Mälardalen University
School of Innovation Design and Engineering
Västerås, Sweden

GUI USER MANUAL

5th December 2023

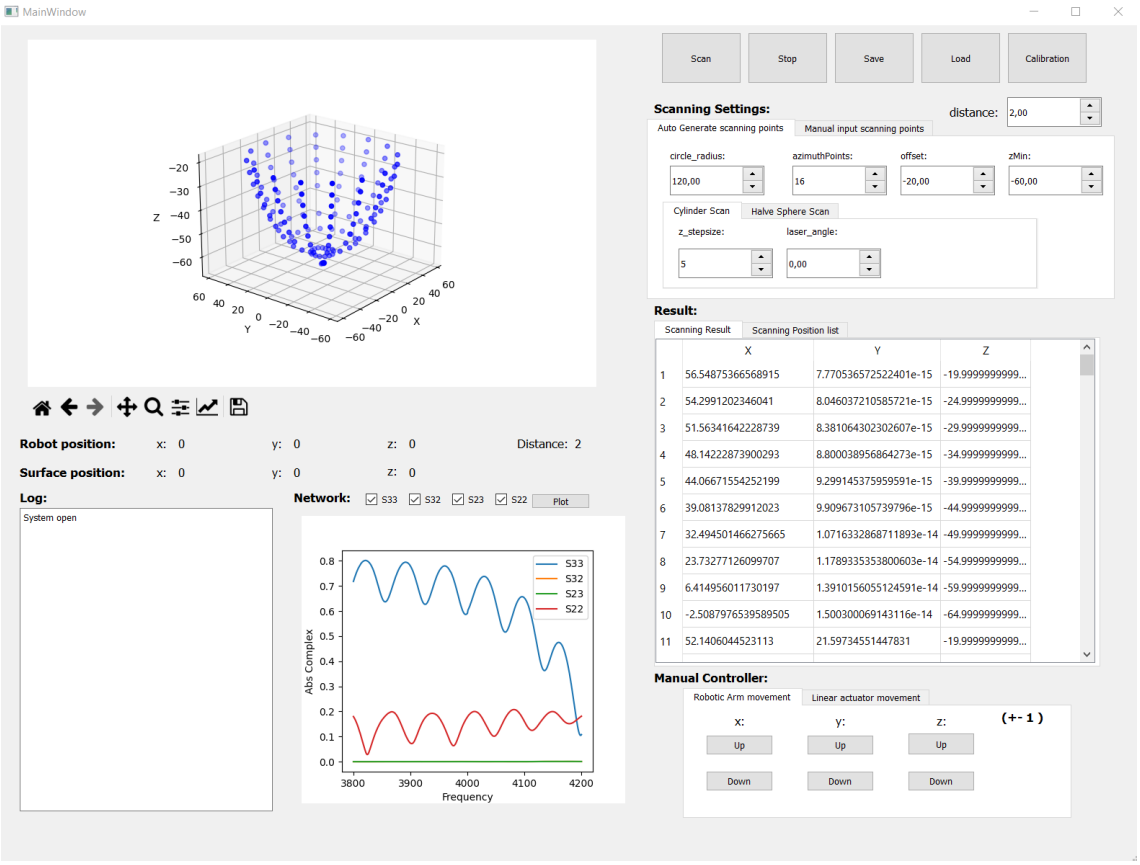
Contents

1. GUI overview

This GUI is not dynamic adjustable. Therefore, you need a big screen for display all functions.

Run MainProgram.py for run the GUI.

It is able to perform cylindrical scan. When you use halve sphere scan, your robot will have a collision with linear actuator. Same problem in manual input scanning, when you want to scan the point on the bottom, collision with linear actuator happen.



2. Scan Button

Perform scanning based on which tab is activating in Scanning Settings when user press the scan button. When scanning, other buttons about robot arm will be disable expect stop button. The result will be save in the Scanning result table in Result and plot in the Scanning viewer.

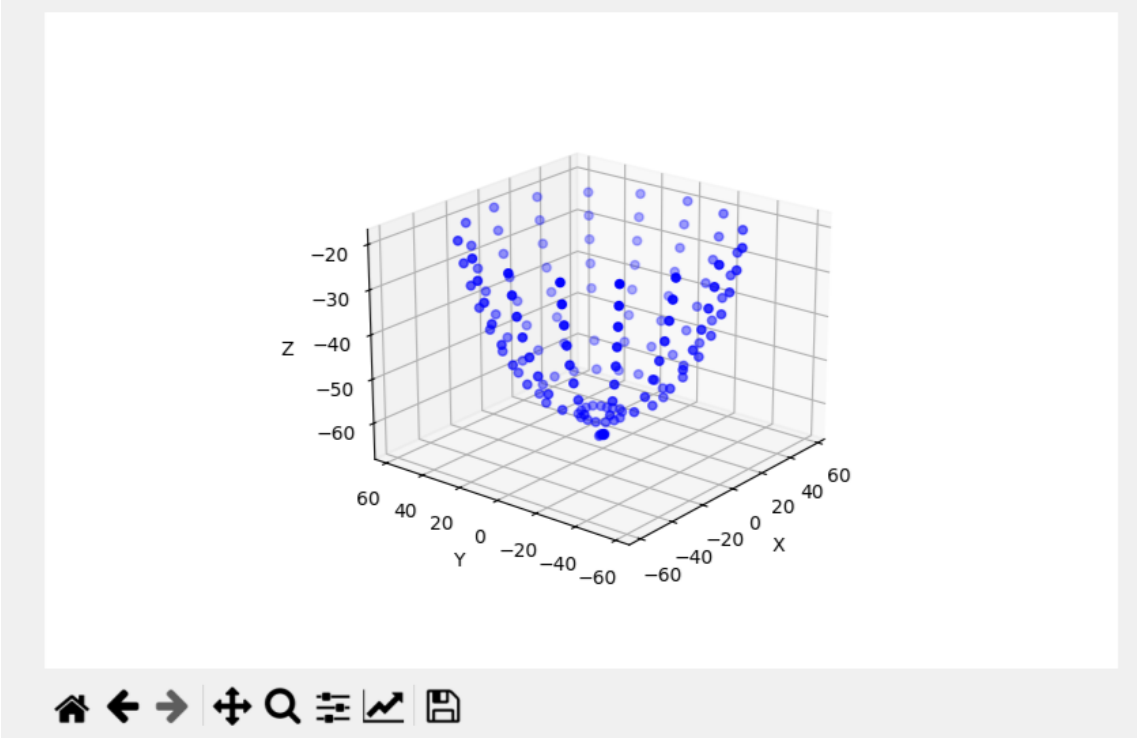
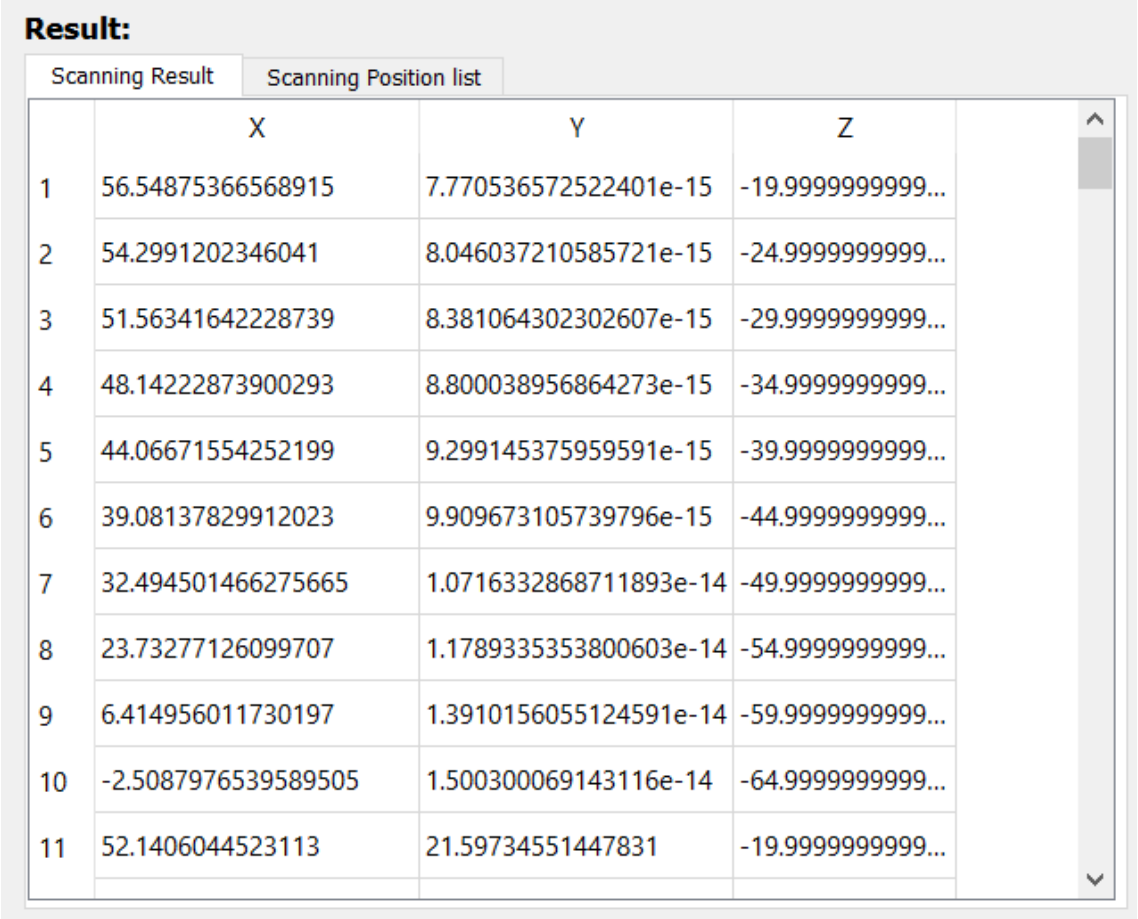


Figure 1: Scanning viewer



	X	Y	Z
1	56.54875366568915	7.770536572522401e-15	-19.9999999999...
2	54.2991202346041	8.046037210585721e-15	-24.9999999999...
3	51.56341642228739	8.381064302302607e-15	-29.9999999999...
4	48.14222873900293	8.800038956864273e-15	-34.9999999999...
5	44.06671554252199	9.299145375959591e-15	-39.9999999999...
6	39.08137829912023	9.909673105739796e-15	-44.9999999999...
7	32.494501466275665	1.0716332868711893e-14	-49.9999999999...
8	23.73277126099707	1.1789335353800603e-14	-54.9999999999...
9	6.414956011730197	1.3910156055124591e-14	-59.9999999999...
10	-2.5087976539589505	1.500300069143116e-14	-64.9999999999...
11	52.1406044523113	21.59734551447831	-19.9999999999...

Figure 2: Scanning result table in Result

2.1. Auto Generate scanning points

When this tab is activating, the robot will preform a scanning by auto generate scanning points.
Meaning of spin boxes:

- circle_radius = Radius of the cylinder
- azimuthPoints = Number of points in the azimuth angle
- zMin = Lowest point of the cylinder
- offset = Offset in the z-axis

2.1..1 Cylinder Scan

When this tab is activating, the robot will preform a cylindrical scanning by auto generate scanning points.
Meaning of spin boxes:

- z_stepsize = Number of mm between each z-plane
- laser_angle = The angle of the end effector to point the laser (between +90 and -90)

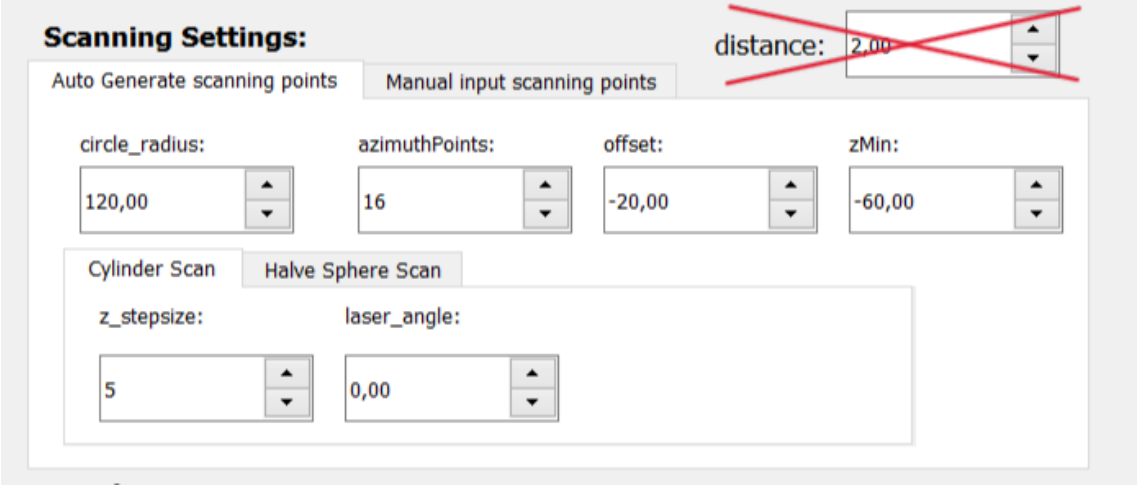


Figure 3: A cylindrical scanning setting

2.1..2 Halve Sphere Scan

Warning: Don't use this function when there is a linear actuator on the bottom of the object.

When this tab is activating, the robot will preform a halve spherical scanning by auto generate scanning points.

Meaning of spin boxes:

- elevationPoints = Number of points in the elevation plane

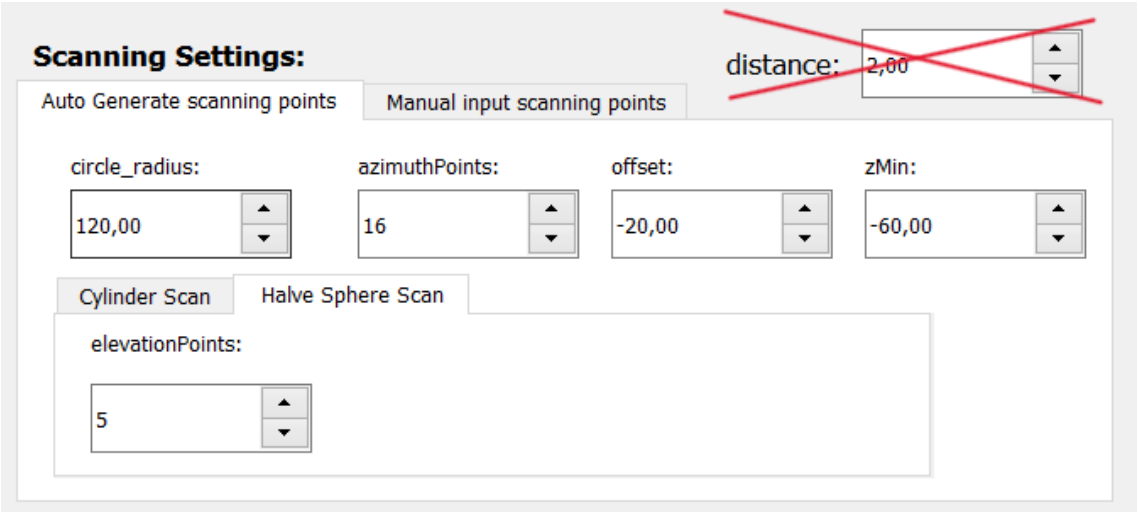


Figure 4: A halve spherical scanning setting

2.2. Manual input scanning points

Warning: When you want to scan the point on the bottom, collision with linear actuator happen.
Warning: Sometime, when the robot return to start position from the position now, collision with linear actuator will happen.

When this tab is activating, the robot will preform a scanning by reading the values in the Scanning Position list. Before performing, the system will check all values in the table if it is a number or not. After scanning, the result will be latest result will be display in Robot position

and surface position labels. Also, the result of the network analyser will be display in the network viewer.

Buttons:

- Input = Read the values in the x, y, z text box.
- Clear all = Remove all items in the Scanning Position list table.
- distance spin box = how far between the surface of object and the antenna in mm.

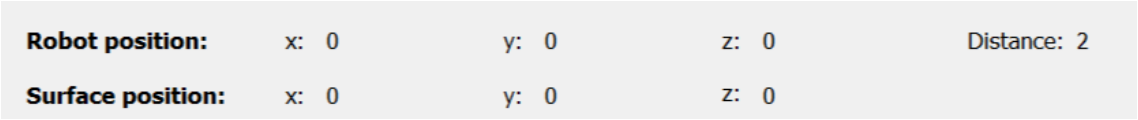


Figure 5: Latest scan point will display in labels if you scan the object with manual inputs.

Note:

- You are able to change the value in the table by double click the value.
- This scanning using the mesh data from 3D reconstruction. The mesh data generated by using values in results. There, you must scan the object or load data from csv using Load button.

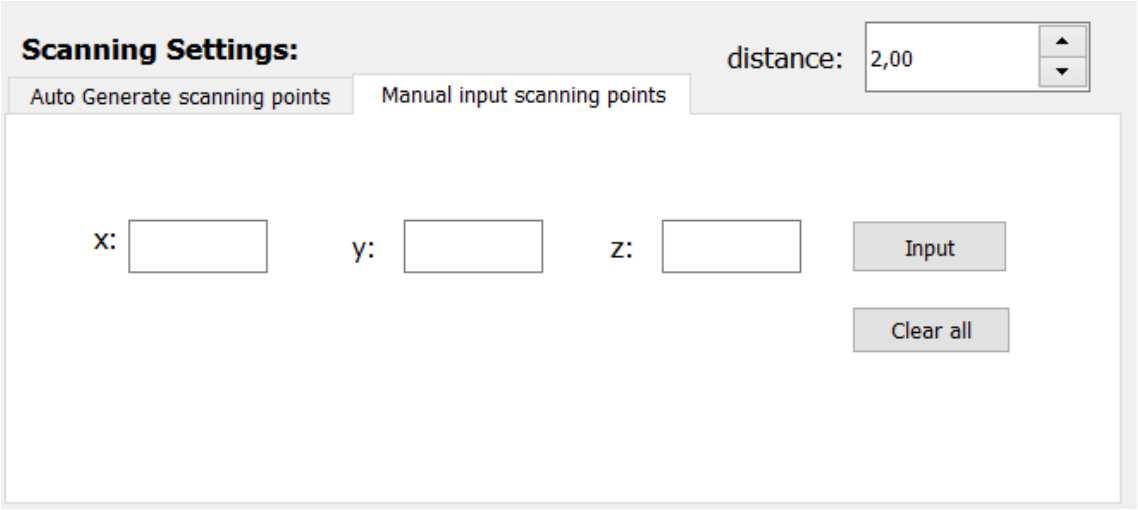


Figure 6: Scanning Position list in Result

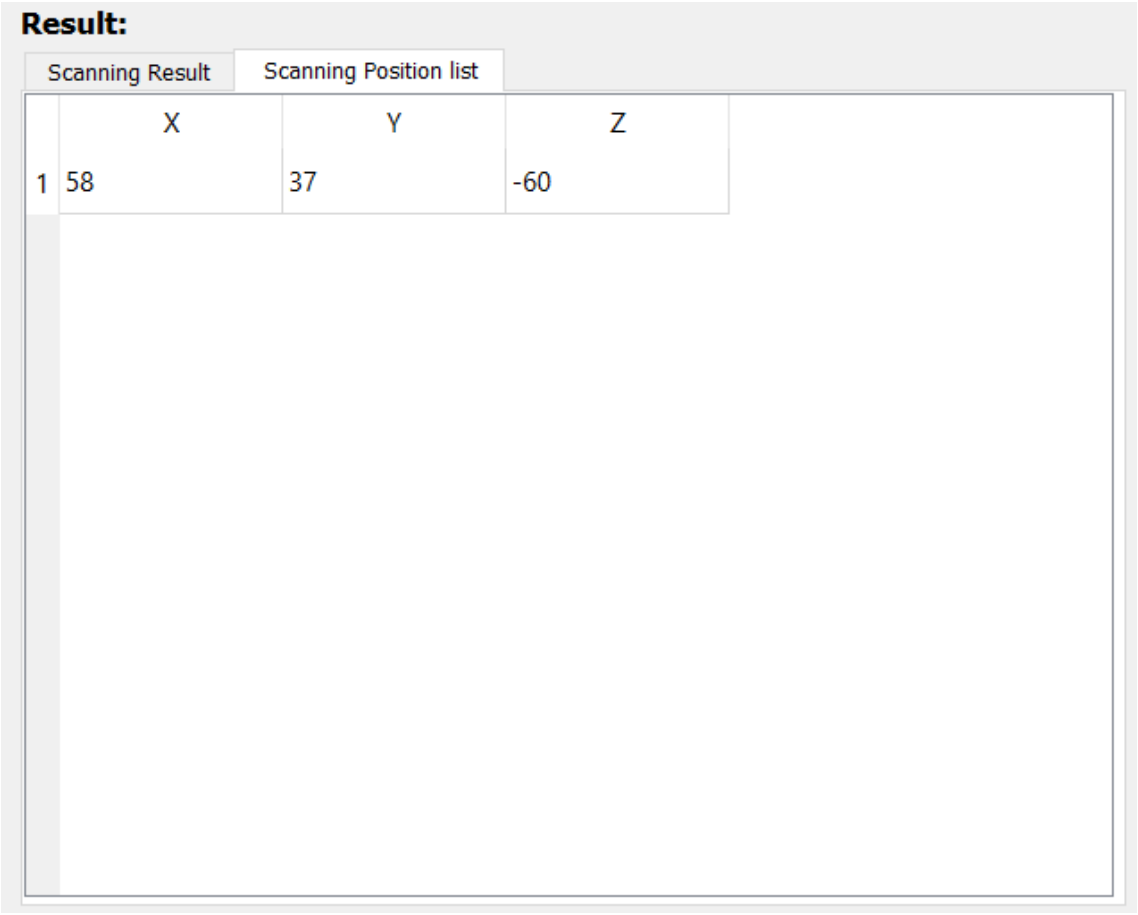


Figure 7: Scanning Position list in Result

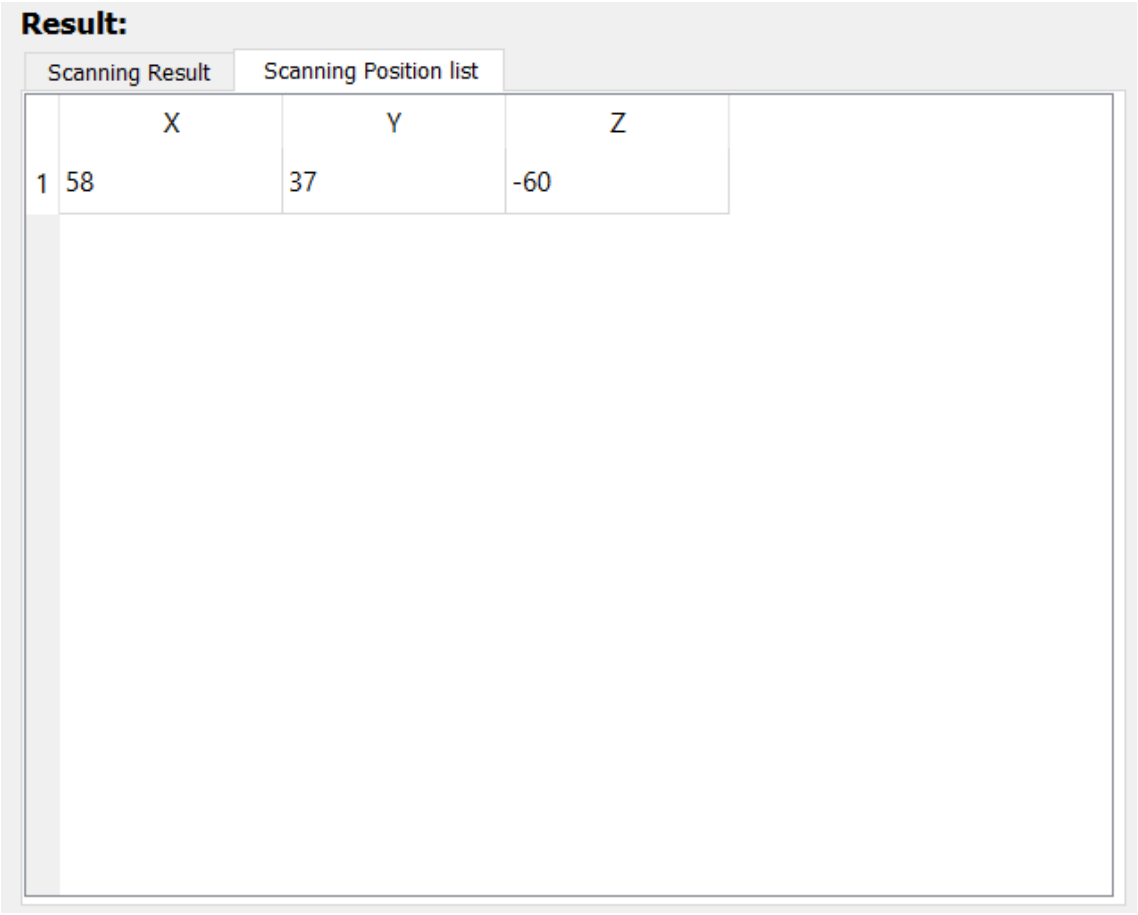


Figure 8: Scanning Position list in Result

3. Stop Button

Stop the scanning or calibration.

Note:

- When you perform stop action, this means the thread of scanning or calibration will be terminate. But the values are still in the Yumi Controller. So the Yumi will perform actions until end of the command. Use the red stop button in the Yumi Controller if you need to stop immediately.
- When you perform stop action, the connection between Raspberry Pi and Yumi controller is not disconnect. Therefore, you need to restart the program to disconnect. Because of that, after you press the stop button, other buttons are not enable again.

4. Save Button

Save items in the Scanning Result table in Result as a csv file.

5. Load Button

Read data from a csv file and insert to the Scanning Result table. It will also plot the point cloud base on the data and perform a 3d reconstruction.

6. Calibration Button

Warning: It cause problem when robotic arm have too many cables.
Perform a calibration scanning and update the quaternions which are used for scan the object.
Note:

- The quaternion is [9.99954527e-01, 9.41712207e-03, 1.50357889e-03, 9.45543129e-06] in ClassGUI.py. If you want to change the quaternion permanent, you need to go to ClassGUI.py in GUI folder to change it manually. It will use old quaternion when you restart the program.

7. Manual Control

Functions for control the robotic arm and linear actuator manually.

7.1. robotic arm movement

The principal of robotic arm movement is to able perform small movement +-1 mm. But it always go back to the start position and then go to the specific position. Therefore, it is not good to use it. Use manual input scanning points instead. It also use same distance spin box same as the manual input scanning points.

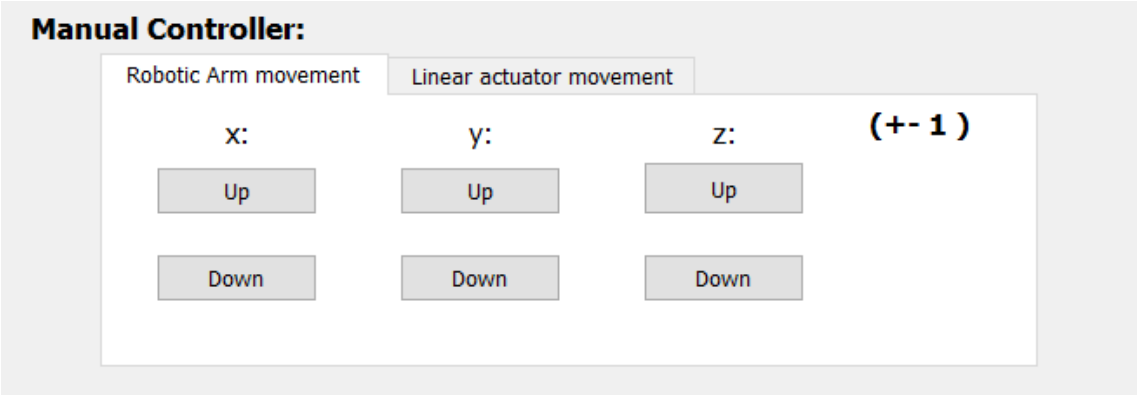


Figure 9: Manual robot controller

7.2. Linear actuator movement

Functions for control the linear actuator. You are able to move the linear actuator +-1 mm or go to specific position by use Move button. Also, before you use the controller, you need to move the linear actuator down to bottom (the zero position), and then press calibration button in the tab to let the program know the linear actuator is on the zero position.
Buttons:

- Move = move to specific position using input in the spin box.
- Calibration = set the current value to 0
- Up = move linear actuator up 1mm
- Down = move linear actuator down 1mm

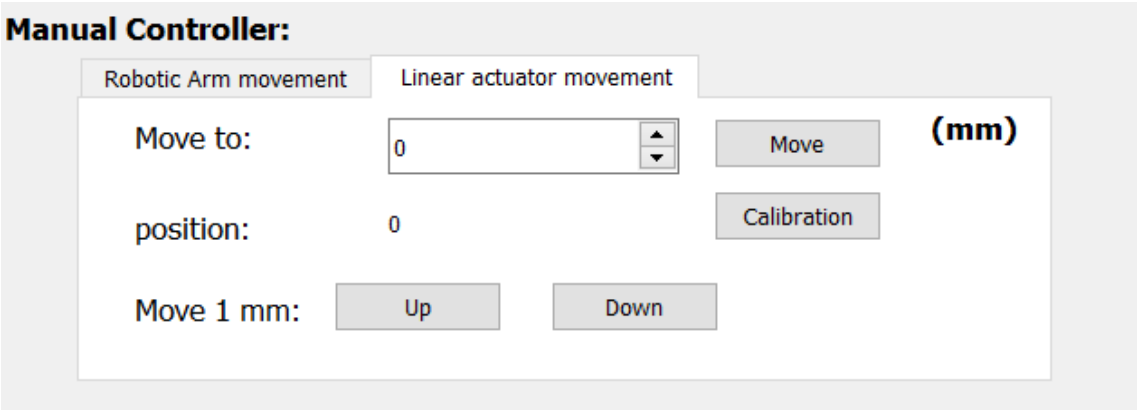


Figure 10: Linear actuator

8. Log

A text box that use for display messages.

9. 3D reconstruction

Function for plot the 3D model. But because Raspberry pi is not able use the plot function in open3D. Therefore, this functions is not available. But the 3D reconstruction data saves in a file called meshNew.obj.

10. Network viewer

A viewer for display the result of network analyser. It is also automatically save the result in the mw_data folder. Which result will be display base on which checkbox you had checked.

Buttons:

- plot = read a csv file in mw_data and plot it in the viewer

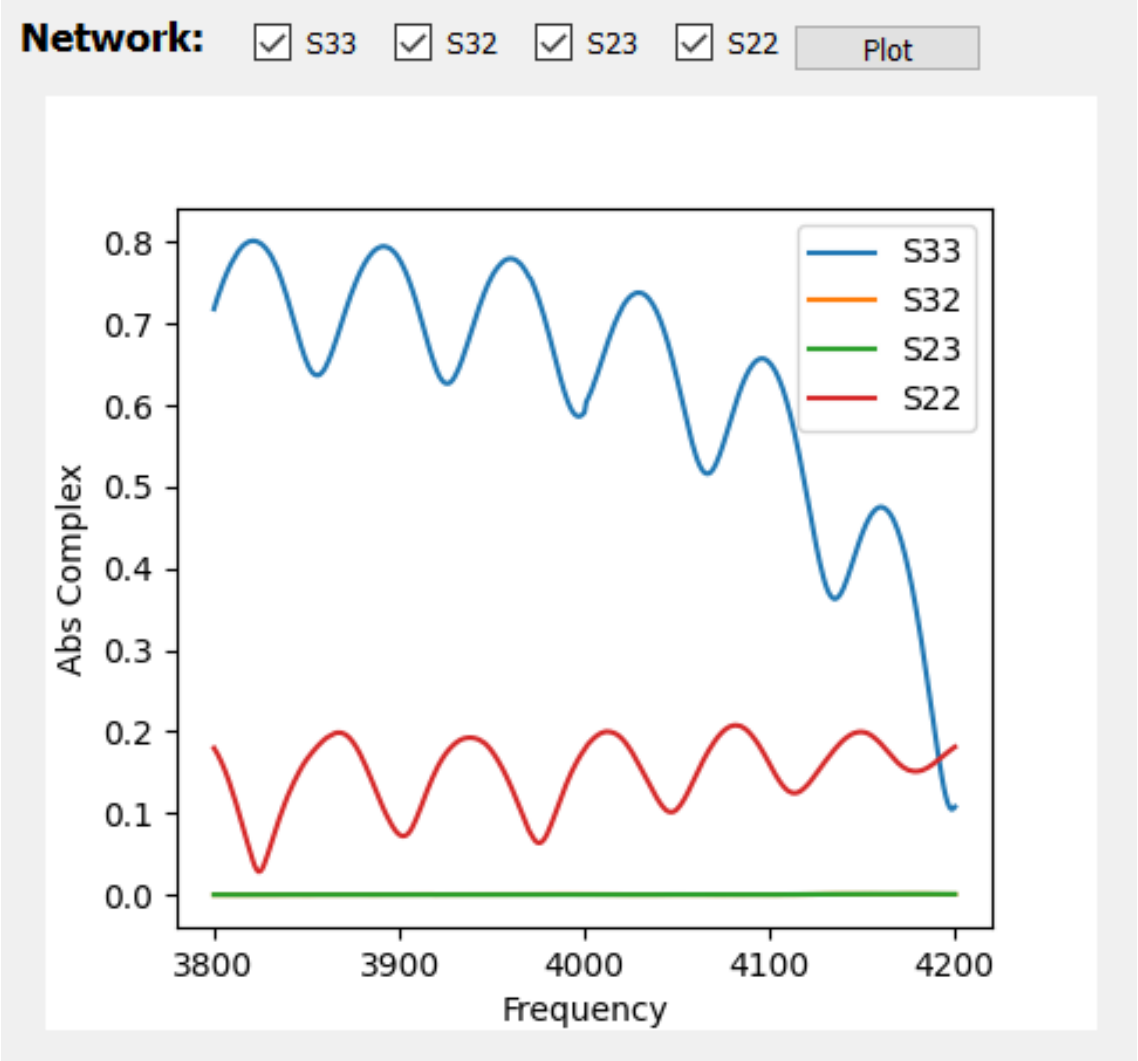


Figure 11: Network viewer