Lidar Lab

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1 Gap Finding Algorithm

Gap finding algorithm Pseudo Code

1. Check each step of lidar scan and 0 everything under 1.5
2. Clustering Parameters
   - Minimum distance between two points 0.1
   - Minimum number of step to consider points for clustering.
     Each step is of 0.25 degrees for 3 degrees of angle lidar takes 12 steps.
   - Maximum number of steps to consider for clustering.
     Each step is of 0.25 degrees for 90 degrees of angle lidar takes 360 steps.
3. Code scans for all the steps in lidar scan and returns index of the clustered steps.
4. All the parameters related to gap is stored in respective list including length, center and the gap list itself.
5. After that center step of each gap is considered and compared with center of other gaps.
6. The one with highest range value is selected as the gap for car to go.
7. Using center step find x, and y for that scan and use it as gap_center

Since we have two way filter in the algorithm first in which we neglect all the values under 1.5 since the width of track is 3 and car is in the center.
We also have another filter where we only look at clusters which are in the range of 3 degrees to 90 degrees of step size, in other words if a cluster angle is below 3 degrees or above 90 degrees we have ignored all those clusters.
After filtering out all the clusters we select center of each cluster as the main

goal of the task is to keep car in the center.
We compare all the centers of the gap and select the one with highest range that means it can go far and fast in that direction.
The one with highest is the gap is selected to calculate the center of gap and publish.
We also publish to lidar gaps topic each time we find a gap satisfying the condition.

This code does not look for the best or closest gap available and rather looks for the one it can achieve without having to reduce speed considerably.

2 Algorithm Hyper-parameters and it's effects

- Distance between two cluster points
  If we increase the distance between two cluster points more points will be considered for the clustering and this will lead to lower number of gaps found.
  If the distance is lowered less points will be considered for clustering leading to increase in number of gaps found.

- Minimum angle to be considered for a cluster
  This is an crucial parameter as this regulates the minimum number of cluster points by increasing or decreasing we will reduce or increase clusters respectively.

- Maximum angle to be considered for a cluster
  This parameter plays a crucial role in determining if the gap we found is a place for car to go or a wall.
  As the algorithm cannot differentiate from the lidar scan.