Point cloud operations

Exercise 1 – 3D Plane fitting :

First, get some depth maps (point clouds) from your Turtlebot using the Asus Xtion depth sensor. Try first to get a "clean" wall area that is easy to detect – e.g. 2m directly in front of robot and without any direct sunshine. Also try to get same wall, but with a "rotated" Turtlebot.

Then, try to fit planes to these maps. First use only smaller regions/blocks of the map – where there is a clear wall area. You can use the supplied MATLAB templates.

Exercise 2 – Extract range and angle from scan - MANDATORY :

The overall purpose of the exercise is to extract range and angle data from scanning data from the Turtlebot – this is important in many localisation methods.

First, capture range data with the Turtlebot – you may choose either the Laserscan (2D) message from ROS or manipulate the 3D depth map as in Exercise 1. You should place the Turtlebot with know distance to a wall and at fixed angle to the wall.

Develop an algorithm that can extract range-angle coordinates (ie. range from robot to wall and angle between robot heading and wall) from the range data and compare to the true measured values. NOTE: The algorithm needs to do a line fitting or similar technique to make the algorithm robust to small irregularities on/near the wall.

Test the algorithm by making a small program to drive the robot along a wall with a fixed distance to the wall (say, 0.5 meters). It should be able to keep the same distance at all times by changing angle of driving to adjust distance to wall.

Optional : Make the algorithm more robust with methods like kmeans-clustering or Hough transform, to only fit line/plane to "largest" wall area (e.g. not fit to a corner).

Optional : Test with "irregular" wall (e.g. wall with door, wall with some part of corner, ..).