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1. Software Application Setup

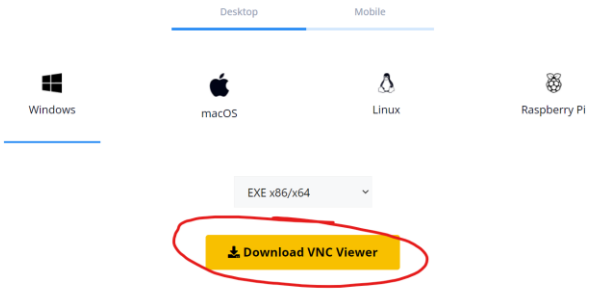
To use some of the applications, you will need to install the ZeroMQ, VNC View, setup remote desktop connection and adjust your computer's IP Address.

ZMQ Installation

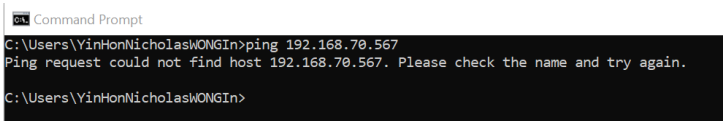
To install the ZeroMQ repository, simply open Command Prompt on your computer and enter "pip install pyzmq"
For more information, refer to this link: https://zeromq.org/languages/python/

VNC Viewer Installation

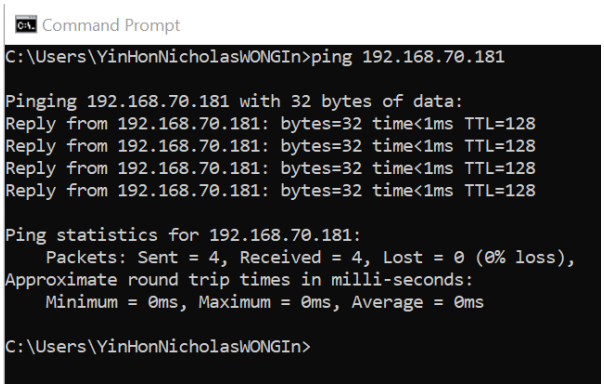
Head to this link: https://www.realvnc.com/en/connect/download/viewer/



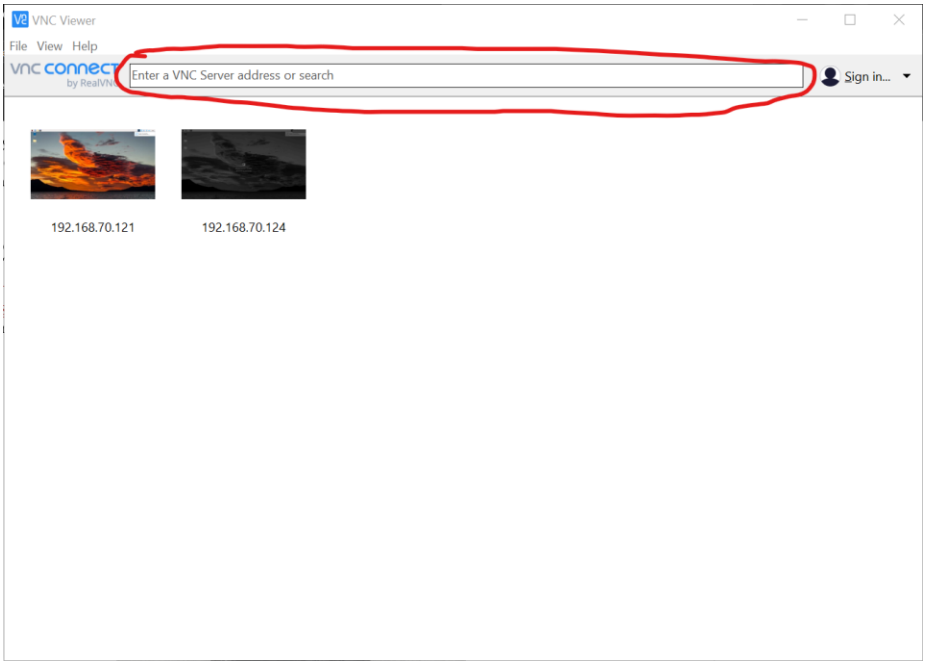
Click on:
Before connecting to the Raspberry Pi, ensure that you change your computer's IP address to 192.168.70.* where * is a number that you can choose. But ensure that the chosen IP address is not already chosen. You can check the availability of that IP address by first heading to your command prompt and entering "ping …" where … is your chosen IP address. For example, to test for 192.168.70.567:



If the result is as seen below, it means that the IP address has been taken already:

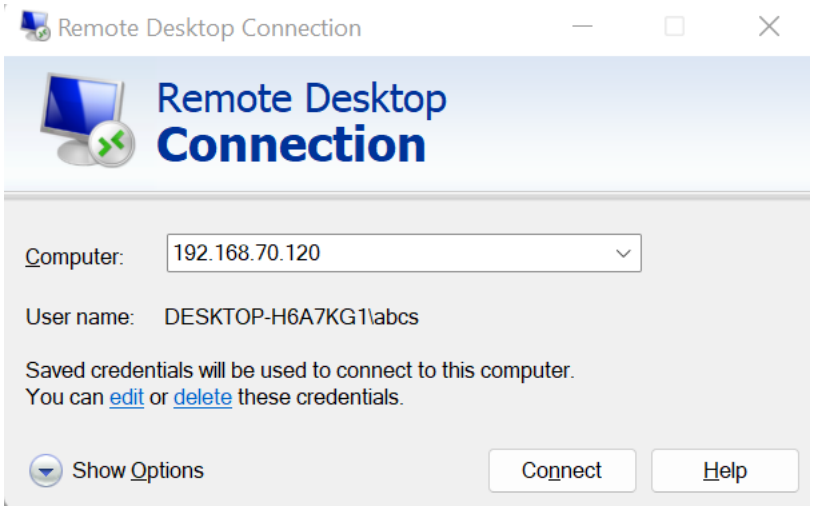


Once you have changed your IP address, you can now try and connect to the Raspberry Pi. First ensure that the Raspberry Pi is connect to the Wi-Fi and the IP address is fixed. Then, enter the IP address of the Raspberry Pi into the text box at the top of the VNC viewer.



When you attempt to connect to the Raspberry Pi, the username is “pi” and password is “P@ssw0rd”.

Remote Desktop Setup



https://www.top-password.com/blog/use-microsoft-remote-desktop-app/

You may click on the icon below to launch the remote desktop.

Username: abcs

Password: abcs

IVOD.rdp

2. Data Collection Equipment Setup

Physical Setup

Radar 1 Positioning:

1. Place the hanger on the taped string.
2. Stick the back of hanger to the velcro tape on the wall
3. Elevation is **-0.8**. Tilt the radar by placing a folded plastic behind the hanger as shown in Figure 1
    a. Place your phone on top of the radar but **not resting on it** to measure the elevation using the apps bubble level app or Measure (for iphone).

Figure 1: Radar 1 Position

4. Using an extension cord, power on Raspberry Pi.
5. Plug the USB into the Raspberry Pi port.
    a. White wire is placed above the black wire

Radar 2 Positioning:

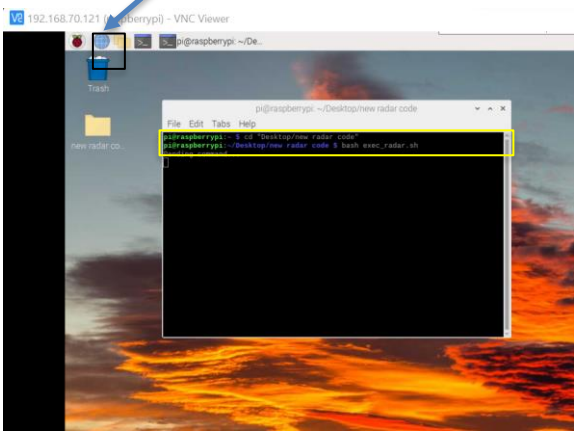
1. Using a measuring tape, place radar 1 meter away from the center of the car
2. The height is measured by using the second hole of the tripod and using the **masking tape indication.**
3. Elevation is -0.5. Using the app, place your phone on the radar to measure the elevation
4. Using an extension cord, power on Raspberry Pi.
5. Plug the USB into the Raspberry Pi port.

a. White wire is placed above the black wire

Software Setup:

1. Ensure the laptop is connected to IVOD_Wireless.
2. Launch VNC > start radar code for both radars.
    a. Launch terminal and enter code below

```
cd "Desktop/new radar code"
bash exec_radar.sh
```



3. Launch Remote Desktop Connect.
    a. Start WebSocket **Server**: Launch Command Prompt and enter the code below:

```
C:\Users\abcs\Documents\webSocketServer
npm start
```

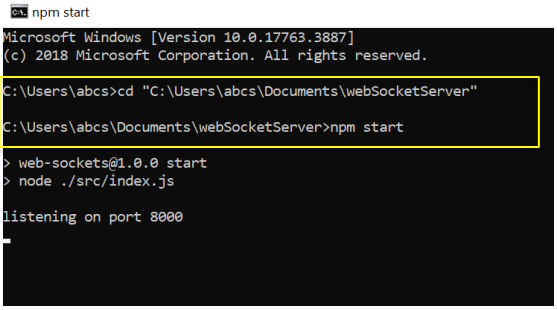


Figure 2: Code to launch WebSocket Server.

b. Start WebSocket **Client:** Launch Command Prompt and enter the code below. This will launch the website as shown.

```
C:\Users\abcs\Documents\websocket-clien\src
npm start
```

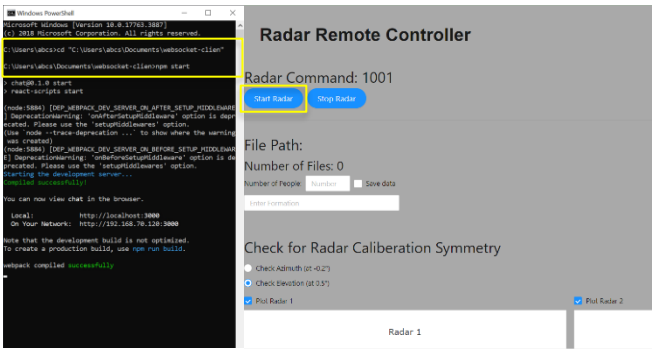


Figure 3: Code to launch WebSocket Client.

c. WebSocket Client is connected to the Server is if prompt below appears.

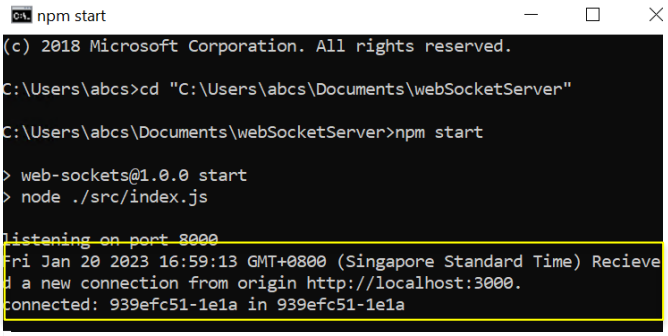


Figure 4: Ensures WebSocket Client is connected to Server.

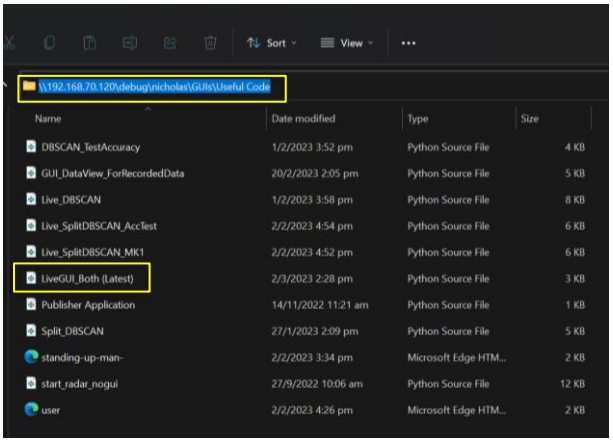
4. Press the "**Start Radar**" button to start radar in Figure 3.

<u>Check calibration symmetry</u>

5. On your laptop, open File Explorer > copy paste this **path**:

```
\\192.168.70.120\debug\nicholas\GUIs\Useful Code
```

6. Launch **LiveGUI_Both (Latest).py.**



7. In the **LiveGUI_Both (Latest).py** code, go to the *line number* shown below

    a. Check for **azimuth**: change to ax.view_init(90,0)

    b. Check for **elevation**: change to ax.view_init(0,90)

```
57      if arr1:
58          ax.scatter3D(data1[:, 0], data1[:, 1], data1[:, 2], color="red")
59          ax.view_init(0,90)
60
61      if arr2:
62          ax2.scatter3D(data2[:, 0], data2[:, 1], data2[:, 2], color="green")
63          ax2.view_init(0,90)
```

8. 2 passengers sit in front and wave. When waving, the data points:

    a. Elevation should be at -0.2°.

    b. Azimuth should be at 0.5°.

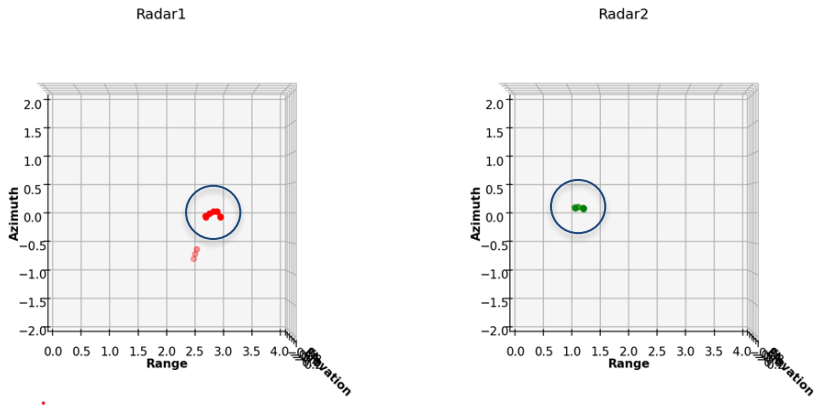


Figure 5: The circles shows the position of the radars.

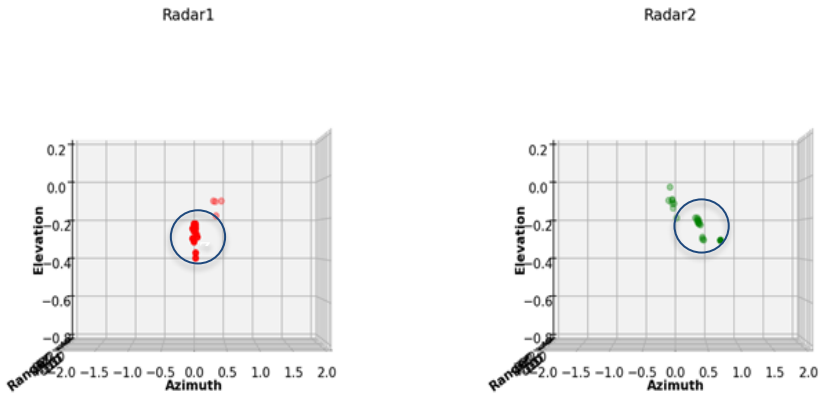


Figure 6: Data generated should be at the circled area, at -0.2 elevation.

Once the symmetry of the calibration is checked. You may *start to collect data*.

9. Go to Remote Desktop Connect > WebSocket Application.
10. Enter the **Number of People:** as shown in Figure 7.
11. Enter the **Number Formation** as shown in Figure 7.
12. Click on the **Save Data** check box to start saving and collecting data.

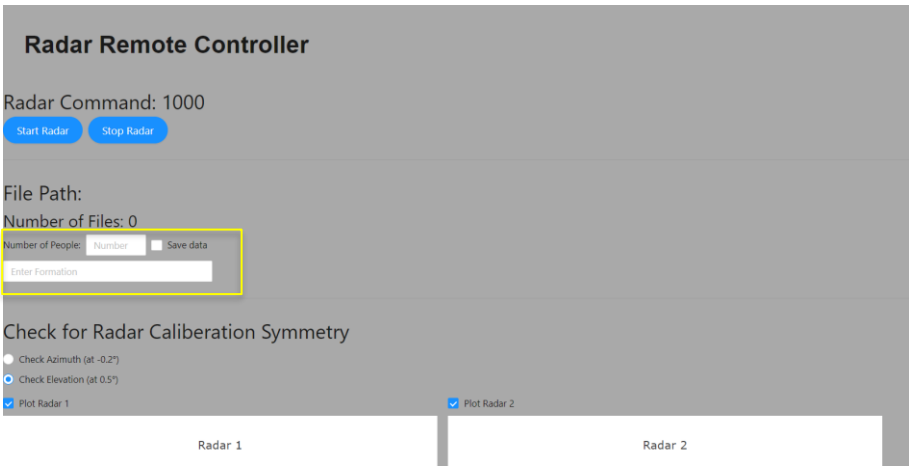
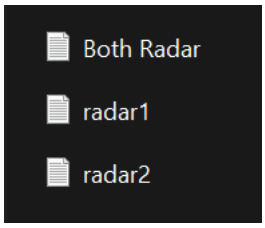
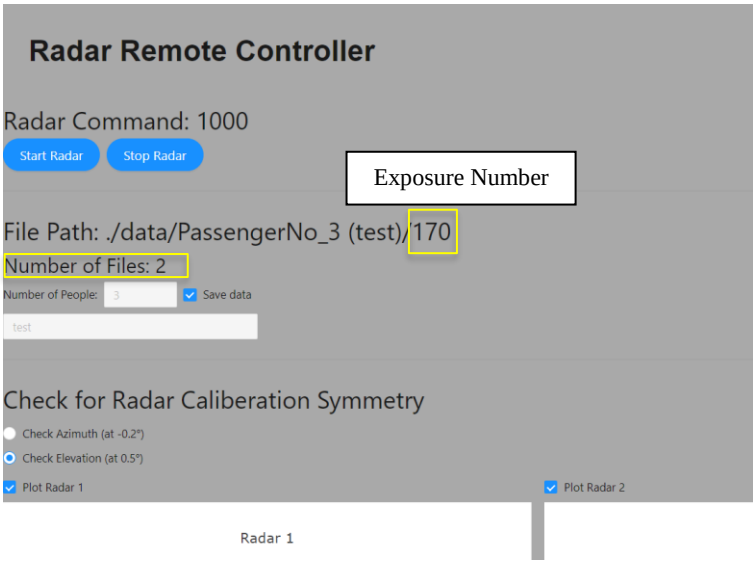


Figure 7: Web-Application

13. Look at **File Path:** to ensure the files are saved correctly. The boxed number should increment after each exposure (10 Seconds).
14. The **Number of Files:** should be **3**. The 3 files are shown below.

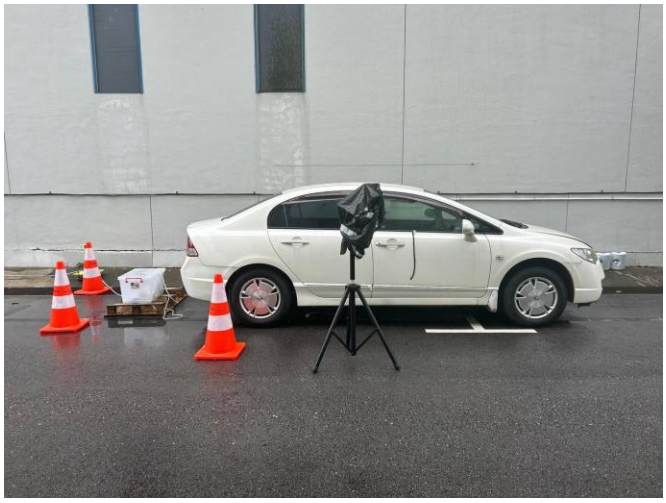




3. Troubleshooting for Setup

1. Wet Weather: (Tip:

a. When raining, the set up for the car will be as follows:



b. Wrap up the radar on the Driver's side with a trash bag (as seen in the picture above)
c. Keep the radar on the Passenger's side into the car.
d. Power on the battery for the car and wind up the windows, and unplug the battery once done.
e. Keep the extension cords back into the box and close the lid.

2. The Driver's window is unable to wind up/down

a. To avoid this issue, ensure to charge the car battery from time to time using the electrical car battery charger.
b. To check for the power of the battery, attach the red clip to the positive pin of the battery and the red clip to the negative pin of the battery. **DO NOT POWER ON THE CHARGER**. Based on the voltage shown the small screen, you can tell whether to charge the battery or not.
    i. Voltage is lower than 11V = Battery is low. Charge the Battery

ii. Voltage is more than 11V, less than 12V = Battery can be charged, but only for about an hour or so
iii. Voltage is more than 12V = Battery can be used for more than 3 days. No charging needed

c. Usually, when the battery is charged while it is under 11V, it can be charged for the entire day, but is recommended for you to still check the voltage of the battery from time to time when charging it.
d. To Charge the car battery:
    i. Before plugging in the charger, attach the red clip to the positive pin of the battery and the black clip to the negative pin of the battery.
    ii. Ensure that both black switches of the charger are on the (I) side and not the (O).
    iii. Plug in the charger and power it on. The gray button at the bottom left should be flashing rainbow colors. That means that it is charging. Now you can leave the battery to charge.
    iv. Once done charging, first power off and unplug the charger. Remove the pins and leave them on the ground **AWAY FROM EACH OTHER AS IF THEY COME INTO CONTACT AFTER CHARGING, IT MIGHT CAUSE A SPARK.** Another note is to not touch both pins after charging as it might still be live.
    v. Put the battery back into the car (into the correct angle of the positive pin on the left side and the negative pin on the right side).
    vi. The charger can then be placed back into the car but do ensure that throughout the entire time, the two clips do not come into contact.

3. Unable to find port

a. There will be times that during set up, the wires of the radar to the Raspberry Pi come loose. When that happens and you try to start the radar, what will happen is that in the terminal, it will show a message of something along the lines of "PORT /dev/ttyUSB0 not found". When that happens, there are two ways you can go around this:
    i. Reconnecting
        1. Disconnect the power source for the Raspberry Pi and ensure that the cables for the radar are properly connected.
        2. Power the Raspberry Pi back again and try to start the application up again
    ii. Finding the new port
        1. Enter 'ls /dev/ttyUSB*' and find the new port numbers
        2. Once the new port numbers are found, head to the exec_radar.sh file and change the numbers to the new port numbers (Refer to the later part of the document to find the exec_radar.sh file.)

4. Configuration file Altered

Whenever a configuration is changed in the config file (config.cfg), the hard button at the side of the radar must be pressed in order for the new configuration to take place. After pressing the button, you will have to restart the radar.

5. Unable to connect to the Raspberry Pi VNC.

When this happens, two of one thing has happened. But before checking the Raspberry Pi, check that your computer is already connected to the Wi-Fi for ISWireless@Level4 or IVODWireless. If so, then continue reading below for the solution:

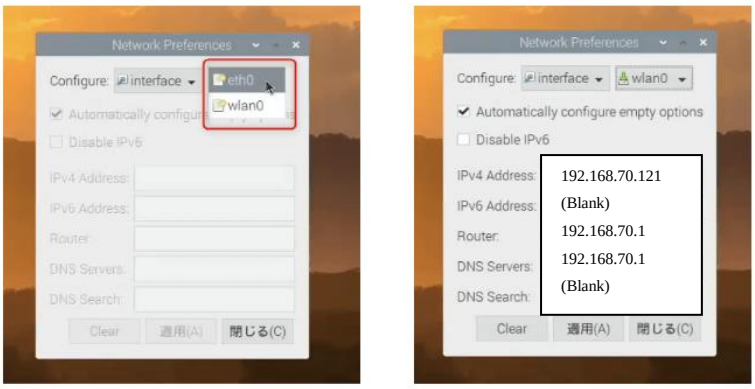
a. The Raspberry Pi is not connected to the Wi-Fi. (Highly unlikely)

i. Bring the power source and the Raspberry Pi back to the office and connect it to a monitor to ensure that the Wi-Fi is turned on for the Raspberry Pi

b. The IP address for the Raspberry Pi has be occupied.

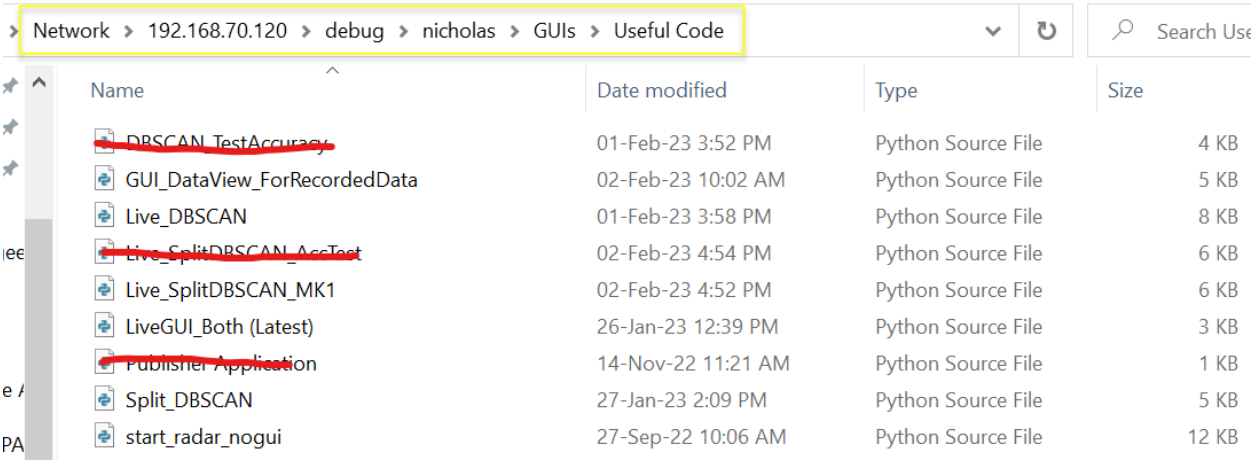
i. Bring the power source and the Raspberry Pi back to the office and connect it to a monitor. Connect it the ISWireless@Level4 Wi-Fi and check its connected IP address by hovering the cursor over the Wi-Fi logo. If the IP address of the Raspberry Pi is not what was originally set, that means that someone else has occupied that IP address.

ii. A quick solve for this is to right-click on the Wi-Fi logo and go to the Network Preferences option. For the dropdown on the right, select “wlan0”. Make sure that both checkboxes are unticked. The Router and DNS Servers should be “192.168.70.1” while the IPv4 Address should be “192.168.70.*” where * is supposed to be the number that it originally was based on the setup. (e.g. Radar 1 IPv4 Address will be 192.168.70.121) while the IPv6 address and the DNS search bars should be left blank. An example of how you should fill the boxes based Radar 1 is in the picture below:



iii. Once that is done, click “Apply”, turn off then turn on the Wi-Fi again. Wait for around 10 seconds. When you hover the cursor over the Wi-Fi logo this time, the connected IP address should be what you set before. However, if the IP address does not show up, this means you have to change the IP address to a new one. Repeat the steps above but this time, where there is * in the “192.168.70.*” increase the original * value by one and try again. Keep doing so until the IP address for the Raspberry Pi is locked and confirmed. Note down the new IP address and reconnect to it using the VNC Viewer.

4. List of Applications used



GUI_DataView_ForRecordedData

This application is used to view specific exposures from the data saved

```
9   DATADIR = "//192.168.70.120/debug/data/PassengerNo_2/3372/Both Radar.txt" # Adjust the specific file from here
```

Live_DBSCAN

This application is used to DBSCAN live data once only before sending the clustered data points through ZeroMQ

Live_SplitDBSCAN_MK1

This application is used to DBSCAN live data twice (once in cubes and once in centroids) before sending the clustered data points through ZeroMQ

LiveGUI_Both (Latest)

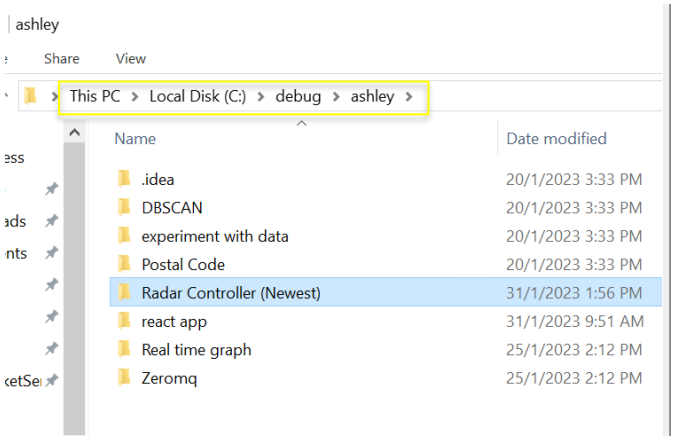
This is used to see the live data coming from the radar. But the data points from both radars are showed seperately

Split_DBSCAN

This application is used to DBSCAN collected data in cubes.

start_radar_nogui

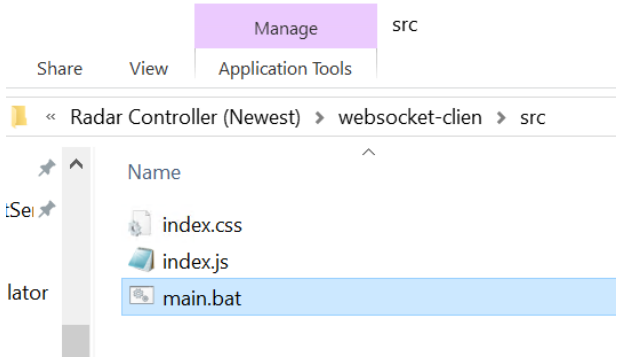
This is the application that is used to run the radar in the Raspberry Pi.

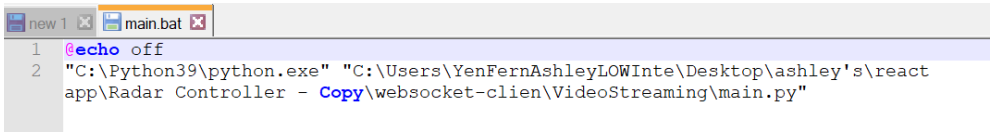


Radar Controller (Newest)

This folder contains both the server and client code. This application plots the live DBSCAN clusters, save data and have the video camera module.

To use this application, you have to change the batch file commands according to your file paths





Radar Controller

This is the older Application code but it can save the data locally.