Team F: FALCON EYE

# Individual Lab Report 9

## Progress Review 10

Rahul Ramakrishnan

*Team*
Pulkit Goyal
Yuchi Wang
Pratibha Tripathi
Danendra Singh

March 22, 2018

# 1 Individual Progress

My primary contribution to the progress was to setup the tf tree for the the ros navigation stack and also in incorporating laser scan from Hokuyo to develop a costmap. I also worked on the overall setup of the navigation stack alongside Pulkit, Pratibha and Danendra.

## 1.1 tf Tree

Setting up the transforms right was the most important part of the navigation stack as all the computations needed to be based on a single reference. I had to map all the links namely gps_link, imu_link and laser_link to base_link.

To do so, I took the physical measurements of each of the sensor with respect to the base_link which lies at the center of the base plate of husky. These measurements were taken as (x,y,z) and updated in the transform tree. The method of measuring the position is shown in fig.1.
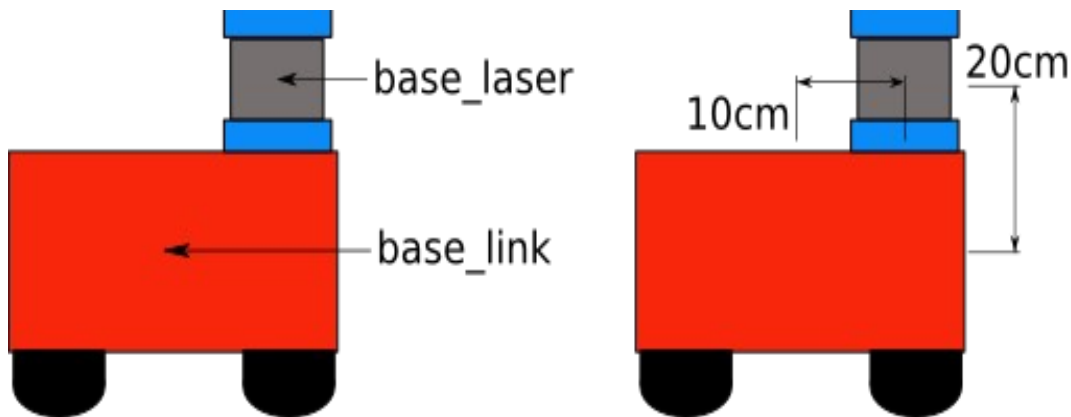


Fig.1 Visualization of measurement of Lidar position w.r.t base_link

Also the RPY of for laser and gps were updated to (0,0,0) since they were in the same orientation as the base_link. For IMU, the RPY was measured in static state and updated accordingly. All this made the measurements to be to be processed with respect to the base_link thus providing the ekf, obstacles and map with respect to the husky's base_link.

The transform between the base_link and map is internally setup. Fig.2. shows a part of final transform tree. The husky's description urdf file was provided with the package enabling us to use visualize the position of laser and gps as transformed with respect to husky in rviz as shown in fig.3.
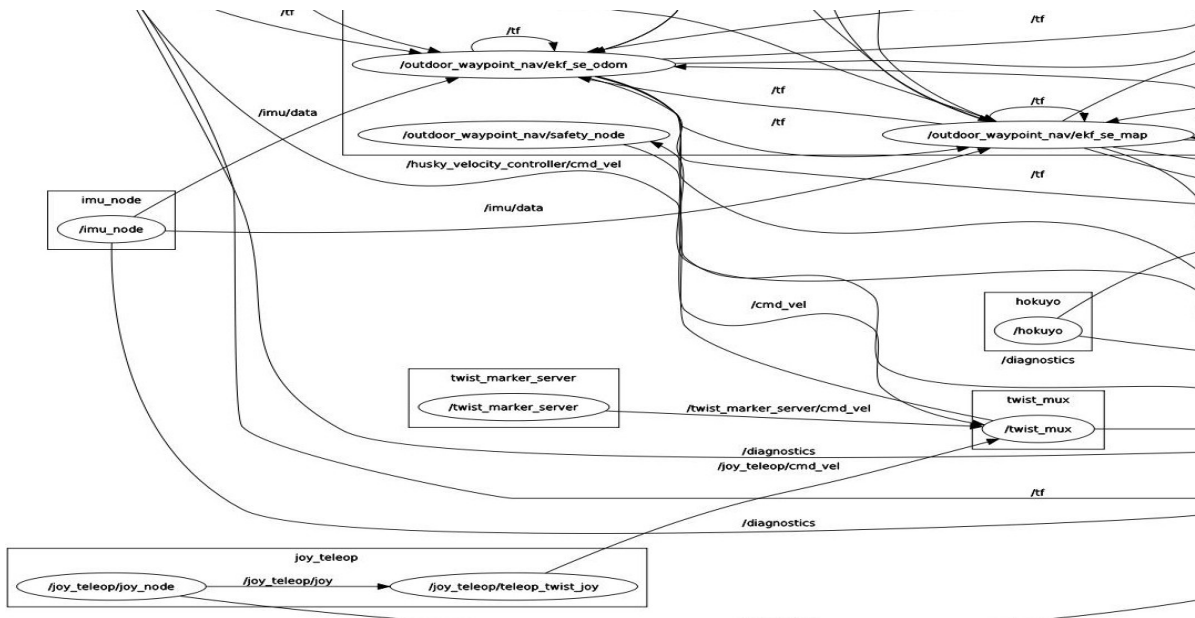
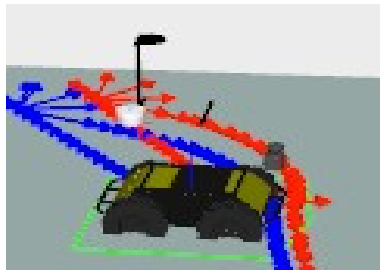Fig.2. Visualization of part of tf tree showing the imu and hokuyo



Fig.3. Visualization of lidar and GPS mounted on husky

## 1.2 Hokuyo laser scan

The hokuyo package had to be merged with the navigation package to make the costmap which is used for obstacle avoidance. I made changes in the launch files of the nav_stack to use hokuyo's laser scan for obstacle detection.

The previously set transform from laser_link to base_link enabled the obstacles to be detected and mapped with respect to the husky, making the map reliable and to make accurate planning using husky's ekf. Fig.4. shows the costmap created, here the black patches represent the obstacles. As the husky moves, it retains it's map with the previously seen obstacles. This can be used to plan for the future goals without colliding with the obstacles.
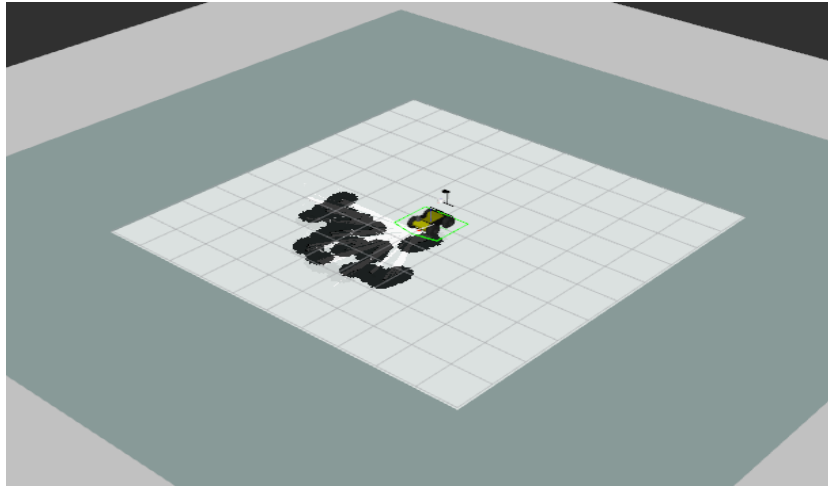
Fig.4. Visualization of obstacles detected by Hokuyo laser

## 2 Challenges

Our biggest challenge continues to be the weather for testing the system outside putting us behind in testing the gps based navigation with obstacle avoidance. Another biggest challenge was to get the ros navigation stack to work. We were facing a lot of random issues which delayed our implementation until the day before PR. But our team came together to debug and successfully got it working.

## 3 Teamwork

Yuchi worked on the UAV exploration algorithm and was able to successfully set it up without any issues. This is a significant step towards our final goal. Rest of us worked rigorously on setting up the navigation stack and getting it to work. Danny worked on the costmap development alongside me and Pulkit. Pratibha worked on incorporating the imu and gps packages into the nav_stack. Pulkit worked extensively on debugging the errors, setting up the framework as a whole and in updating out team git account.

## 4 Future plans

From now on, the entire team will work on the integration of the UAV and AGV together and debugging minor issues in the husky's navigation stack such as costmap size and improvising the planning. Yuchi will work on setting up the communication layer of the UAV. Pulkit and I would work on making the navigation stack robust and test it outdoors incorporating GPS data. Pratibha and Danny will work on setting up the communication layer for husky enabling data transfer from drone via a central computer.