Q1.

A black square with a white dot

AI-generated content may be incorrect.

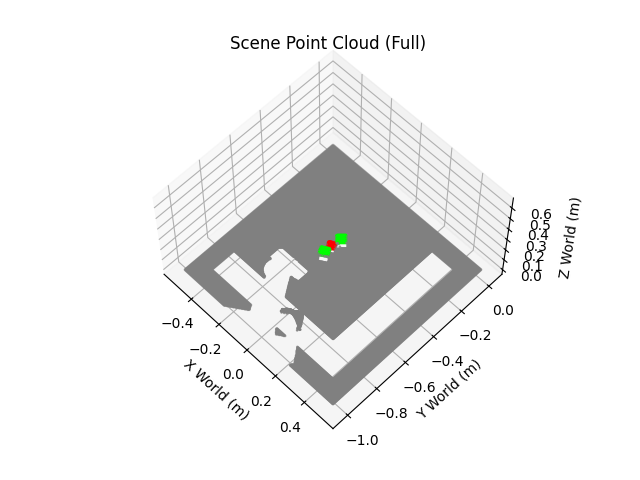
Q2.

1. Equations for calculating 3D point cloud (camera frame) from a depth image

Where and are the focal lengths, and are the principal point.

1. Equations for transforming the obtained point cloud to the world coordinate frame

Where is the inverse of the extrinsic matrix.



Q3.

Grasping Strategy: It begins by processing the image to resist noise through color segmentation, morphological filtering, and selecting the largest component, then precisely calculates the red cube's 3D centroid and top surface height using the median and percentile of its point cloud coordinates. Subsequently, the robot plans three critical waypoints which are a safe hover position directly above the cube, a grasp position for acquisition, and a lift position for retreat. The entire motion sequence strictly follows a vertical descend, grasp, and vertical lift pattern to ensure no side collisions occur while entering or exiting the confined space surrounded by the green cubes.