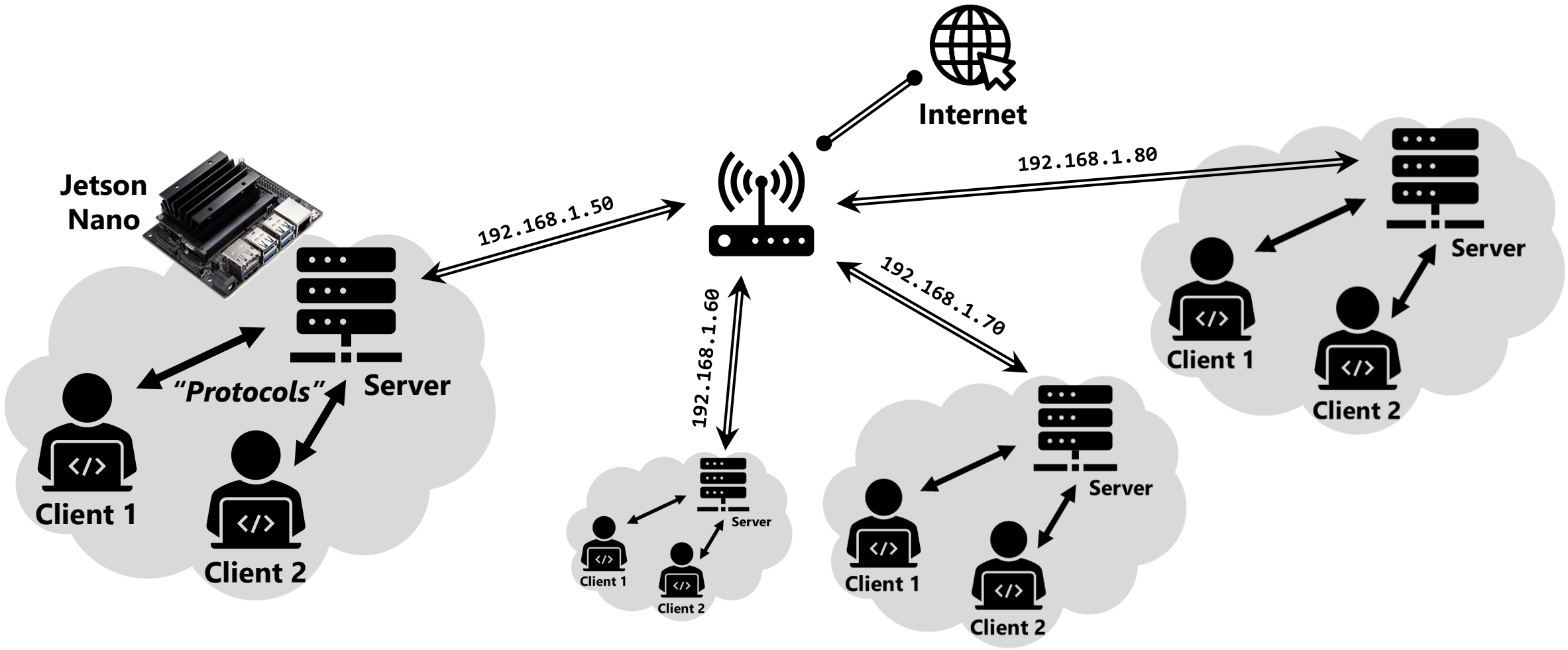
Access Your JetRacer Remotely

Basic Development Environments for CS Engineering

How to communicate remotely with a server?



Option 1. Jupyter Notebook

+ Using Jupyter Notebook

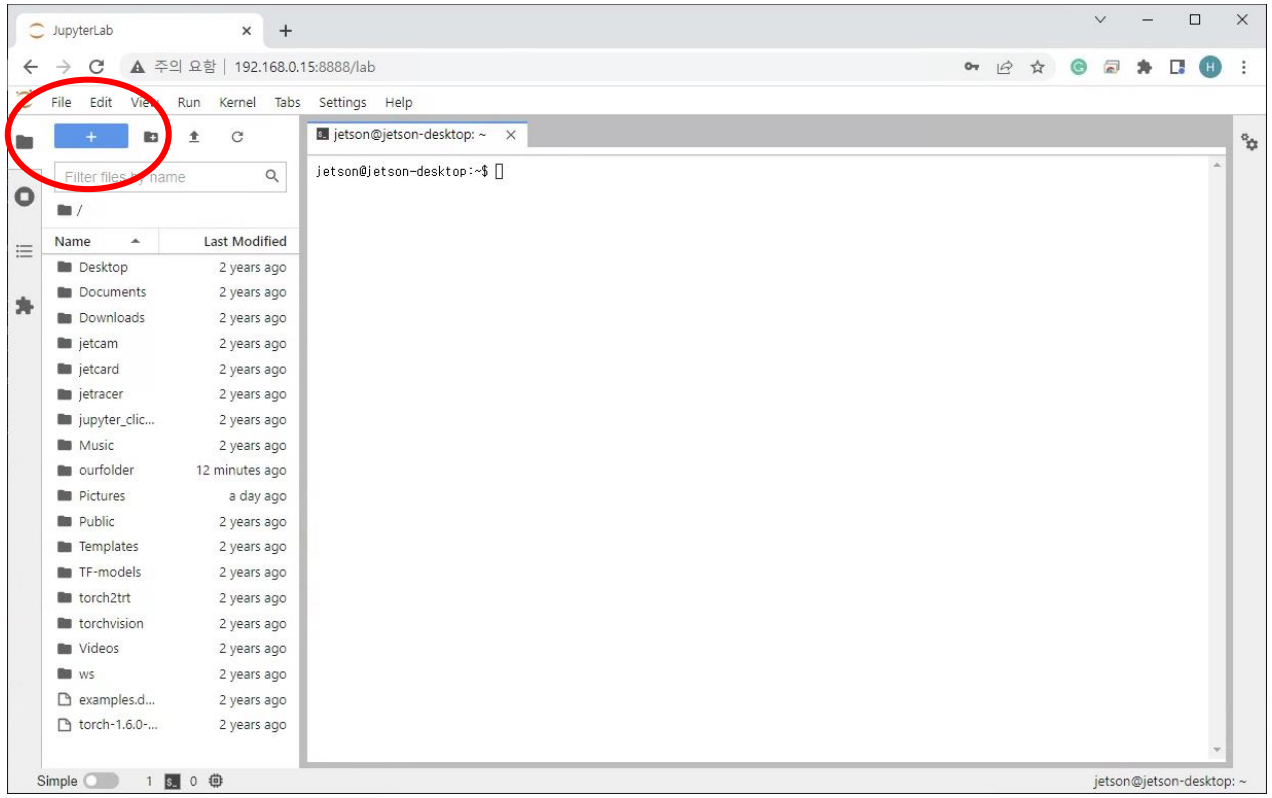
→ Web-based terminal & code editor.

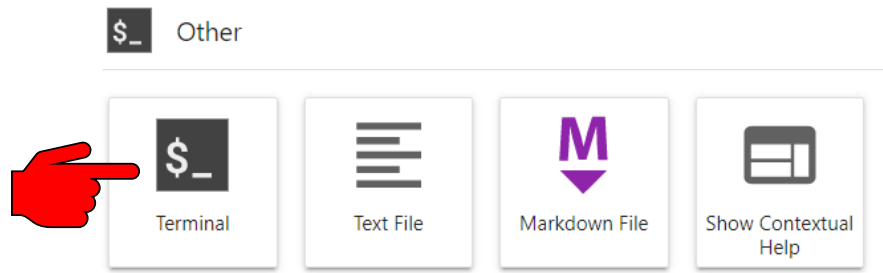
→ Open a new browser tab and navigate to `http://192.168.***.***:8888`

IP address

Port number for Jupyter

Passwd: **jetson**

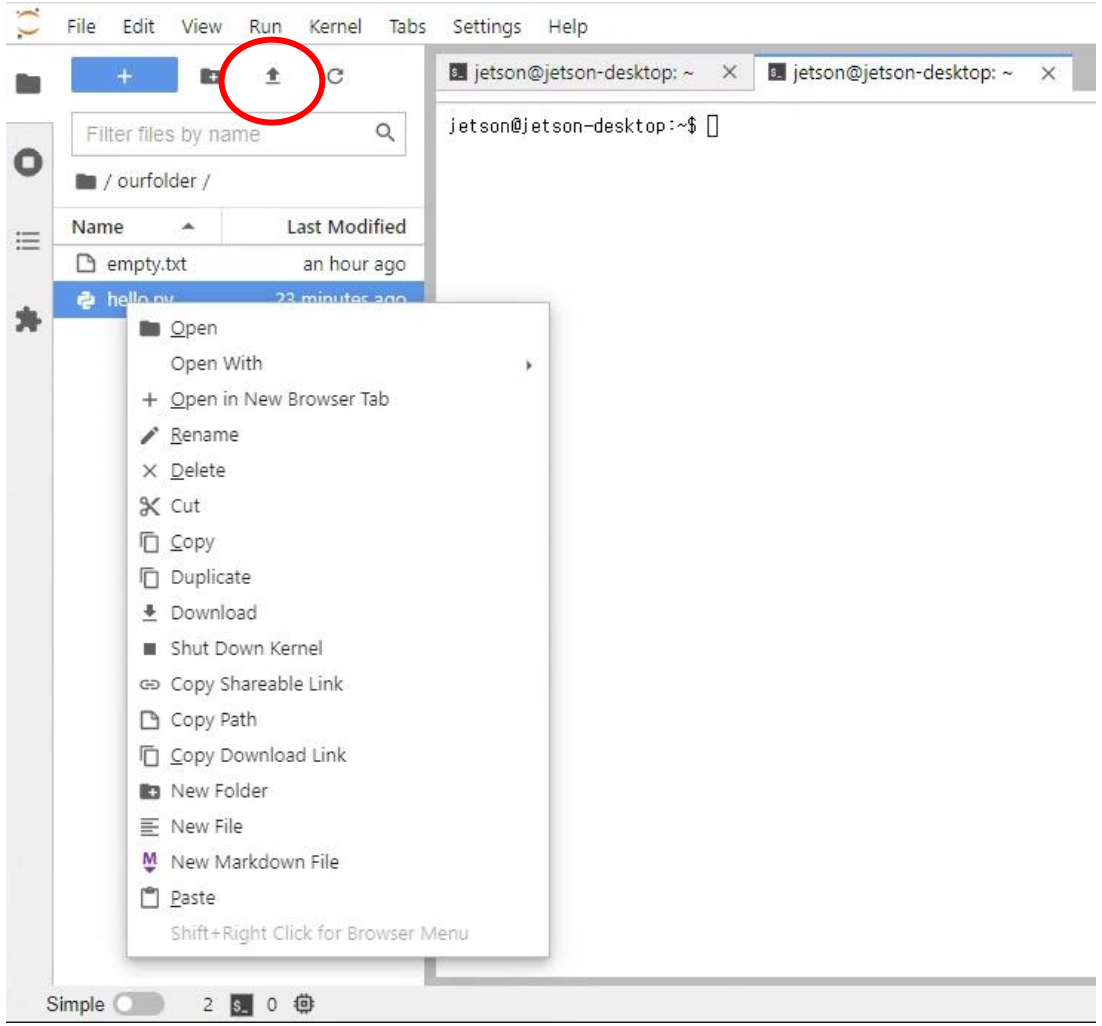




Option 1. Jupyter Notebook

Task 1. Download your files to your laptop computer

1. Use the directory browser on the left pane.
2. Move the **ourfolder**
3. Click the file using your mouse
4. Press your right button of your mouse
5. Choose the download command
6. Upload a file from your laptop to Jetson nano



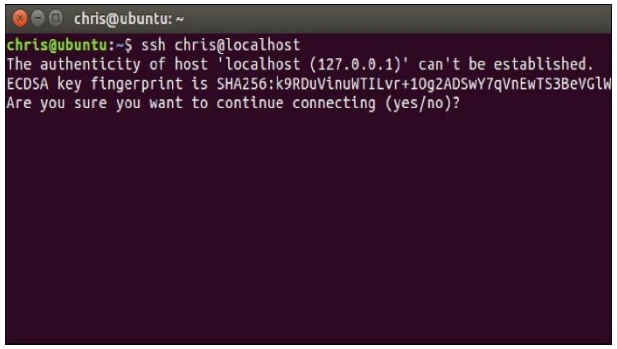
Option 2. SSH & SFTP

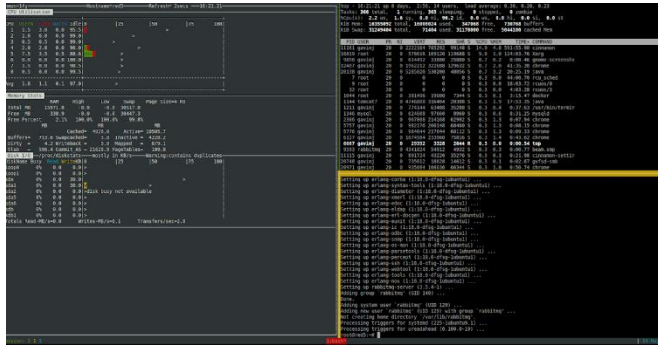
Protocol?

→ A system of **rules** that allows two or more entities of a **communications** system to **transmit** information.

SSH: Secure Shell Protocol

→ A cryptographic network protocol for operating network services securely over an unsecured network.





SFTP: Secure File Transfer Protocol

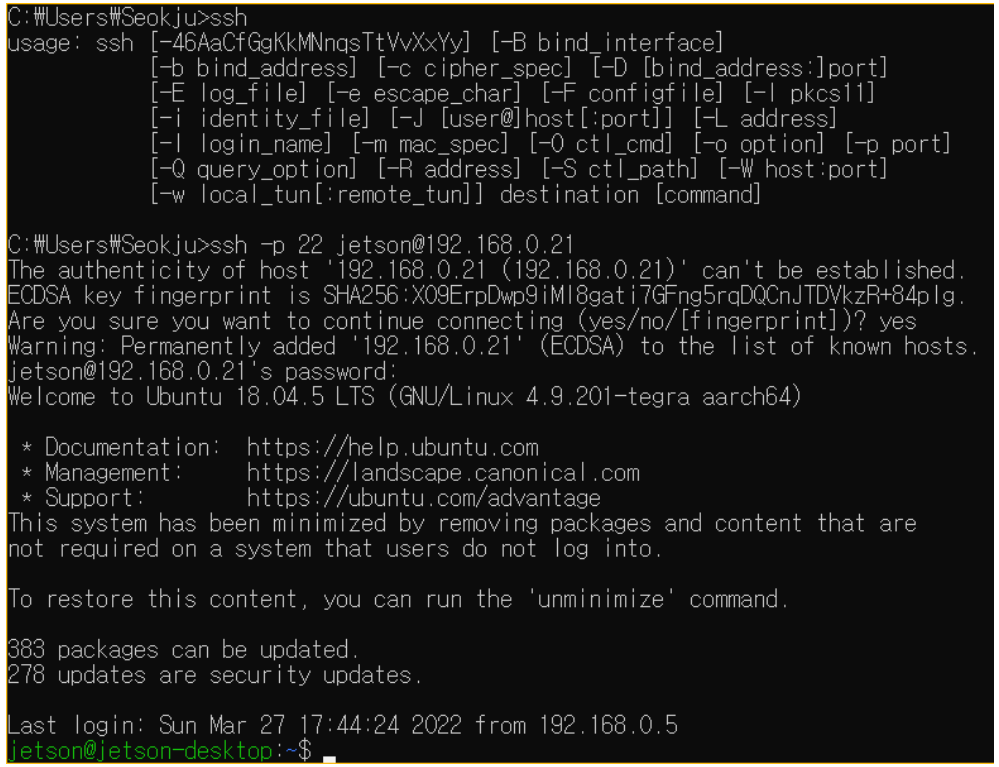
→ A network protocol that provides file access, transfer, and management over any reliable data stream.

Option 2. SSH & SFTP

SSH to connect Jetson remotely

→ Open Terminal and type below commands:

```
$ ssh -p 22 [your_email_id]@192.168.***.***
```



SFTP for file transfer

→ Open Terminal and type below commands:

```
$ sftp -p 22 [your_email_id]@192.168.***.***
```

SSH & SFTP Clients

SSH to connect Jetson remotely

Mac is similar to Linux

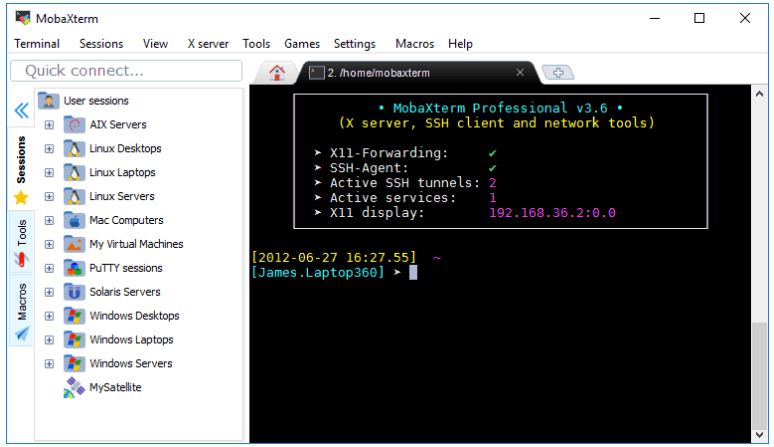
→ Windows: *MobaXterm*, *Putty* / Mac: *Terminal* (basic app)

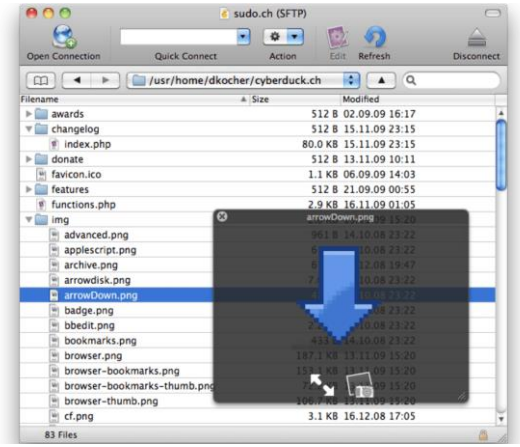
SFTP for file transfer

→ Windows: *MobaXterm*, *WinSCP* / Mac: *Cyberduck* (link), *Sharing* (basic app)

Code editor

→ *VS Code, Sublime Text*

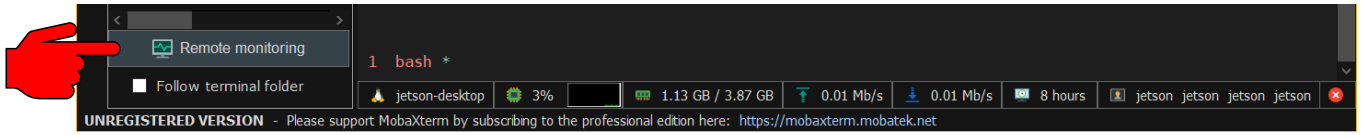


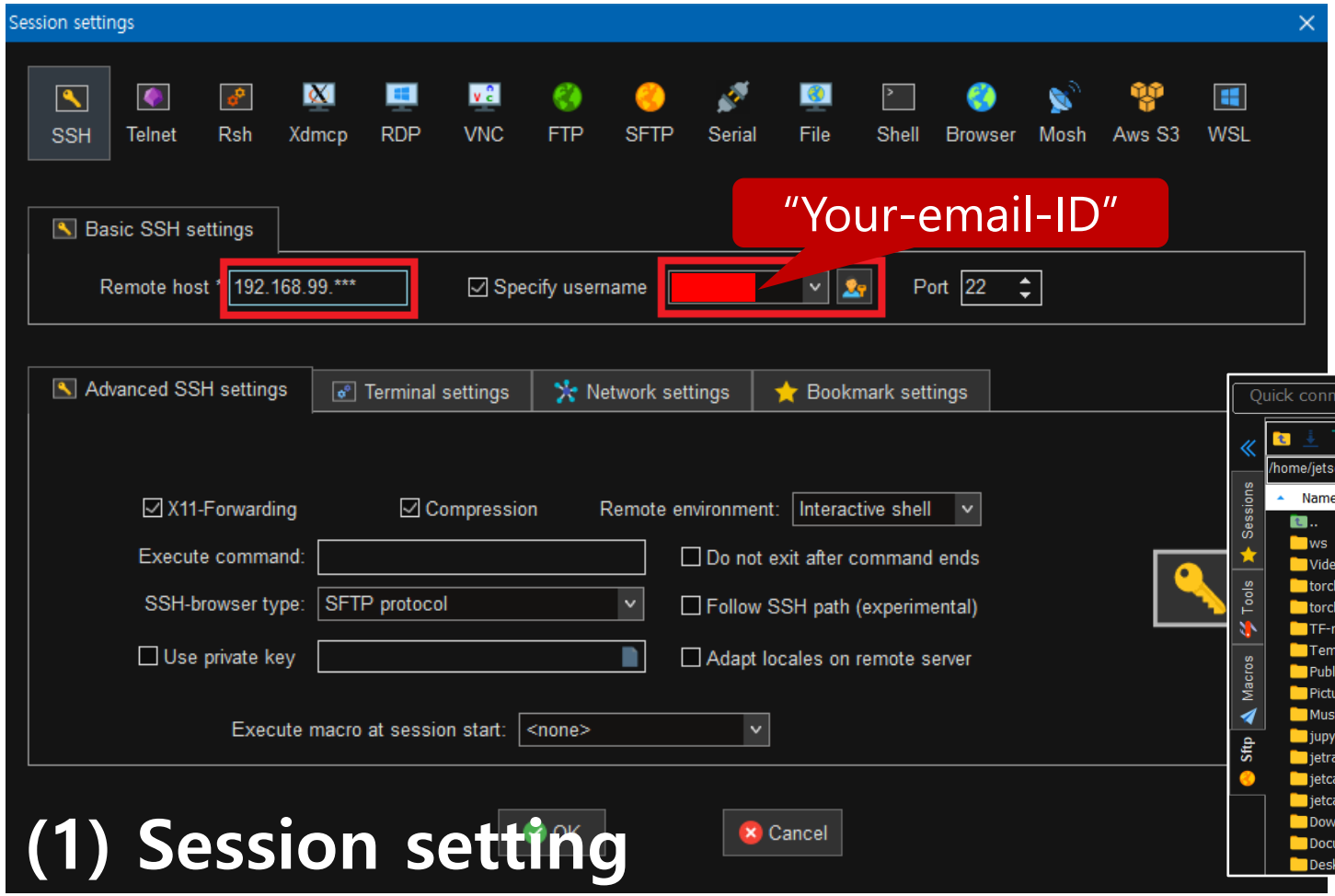


SSH & SFTP Clients

Windows: MobaXterm

(2) System monitoring





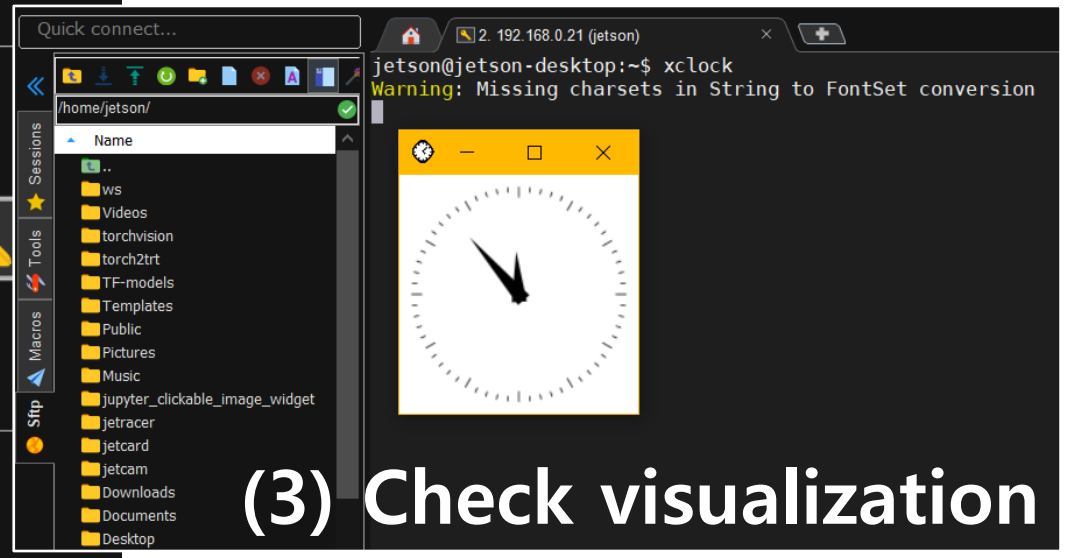
(1) Session setting

Type password `[your_email_id]`, and log in.

Check SFTP in the left panel.

Check visualization by typing below:

`$ xclock` `$ xeyes` `$ xcalc`



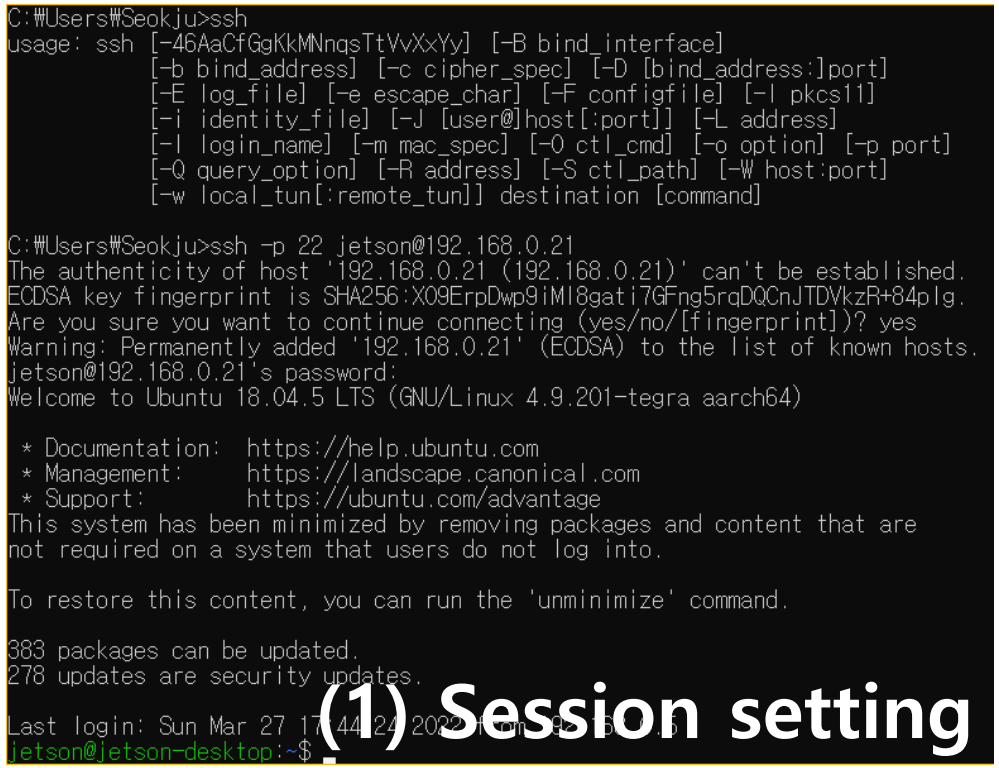
(3) Check visualization

SSH & SFTP Clients

Mac: Terminal or iTerm2

→ Open Terminal and type below commands:

```
$ ssh -p 22 [your_student_id]@192.168.***.***
```

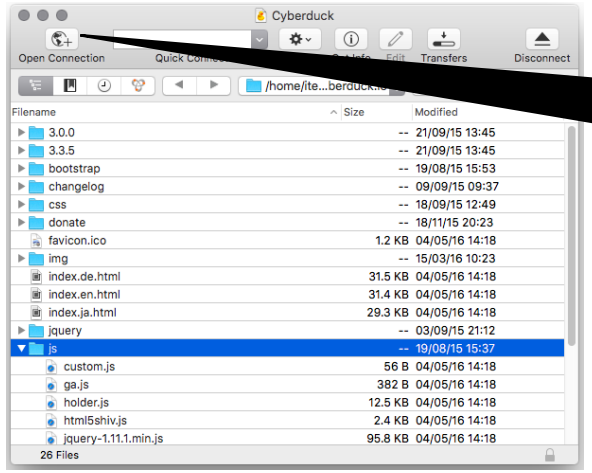


(1) Session setting

→ If the visualization is not available, please refer below link:

- **XQuartz solution:** https://www.cyberciti.biz/faq/apple-osx-mountain-lion-mavericks-install-xquartz-server/

→ SFTP setting (Cyberduck, or VS Code)

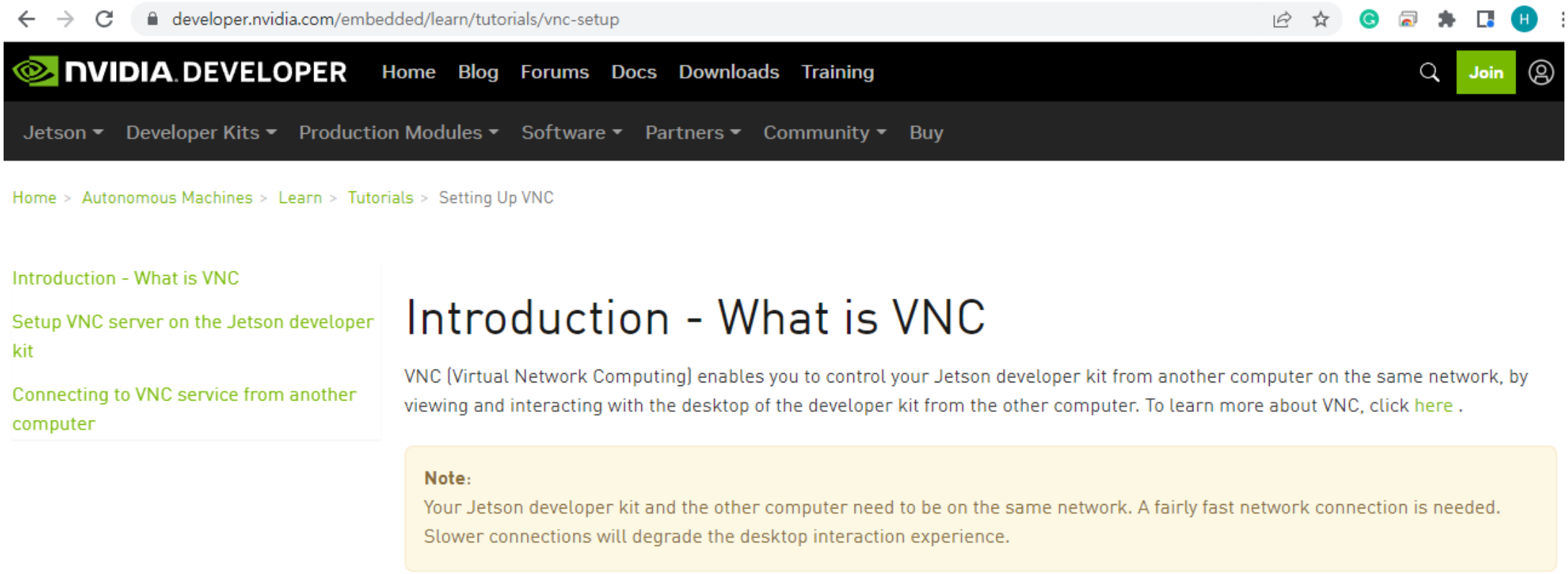


Click Open Connection, and configure your IP, port number, and ID/PW.

(2) SFTP setting

Option 3. VNC

VNC (Virtual Network Computing) enables you to control your Jetson developer kit from another computer on the same network, by viewing and interacting with the desktop of the developer kit from the other computer.



https://developer.nvidia.com/embedded/learn/tutorials/vnc-setup

Option 3. VNC

Setup VNC server on the Jetson developer kit

1. Enable the VNC server to start each time you log in

   If you have a Jetson Nano 2GB Developer Kit (running LXDE)

```
mkdir -p ~/.config/autostart
cp /usr/share/applications/vino-server.desktop ~/.config/autostart/.
```

   For all other Jetson developer kits (running GNOME)

```
cd /usr/lib/systemd/user/graphical-session.target.wants
sudo ln -s ../vino-server.service ./.
```

2. Configure the VNC server

```
gsettings set org.gnome.Vino prompt-enabled false
gsettings set org.gnome.Vino require-encryption false
```

3. Set a password to access the VNC server

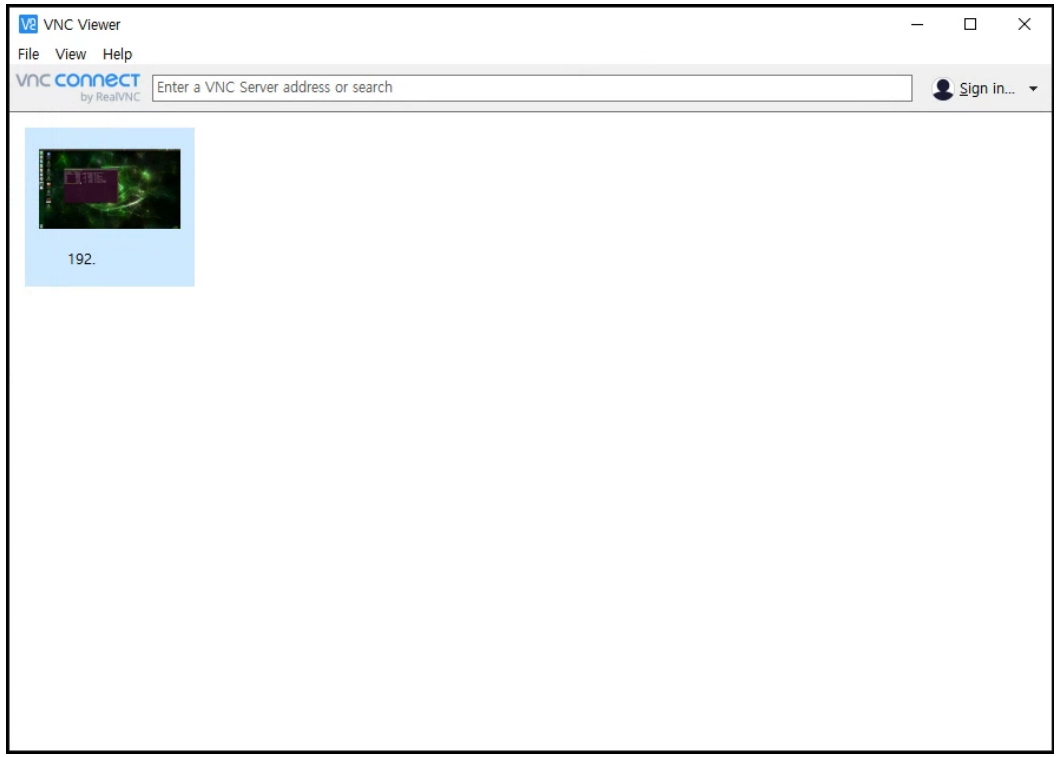
```
# Replace thepassword with your desired password
gsettings set org.gnome.Vino authentication-methods "['vnc']"
gsettings set org.gnome.Vino vnc-password $(echo -n 'thepassword'|base64)
```

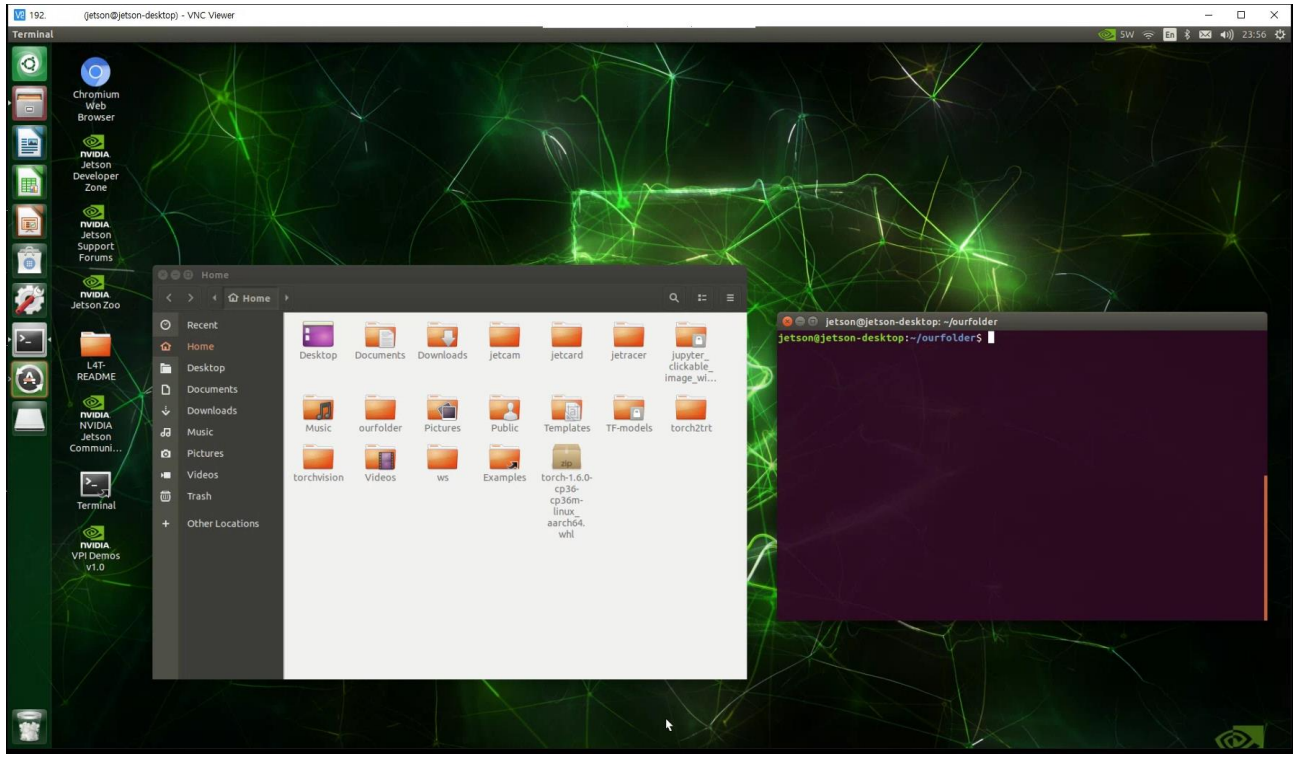
4. Reboot the system so that the settings take effect

```
sudo reboot
```

Option 3. VNC

Download the VNC viewer at **https://www.realvnc.com/en/connect/download/viewer/**





KENTECH
Korea Institute of Energy Technology

Announcement

Before Finishing the Lecture…

Notice: Team members and weekly roles of AI Kit management

- Students in the group should take the duty (kit distribution & collection) in the given week
- Roles
  - Kit distribution: Move the kits (2F 교수연구실2 cabinet → classroom) and distribute the kits to each group
  - Kit collection/return: After the class, collect the kits from the groups and check all the kits, and return them (classroom → 2F 교수연구실2 cabinet)
  - Check classroom: Check if there are any leftover equipment parts in the classroom.

Team	Members	Week
1		7
2		8
3		9
4		10
5		11
6		12
7		13

Any Question?

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