

Team F: FALCON EYE

Individual Lab Report 3

Progress Review 2

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1 Individual Progress

My primary contribution to the progress was to build a Velodyne Driver from unsupported source, set up the calibration parameters and visualize online Velodyne pcap files in Rviz by conversion into a bag file. Also, I worked on developing the CAD model for our project along with Pulkit.

1.1 Velodyne Driver

Any Velodyne LiDAR, when purchased, comes with a USB stick that has all the drivers, files for calibration and other network connection files which make the initial setup for the LiDAR easy or hard if there are unexpected compatibility issues. Since we didn't get the LiDAR yet, I decided to start on with the interfacing part of the LiDAR to keep it ready to use upon the arrival of the Velodyne puck.

I initially hoped to find a ready to install driver supported by Velodyne but couldn't find one. I mailed to an official in Velodyne and he required a new serial number of Velodyne to send the original driver file which we didn't have. Hence, I downloaded several unsupported files from GitHub that related to Velodyne and build some link among those files to create a perfectly working driver.

1.2 pcap to bag conversion

I had to convert the online pcap files to be recorded as a bag file to display the 3D Point cloud in Rviz. For this, I had to create a node which publishes the downloaded pcap file and meanwhile store the published data into a bag file by subscribing to that topic. This took quite a while as the format of pcap was hard for me to figure out and subscribe. Eventually it was figured out and all the downloaded files were converted into equivalent bag files.

1.3 Calibration

Even after building the driver, the bag files weren't displayed in 3D with the same spatial representation as it was obtained using the LiDAR in real-time. It was clustering around some random points. There were several calibration parameters that had to be put under Velodyne_Pointcloud and Velodyne_heightmap node manually. I worked on the same and figured out the necessary parameters required to represent the bag files in the 3D format with the actual spatial representation. It worked out well and I can visualize any given pcap/bag file without any complications.

Overall, though the driver part could have been done in an easier way with usb stick from the other team, it was really a great learning experience in knowing the intricacies of requirements of Velodyne functioning. Also, since the node is calibrated and setup with all required parameters, I am confident to be able to visualize the data from actual Velodyne right after we receive it giving us more time for LiDAR data processing.

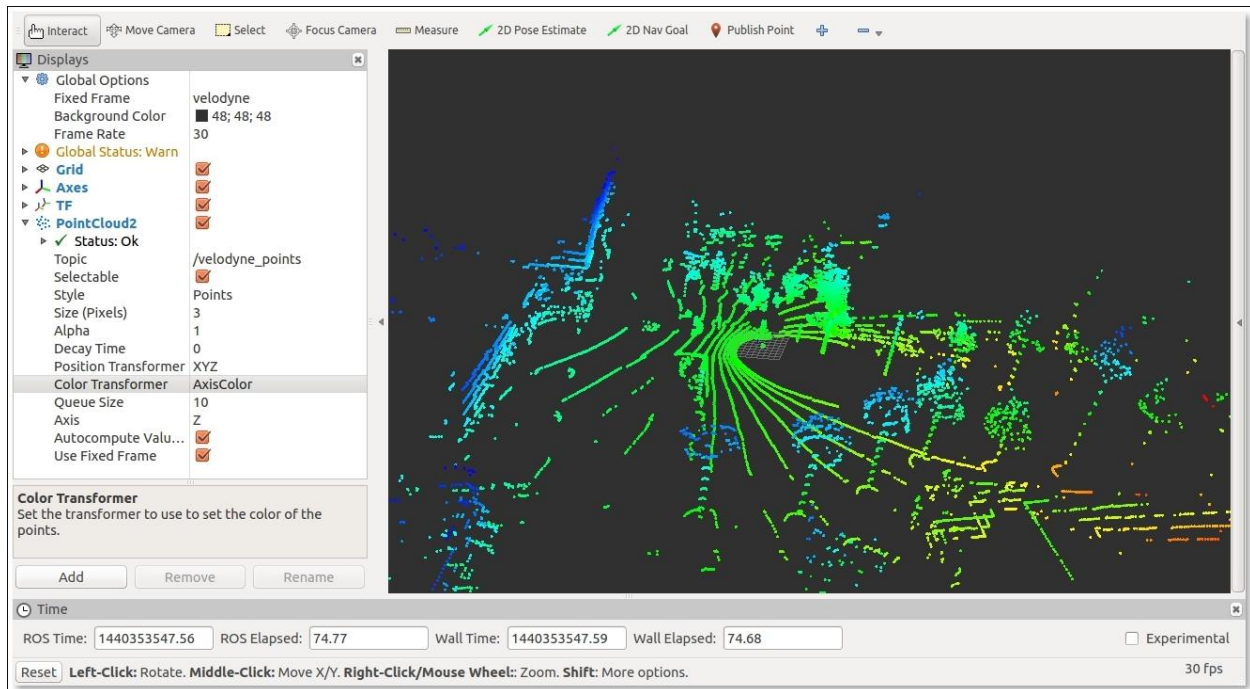


Fig.1 Visualization of top-view of Velodyne pcap data file downloaded from google cartographer

1.4 CAD Model

Me and Pulkit worked on developing the CAD model for our final system. The CAD model for Velodyne Puck, Husky, Camera and Mini-PC were downloaded directly from online sources. The models of GPS, Battery, Aluminum profiles, profile connectors, drone platform and screws were created by us. My part was the to create GPS and Battery models and in their integration with the husky. I also helped in the calculations of placement of LiDAR to ensure no obstruction in its 360 degrees horizontal and 30 degrees vertical view.



Fig 2. CAD Model developed for our system

2 Challenges

Since our use case is well-defined now, we were more productive for this progress review and didn't face that as a challenge unlike last progress review. Still the amount of technical challenges remained undiminished. The amount of unknown errors that I faced during the driver setup was immense. Solving each one of them was a challenging task by itself. But that I now know how to handle those errors makes my work faster in the upcoming stages. Studying about each parameter required to calibrate the data took longer than I expected as they each had different formats.

Integrating and constraining each component within the husky mount space was a bit challenging as there were many constraints for Velodyne, GPS placements with respect to the drone. Trade-offs had to be done to come to a final schematic. This time, all the challenges faced gave me extensive learning experience.

3 Teamwork

Yuchi took up the work of controlling the drone with Logitech gamepad and successfully completed it within days. He also worked on interfacing the Radio link GPS taken from the inventory with the Arduino and received the GPS in NMEA form. He has been performing his tasks quickly giving him more time to help us with errors if any. Danendra helped Yuchi with the controlling of Bebop drone and worked extensively on PCB along with Pratibha. Pratibha worked a lot on the PCB part of the project and helped Pulkit with the tele-op control of Husky. Pulkit worked hard on the CAD model for the entire system with me. He also made the Husky able to take in commands (tele-op) from remote PC and perform accordingly. For this PR, the entire team worked in consonance with each other making it possible for us to reach our PR2 goals successfully.

4 Future plans

I will continue to work on Velodyne to detect obstacles from either the pre-loaded bag file or if we get the Velodyne puck I will use the data captured from the Velodyne. Pulkit and Pratibha will work on acquiring pose estimate of Husky using encoders and check for GPS accuracy. Danendra will work on high-level flight control of Bebop given a GPS location. Yuchi will further work on GPS and integrating the localization of husky, Bebop and april tags.