Hardware preparation:

1. BlueROV2 Heavy configuration: (BlueROV2 heavy)

    1) Replace old raspberry pi with Pi4 pin to pin, port to port. (other mode might work as well, but the computing speed might be affected.)
    2) Pixhawk 3 with px4 firmware (BlueROV2 build in Pixhawk will do)
    3) Other BlueRobotics sensor such as depth sensor (integrated) and pinger (buy separately)

2. SD card at least 32GB

Software integration

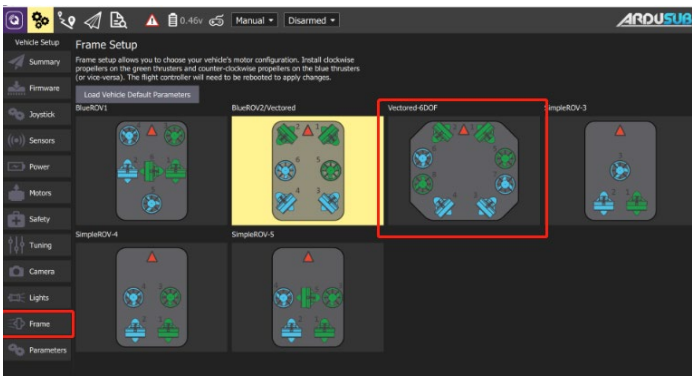
1. Flash Raspberry Pi system to your SD card with image (you can download here, named pi4-7-28.img)

Download raspberry imager, flash and then following packages are intergrated:

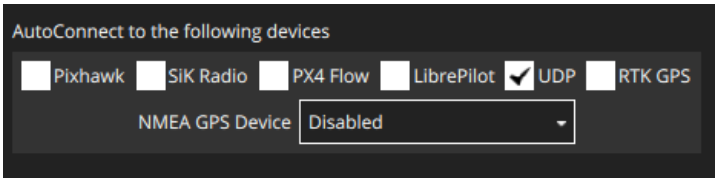
ros melodic
usb_cam
apriltag_ros
ping_nodelet
image_transport
mavros
zrsh shell

once successfully flashed, put SD card on Pi 4.

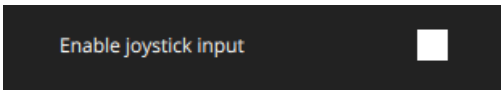
2. Install/update firmware on pixhawk
    1) Install QGroundControl on your ubuntu laptop (tested with ubuntu 18, newer versions might work as well).
    2) Connect the pixhawk to your laptop via usb.
    3) Open QGC, follow instruction on here to install ardusub, select the frame as follow:



4) Back to QGC desktop. Click Q icon, and click Application Setting, click AutoConnection to following devices, just tick the UDP and distick the rest as the picture shown below:



5) Enable the joystick of QGC. This step can ensure that your signal of joystick comes from the MAVROS. In Vehicle Setup, Joystick, don't tick this box.



Now you can plug Pixhawk to the Pi 4

Your PC

Connect to the wifi you want BlueROV to be. Check your PC's IP address under this wifi.

ifconfig

Assuming the IP address is 'PC_IP'

Network setup

Although package comes with the system, there are some setups need to be done when running under different network. All blue texts are commands you shall type in.

1) Boot in the Pi: (all passwd and username are bluerov)

sudo gedit /etc/netplan 50-cloud-init.yaml

you shall see the following: (change the wifi name and password to access internet.)

```
# This file is generated from information provided by the datasource.  Changes
# to it will not persist across an instance reboot.  To disable cloud-init's
# network configuration capabilities, write a file
# /etc/cloud/cloud.cfg.d/99-disable-network-config.cfg with the following:
# network: {config: disabled}
network:
    version: 2
    wifis:
        renderer: networkd
        wlan0:
            access-points:
                Grapes:
                    password: bluerobotics
            dhcp4: true
            optional: true
    ethernets:
        eth0:
            dhcp4: no
            dhcp6: no
            addresses: [192.168.2.2/24,]
            gateway4: 192.168.2.255
    version: 2
    renderer: networkd
```

this is the name of the wifi you want to connect

this is the password of your wifi

2) Check Pi's IP under this wifi:

ifconfig

Assuming the ip address is 'PI_IP'

3) Now edit the zshrc file:

sudo gedit ~/.zshrc

scroll down, you shall see two lines at the end:

```
# Your PC as master
export ROS_HOSTNAME="10.42.0.113"
export ROS_MASTER_URI="http://10.42.0.199:11311"
```

Replace *10.42.0.113* with PI_IP

Replace *http://10.42.0.199:11311* with PC_IP

4) Close the file and source:

source ~/.zshrc

Now every is in position, reboot Pi.

Test

You can do it all on your PC as long as the network setup correctly:

Open QGC on your laptop.

In one terminal:

roscore

Open another terminal

ssh bluerov@PI_IP

roslaunch wake_hardware all_hardware.launch gcs_url:=udp://:14560@PC_IP:14550

if you can see connection on your laptop's QGC, you are all set.

Regarding the control code, I suggest we test it when we have the tank. (easier than running the web_cam pkg). I will put on github later on as well, all will be running your laptop, so you can put all BlueROV2 screws back.