Team F: FALCON EYE

Individual Lab Report 7

Progress Review 8

Rahul Ramakrishnan

Team
Pulkit Goyal
Yuchi Wang
Pratibha Tripathi
Danendra Singh

February 15, 2018

1 Individual Progress

My primary contribution to the progress was to perform point cloud processing of the incoming points from the LIDAR mounted on the husky. The processing included filtering out the desired pointcloud for husky's navigation and performing clustering on the desired cloud to segment out the obstacles with their respective maximum x and y positions. These tasks we done alongside Pulkit.

1.1 Point Clod Filtering

Working with the entire pointcloud proved computationally inefficient and unnecessary for our use case. Hence we decided to filter out the point cloud to bare minimum that's required for the navigation of Husky. Our calculations for required field of view for many possible navigation cases led us to the conclusion to use 210 degrees FOV (180 degrees in the front half and 15 degrees on either side of the back half) of the LIDAR and filter them as the desirable point cloud.

Further we decided to mark points located more than 10 m away from the husky as undesirable and remove them as they didn't serve any purpose for the type of navigation we were planning to perform. Fig.1 shows the complete point cloud before removing the undesirable regions. As you can see, it includes points representing objects behind the Husky and of those located greater than 10 m from the Husky.

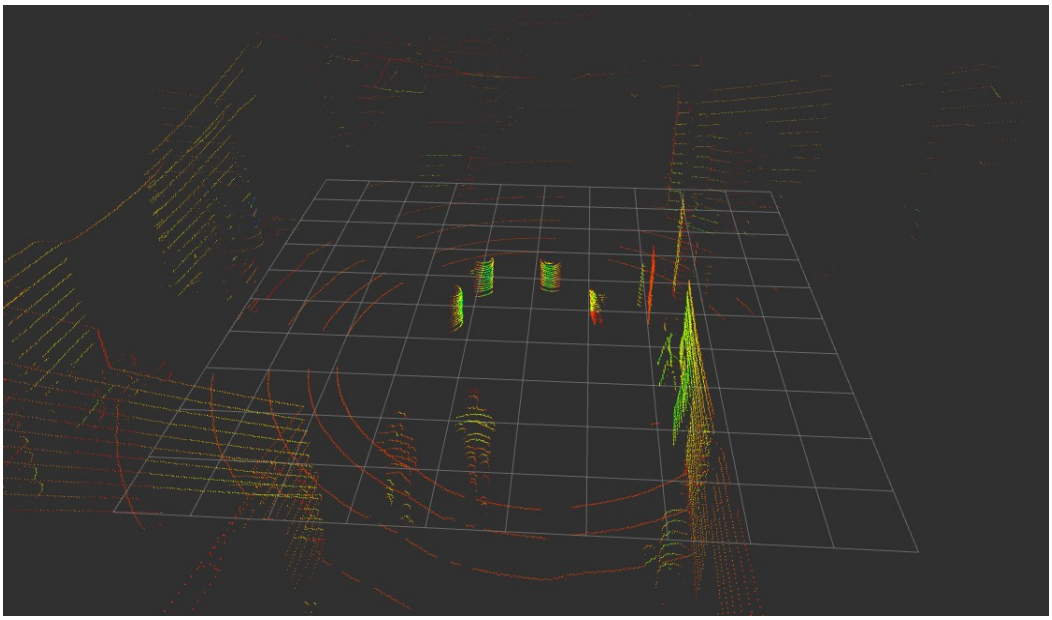

Fig.1 Visualization of unfiltered pointcloud from Husky's LIDAR

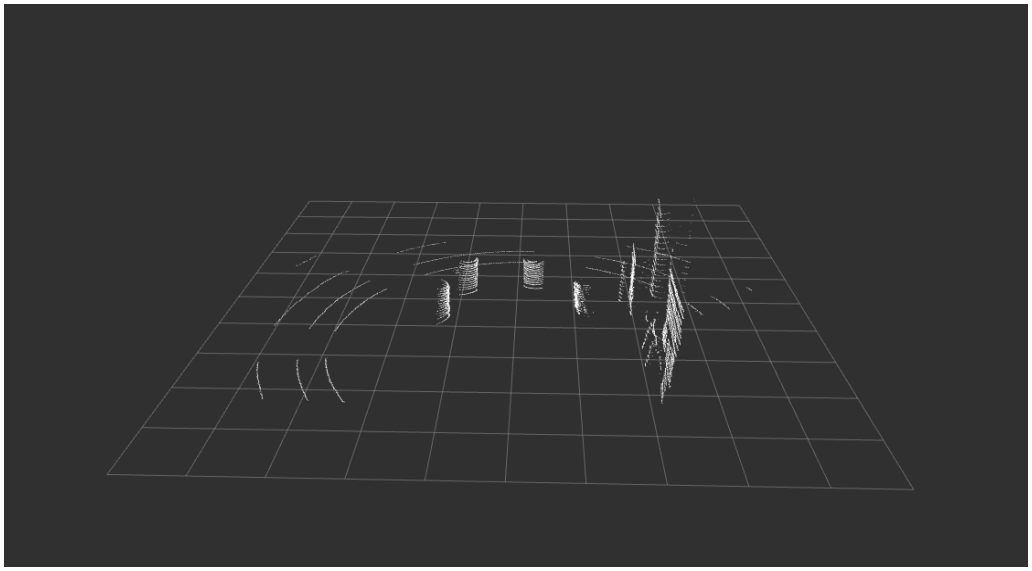

Fig.2 Visualization of Filtered (desired) pointcloud from Husky's LIDAR

Fig.2 represents the desired pointcloud containing points that are within the 210 degrees FOV of the LIDAR and are less than 10m from the Husky.

1.2 Point cloud Clustering and Segmentation

It was essential to cluster point clouds corresponding to each obstacle to find their corresponding maximum x and y locations with respect to the Husky. This is a major requirement to perform suitable navigation around the obstacle. We performed the clustering by associating points that are close together within a certain threshold into one obstacle. We further used ROS PCL library for segmenting each obstacle separately and finding their maximum x and y from the segmented obstacles. Fig.3(a) and Fig.3(b) show two of the segmented obstacles from the filtered pointclouds.

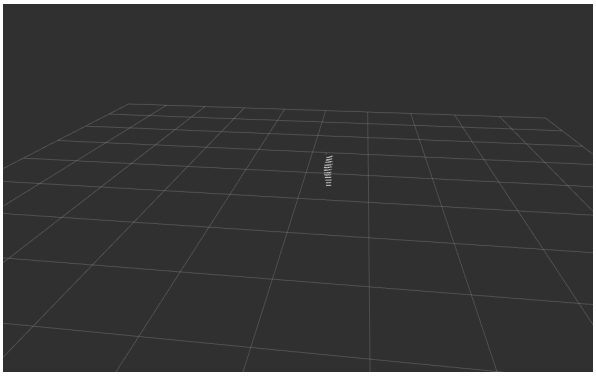

Fig.3.(a)

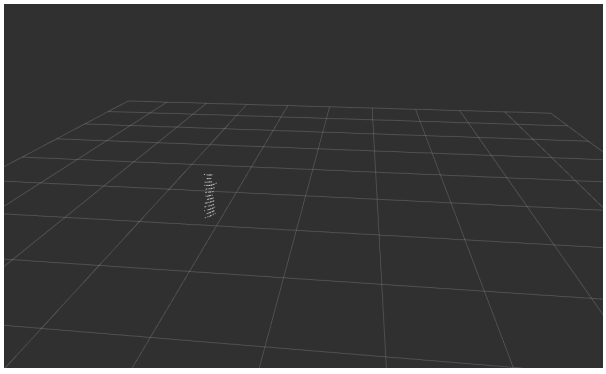

Fig.3.(b)

Fig.3 Visualization of segmented pointcloud of the obstacles

2 Challenges

Finalizing the metrics for filtering the points took long as we had to take into account several edge cases that might arise in practical scenarios. Once finalizing the angle as 210 degrees and distance as 10m, the implementation was smooth and hassle free.

The frame supporting the LIDAR has begun to vibrate with the movement of Husky and is not very stable. This is something we suspect might cause problems and we are planning to look into it.

3 Teamwork

Yuchi worked on testing several methods to eliminate glare in the apriltags. The matte spray paint was able to increase the height of flight of the drone by 1m. He also perfected the graph connection between aprilTags overcoming previous glitches. Pratibha worked on the integration of IMU into ROS node for Husky navigation. Pulkit and I worked on the pointcloud processing as mentioned earlier. Danendra set up the wi-fi mesh network to be able to cover over 100m with ease which will help us cover our test field with ease. Although the individuals in the team have different timing schedules for their course works, we are doing our best to try and come together to work on this project, keeping us all in one page.

4 Future plans

Pulkit and I will work on integrating the processed obstacle data into husky's navigation stack to enable obstacle avoidance on Husky. Pratibha and Danendra will work on outdoor testing and tweaking of IMU parameters on Husky. Yuchi will work on developing the exploration algorithm for the drone to find and connect the April Tags in the field.