Point Cloud Processing – Assignment (Day 4 - 6)

Q1. Inspect Point Attributes

Task:

- Print the point data using **np.asarray(pcd.points).**
- Check if additional attributes like color or intensity are present using **np.asarray(pcd.colors)** or **pcd.normals.**

Answer the following:

a) What attributes (fields) are present in your .pcd file?
b) Do you observe any non-geometric data such as color or intensity? If yes, how is it stored?

Q2. Calculate Basic Statistics (min, max, mean)

Task:

Using NumPy, calculate the following:

- Minimum values of x, y, z
- Maximum values of x, y, z
- Mean values of x, y, z

Answer the following:

a) What are the min, max, and mean values for each axis (x, y, z)?
b) Based on these values, describe the size and spread of the point cloud.
c) Where is the geometric center of the cloud approximately located?

Q3. Normalize the Point Cloud

Task:

Normalize the point cloud by:

- Subtracting the mean (centering the cloud at 0,0,0)
- Dividing by the maximum absolute range to scale it within -1 to +1
- Visualize the normalized cloud using Open3D.

Answer the following:

a) After normalization, is the cloud properly centered?
b) Do all coordinates fall within the expected range (around -1 to 1)?
c) How does the normalized cloud look compared to the original?

Q4. Remove Noise and Save Cleaned Cloud

Task:

Apply statistical outlier removal using :

- cleaned_pcd, ind = pcd.remove_statistical_outlier(nb_neighbors=20, std_ratio=2.0)
- Visualize the cleaned result and save it as cleaned_output.pcd.

Answer the following:

a) Was noise clearly visible before filtering?

b) Did filtering improve the quality of the point cloud?

c) Confirm whether the cleaned .pcd file saved and reloaded correctly.

Q5. Scaling and Standardization of Point Cloud

Task:

Apply Min-Max Scaling to bring all x, y, z values between 0 and 1.

Apply Z-score Standardization to make the mean = 0 and standard deviation = 1.

Answer the following:

a) What formula did you use for scaling and standardization?
b) How did the point cloud look after applying each step?
c) Why are these steps useful before further processing?