

Individual Lab Report 8

Team: H

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1. Individual Progress:

The previous algorithm for open door detection doesn't work very well as we are using the depth image, and there are many outliers and noises around the door's bottom corners. So, instead, we want to detect open door by using laser scans.

Basically, laser scan is just an array encompassing the frontal 180 degrees of view, where each element represents the distance of the closest point in that angle of point. The opening detection algorithm can be described as below:

First, because there exists a lot of outliers in the laser scan, we want to first detect these outliers. Here we use the Z-score. What it does is to calculate the probability of a point being an outlier, by leveraging that point's neighboring points. For instance, if point i is an outlier, then its value will be obviously above or below the average value of its neighboring points, so the corresponding Z-score will also be very high. So, we can detect those outliers by high Z-scores.

Then, we remove the outliers. We can simply replace the point value with the average of its neighboring point. Here we take the average of neighboring four points.

Next step will be detecting the door corners. The intuition is that at the door corners, we will observe obvious value changes of the laser scan. So we can just take a sliding window of size 8, if the sum of the first four point values are obviously lower or higher than the next four point values, then it's highly likely that it's a door corner. After sliding the window through the whole laser scan, we might get multiple "door corners", some of them might be due to un-removed outliers. So, we store all these "door corners" 's positions and differences. Then, we just need to select the top two positions where the difference maximizes, and they are just the door corners.

2. Team Work

Last two weeks, we submitted our MBZIRC report. Shubham and I worked together to implement the opening door detection as well as door entering. Parv and Akshit worked on the UAV door entering and window detection algorithm improvement.

3. Challenge

The challenges are like integrating the velocity controller for controlling the DJI drone (e.g. what frequency to publish the control signal). Secondly, we need to collaborate with DOE team, which means that we might often remove and re-add the UR5 arm on the Husky, which takes quite a lot of effort. Another challenge is sensor fusion on the Husky (many sensors and cameras), which puts pressure on the ROS topic publishing.

4. Future Work

Hardware:

- Figuring out new extinguishing mechanism
- Assembly/building the new mechanism
- Extinguishing mechanism attached to the Husky
- Extinguishing mechanism attached to the UAV

Software:

- Occupancy grid for UAV
- Local Path Planning for UAV
- Husky testing the IMU and tracking camera integration