Demeter Rover Manual

Classic Rover Configuration

To use classic rover control you will need:

- Node and NPM installed on your machine (for hosting local server)
- Router (to create LAN to which all devices will connect) *needs to work as access point
- Raspberry PI (with python, flask and open-cv installed)
- Arduino IDE (with ArduinoWebsockets library)
- Express and express-ws libraries install with NPM

Router configuration:

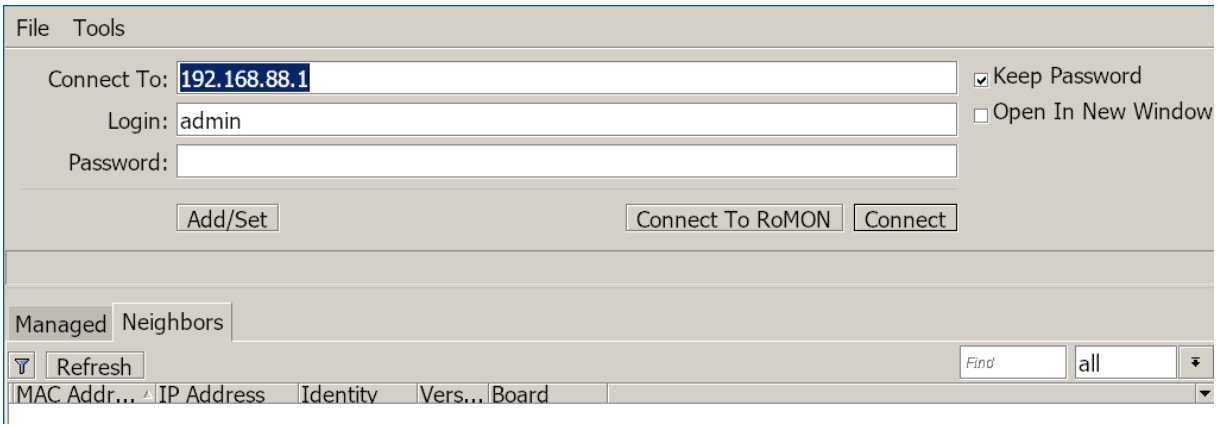
You need to create simple LAN with your Router and configure WiFi to which devices will connect. Network can be very simple you can create a network with subnet mask as 255.255.255.0 and IP addresses in range 192.168.1.2-.192.168.1.254.

We used mikrotik router and configured it thorugh winbox program and its wizard so no deep understanding of networks is needed to create such network.

Winbox can be downloaded at : https://mikrotik.com/download

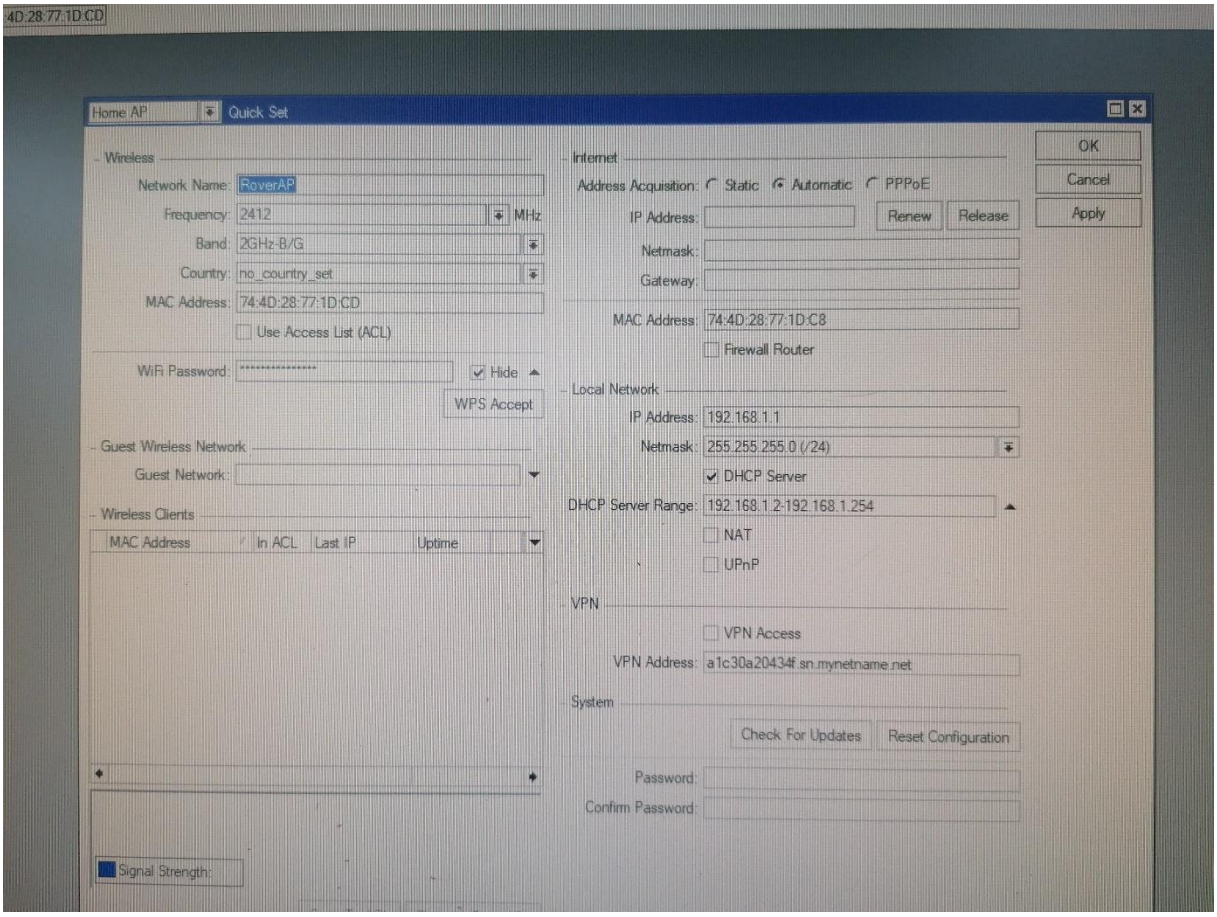
Setup process:

Once you start winbox connect your PC to the router and program will recognize your Router. By default login is admin and you leave password field empty then press connect.



When you connect you will be prompted with a dialog window just press OK if and continue.

On the right side of the screen you will see a section called „Quick Set“ (it should be on top). Open it.



You need to create a configuration that is similar to the one on the picture above, after that you press apply button and you are done with your router configuration. Now if you go to the WiFi on your phone to se available networks you should see your network in the available networks list.

! IT IS IMPORTANT TO REMEMBER YOUR SUBNET MASK SO TO STAY SAFE KEEP IT AS 255.255.255.0 !

PC configuration:

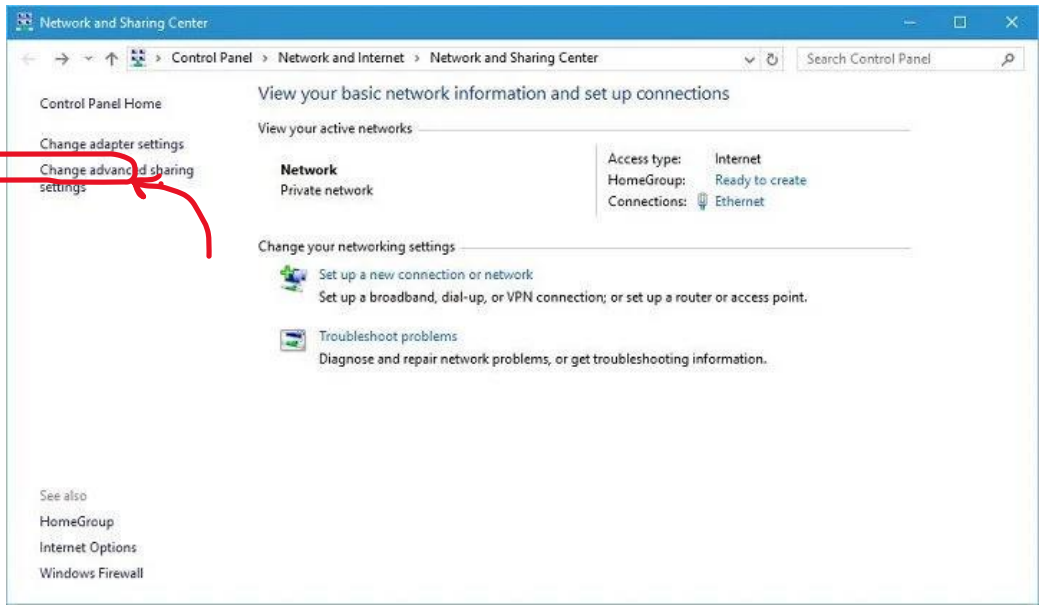
Because DHCP is enabled in our network it is possible for the IP address of the PC or Laptop to change and then ESP won't be able to connect to the server. So because of that we will make the IP address of the PC (server) static.

Before everything you need to have admin rights to work with this so make sure of that before trying anything.

Go to Control Panel (I'll assume you are using Windows 10 operating system, so just type in the search bar Control Panel and you will see it)

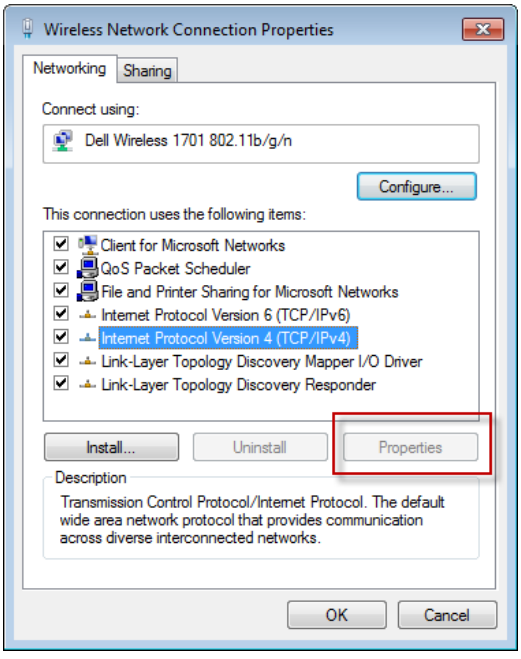
When in Control Panel go to Network and Internet and then Network and Sharing Center (it should be on top)

Now go to „Change adapter settings“



A new window will open it will show you all of your network adapters. Right click the one that is used to connect to the Rover LAN it is usualy ethernet if you use wired connection with router and Wi-Fi network if you connect to the router wireless. When you right click on it go to bottom and press „Properties“.

Once Properties window opens, find „Internet Protocol Version 4 (TCP/IPv4)“ click on it and press „Properties“ button bellow



Now click on „User configured“ radio button and set static values:

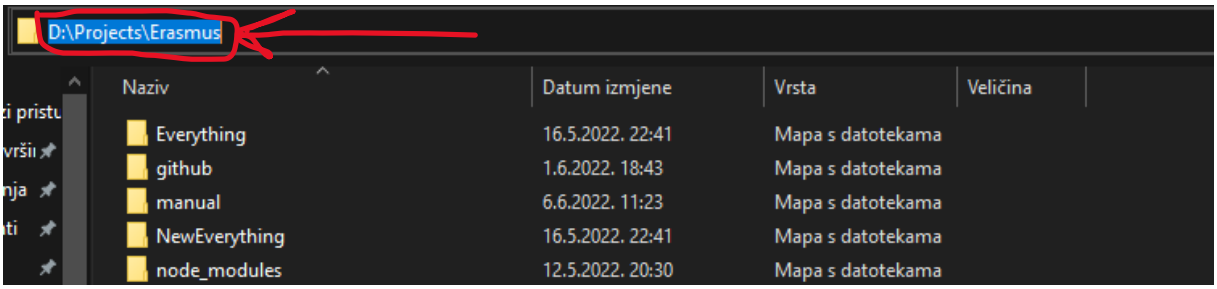
In my code IP address is set to 192.168.1.18 so you can put it so you don't have to change the code. Put the subnet mask to be 255.255.255.0. Other values do not matter in this case.

Last, press OK button and you can close everyting. Congradulations you have created you Rover Local Area Netowork.

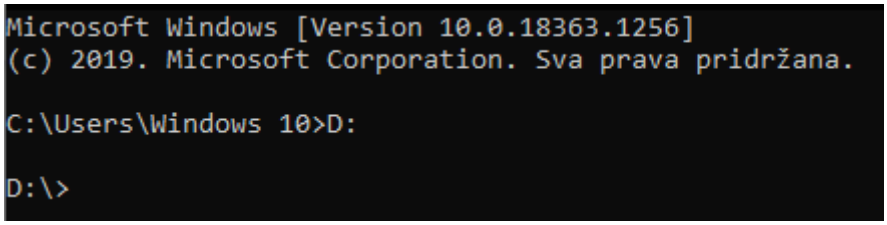
Server configuration:

Download Node from https://nodejs.org/en/download/ run the installer and let it finish. Once everything is done create a directory in which all the files will be placed. Now we need to access it through the cmd or windows powershell. If you are on Windows 10, while you are in the directory hold shift and press right mouse click. You will see the option „Open PowerShell window here“ press it and CLI will open. Skip to the next page if you managed to do it.

If you however can not open it like that, start the command prompt, press windows key + R, then type cmd and press Enter. You will be placed in your user folder now go to the directory you created and in the top bar copy the absolute path to it.

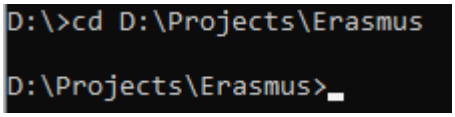


Now in cmd first write The letter at the begining of the path followed with colon sign (:) like this



If you have a partition F or G or Z or what ever you put that instead of D: or if you put your directory ond the C: drive this step is optional

Now that you are on the right partition write a command like: cd D:\PATH\TO\DIRECTIORY. Replace D:\PATH\TO\DIRECTIORY with the path you copied:



Now that you are at your directory you can continue by following the steps on the next page↓

Firstly lets test if you have successfully installed Node and npm. Npm comes with Node don't worry about it… Type two commands :

1. node --version
2. npm --version

```
D:\Projects\Erasmus>node --version
v16.13.0

D:\Projects\Erasmus>npm --version
7.6.3
```

↑What you should see in command prompt↑

```
PS D:\Projects\Erasmus> node --version
v16.13.0
PS D:\Projects\Erasmus> npm --version
7.6.3
PS D:\Projects\Erasmus>
```

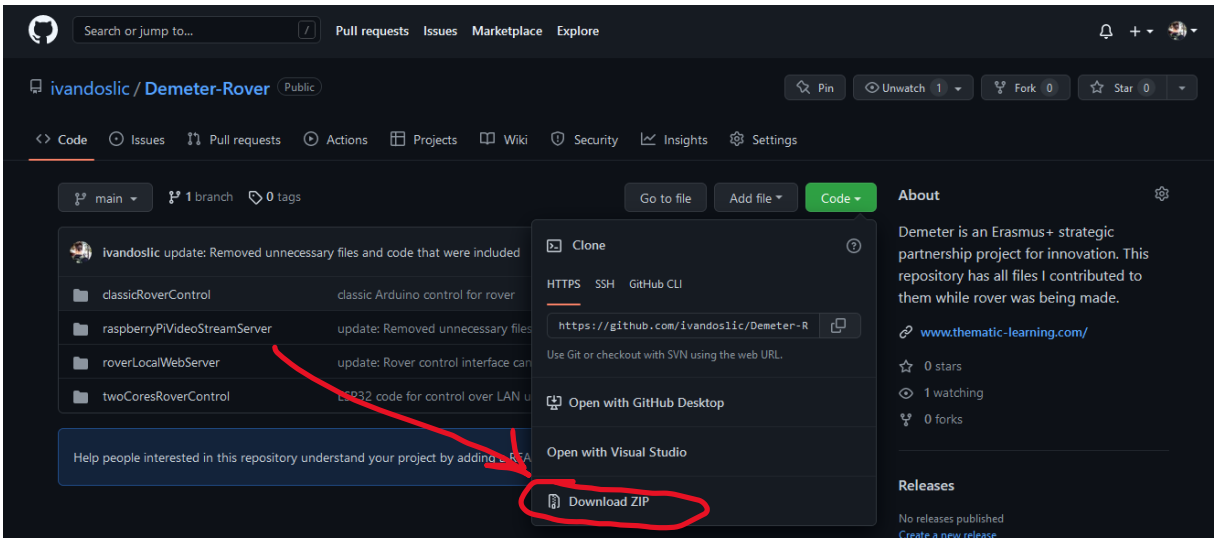
↑What you should see in PowerShell↑

If you get and error message, reinstall node.

Now you will need to type two more commands:

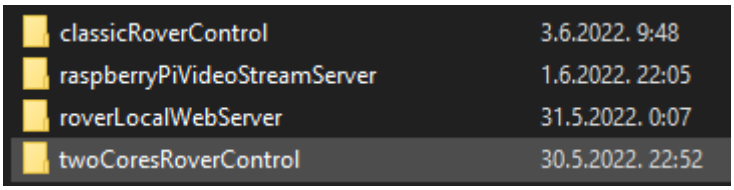
1. npm i express
2. npm i express-ws

When the libraries install you are all set. Go to the https://github.com/ivandoslic/Demeter-Rover and download the project in a zip file:



Open the zip file, in it there will be the folder Demeter-Rover-main open it and copy all folders from there to your directory which you created.

If you did everything as intended your directory should look like :



To start the web server use shell (cmd or PowerShell) and enter the roverLocalWebServer directory -> cd roverLocalWebServer

If everything is good. Type: node ./index.js and the server will start, your console will write a message that server is started on port 5000. That means that server is running and that you can now connect to it with ESP32 and control it.

[↓ ESP configuration is on the next page ↓]

ESP32 configuration:

To program ESP download Arduino IDE from: https://www.arduino.cc/en/software

Along side that you need to make your IDE work with ESP boards. Here is a good tutorial for that, so I don't have to write everything in this manual: https://randomnerdtutorials.com/installing-the-esp32-board-in-arduino-ide-windows-instructions/

When you have done that you need to install the ArduinoWebsockets library. To do that go in your Arduino IDE app and press the combination of buttons on your keyboard Ctrl+Shift+i, that will open Library manager. There search for ArduinoWebsockets and install it.

Finally go to the folder you have downloaded from GitHub and open classicRoverControl. Connect your ESP, set the port ESP is connected to (Tools -> port) and set Board to ESP32 Dev Module. Tip: if you see message „Connecting…..____.....____....“ for a very long time press the BOOT button on ESP and hold it for a few seconds then release it. After that you should see the percentage of code written to board, Wait until it is done and your ESP is successfully programmed.

[Code is commented so if you have a need to change anything you will se the instructions and explanations in it]

RaspberryPI configuration:

To configure your Rapberry Pi you will first need some Linux distribution installed on it. You can pick any one you want and configure it accordingly. We choose DietPi as our Raspberry Pi linux distribution. To install it just follow their official tutorial : https://dietpi.com/docs/install/

When you have flashed your Raspberry Pi in dietpi-wifi.txt aWIFI_SSID[0] put RoverAP and aWIFI_KEY[0] set the password you have set on the router.

Finally put the SD card into Raspberry and boot it.

On raspberry open terminal and firstly we need to install the libraries and packages we need. You will need Internet connection to install libraries and packages if your RoverAP config does not bridge Internet over other network you can find one with Internet and install all that is mentioned bellow and then reconnect to RoverAP.

Test if you have python3. Type **python3** and press enter. If python start type **quit()** and press enter. Next test if pip is installed. Type **pip --version**. Install flask with **pip install flask**. After flask is installed install open-cv library with **pip install opencv-python**. If you have git you can clone the repository: **git clone https://github.com/ivandoslic/Demeter-Rover**. Or transfer files via USB or you can type it yourself. Code is on github in rasberryPiVideoStreamServer folder. Make sure that in last line you put it as **app.run(debug=True, host="RPI_IP_ADDRESS", port=5000, threaded=True)** You can start the server with **sudo python3 app.py**

Last you need to get your raspberry's IP address and put it in the servers HTML code. **roverLocalWebServer/public/main.html** and in iframe src set **http://RPI_IP_ADDRESS:5000/video_feed1**

Also in servers HTML newes version as of this update you can find button that changes video streams and in **webpage.js** there is a function that changes video streams so adjust URLs in them accordingly as:

http://RPI_IP_ADDRESS:5000/video_feed1 and **http://RPI_IP_ADDRESS:5000/video_feed2**