Individual Lab Report – 4

Progress Review 3

By Pratibha Tripathi

Team F – Falcon Eye

Team Members:
Danendra Singh
Pulkit Goyal
Rahul Ramakrishnan
Yuchi wang

November 10,2017

Individual Progress

I was responsible for following tasks:
a) Mechanical design and fabrication of platform for bebop2 and mount for different sensors. Rahul and I worked on this task.
b) Power distribution Board. Danendra and I worked on this task.
c) Reading encoders and IMU data from Husky. Checking the range of network used for Controlling Husky. Pulkit and I worked on this task.

Mechanical fabrication

1) Prepared a Platform to place Bebop2 and the Husky April Tag i.e Parent Frame. I have kept it at a height of 28 cms from Husky top base level to give a clearance for battery, Remote PC, which will be kept inside Husky
2) Since the platform is kept at a height of 28cms, and the vertical field of view of Velodyne LIDAR is 30Deg. So, I have kept it at height of 70cms from Husky top base level, so that platform doesn't obstruct its path.
3) While driving Husky there is still some jerks, and the Aluminium profile supporting Velodyne oscillates, so we may put additional support at a later stage.

Fig1: Husky with all the mounts and components

Power Distribution Board

Danendra and I worked on power distribution board. We have already submitted the schematic and board by PR2, but we got feedback regarding the choice of converters, heat sinks, distribution and placing of components, and trace width at some places.

So, we made the required changes and submitted a new board.

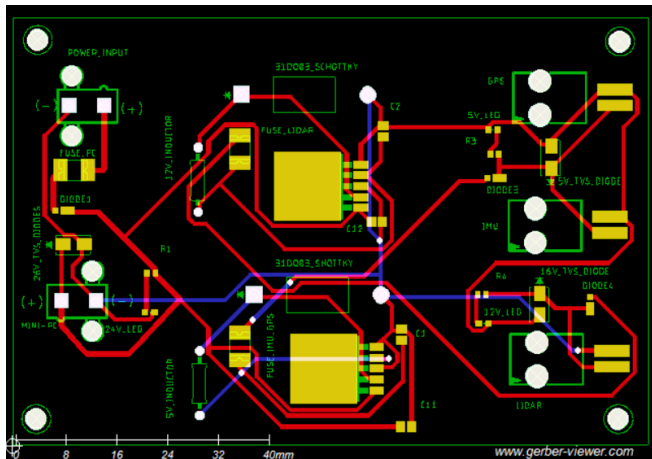We also prepared a Bill of Material and manufacturing files.

Fig2: Manufacturing File

Reading Husky Data

Pulkit and I worked on running the Husky through Rviz interact option and reading the IMU and Encoders data. We were able to control Husky through Rviz interact option. We can read the Encoders data and IMU data using following commands
rostopic echo /odometry/filtered
rostopic echo /imu/data

But we faced problems in resetting the odometry data, explained in challenges section.

Also, we tested the range of network used to control Husky, after replacing the antennae of the router. It is coming to be 58m in a straight line, with previous antennae it was coming as 27m. This will be sufficient for us, as we will be testing in an area of 50mx50m.

```
  x: -0.9623646924
  y: 0.0467620349
  z: 0.2546567098
  w: 0.0824462008
orientation_covariance: [0.002741552146694444, 0.0, 0.0, 0.0, 0.002741552146694444, 0.0, 0.0, 0.0, 0.007615422629706791]
angular_velocity:
  x: -0.000433264905381
  y: -8.01257299392e-05
  z: 0.00164294646858
angular_velocity_covariance: [1.0966208586777776e-06, 0.0, 0.0, 0.0, 1.0966208586777776e-06, 0.0, 0.0, 0.0, 1.0966208586777776e-06]
linear_acceleration:
  x: -0.00508858841835
  y: -0.0448820292424
  z: -10.3205838572
linear_acceleration_covariance: [0.0015387262937311438, 0.0, 0.0, 0.0, 0.0015387262937311438, 0.0, 0.0, 0.0, 0.0015387262937311438]
---
header:
  seq: 2134
  stamp:
    secs: 1510367890
    nsecs: 380743275
  frame_id: imu_link
orientation:
  x: -0.9630696477
  y: 0.0457885252
  z: 0.2534817843
  w: 0.0779814839
orientation_covariance: [0.002741552146694444, 0.0, 0.0, 0.0, 0.002741552146694444, 0.0, 0.0, 0.0, 0.007615422629706791]
angular_velocity:
  x: 9.57219808555e-05
  y: 0.000906044008306
  z: 0.00053180024025
angular_velocity_covariance: [1.0966208586777776e-06, 0.0, 0.0, 0.0, 1.0966208586777776e-06, 0.0, 0.0, 0.0, 1.0966208586777776e-06]
linear_acceleration:
  x: -0.00966762102101
  y: -0.045040169813
  z: -10.3219048767
linear_acceleration_covariance: [0.0015387262937311438, 0.0, 0.0, 0.0, 0.0015387262937311438, 0.0, 0.0, 0.0, 0.0015387262937311438]
---
^Cadministrator@teamf:/dev$ rostopic echo /imu/data
```

Fig3: Data From IMU

```
712538791432e-28, 0.0, 0.0, 0.0, -6.503955193979679e-24, -3.0307712538790953e-28, 1.0939422958858538e-06]
---
header:
  seq: 118450
  stamp:
    secs: 1510367972
    nsecs: 161909342
  frame_id: odom
child_frame_id: base_link
pose:
  pose:
    position:
      x: 0.0
      y: 0.0
      z: 0.0
    orientation:
      x: -6.37604315236e-29
      y: 3.21864788558e-28
      z: -0.442509996812
      w: 0.89676357125
  covariance: [10363820592368.445, 0.03635969590098398, 8.520283743896955e-20, 0.0, 0.0, 0.0, -0.0363586267426399, 10363820592368.445, 3.30683
42672432725e-20, 0.0, 0.0, 0.0, 8.52028374389707e-20, 3.306834267243364e-20, 4.999195507994937e-07, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 4.998391568
328793e-07, 1.6678553318393462e-31, 7.95177515430472e-21, 0.0, 0.0, 0.0, -1.6678553318393462e-31, 4.998391568328793e-07, 6.096987264989151e-21
, 0.0, 0.0, 0.0, 7.951775154304536e-21, 6.096987264989395e-21, 7465401.816061982]
twist:
  twist:
    linear:
      x: 0.0
      y: 0.0
      z: 0.0
    angular:
      x: -5.04222377974e-22
      y: -2.34976604392e-26
      z: 0.00110441355615
  covariance: [22909286.992094137, -2.5624345518324913e-29, -1.0250814179884158e-24, 0.0, 0.0, 0.0, -2.562434551832472e-29, 22909286.992094137
, -7.859699579977119e-25, 0.0, 0.0, 0.0, -1.0250814179884158e-24, -7.859699579977118e-25, 4.998793380123498e-07, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
 4.995180581261081e-07, 4.0383040187555145e-28, -6.5035526716876895e-24, 0.0, 0.0, 0.0, 4.0240741562499773e-28, 4.995180581261081e-07, -3.0307
712538791432e-28, 0.0, 0.0, 0.0, -6.503955193979679e-24, -3.0307712538790953e-28, 1.0939422958858538e-06]
---
```
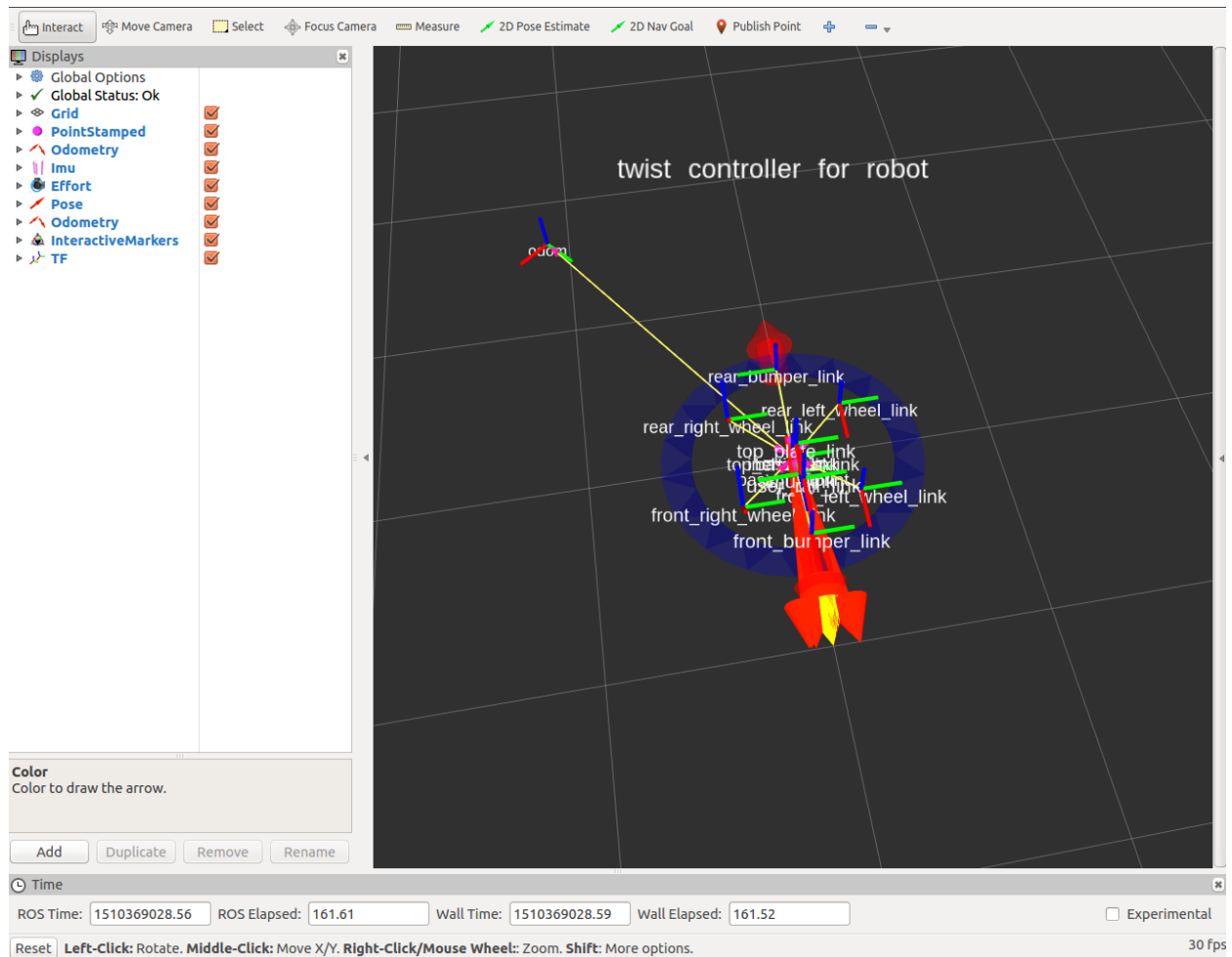
Fig4: Data from Encoders

Fig5: Rviz interact option

Challenges Faced

We had some 80-20 parts, that came along with the Husky from NREC. So, we decide to use them by modifying them. Using some machines for cutting was a bit tricky like I was cutting the aluminium profile at 45Deg for the first time and I had no idea how to rotate that saw to set it at a desired angle. And then fixing screws on the nuts in the aluminium profile is a bit tricky as they are not fixed they can move, I guess that consumed most of my time in the fabrication task. It might sound easy but it's not.

I Power distribution board, we had never generated the manufacturing files. We tried to follow the lectures but were not able to generate all the file extensions as desired. So, we took help from another team, after struggling for a while in that. We learned that considering heat dissipation, trace width and other minute details are quite important.

While trying to read data from IMU, we found out that ttyUSB0 was set to some random user and group and we were not able to read the data from it. We changed ownership of the port to the user we were logged in with.

Fig6: Error in reading IMU data

Fig7: Success in reading IMU data

One of the biggest challenge is testing outside in such a cold weather.

Team Work

Pulkit and I worked on reading IMU and encoders data with ROS installed on Husky PC. Rahul and I worked on mechanical fabrication and mounting required for various components of the system. Rahul also worked on Velodyne Puck for obstacle detection, using Velodyne height map. He also worked on reading GPS data. Yuchi and Pulkit worked on teleoperation of Husky, WiFi setup and setting up Bebop as a client in the common network. Danendra and Yuchi worked on navigating Bebop2 through GPS waypoints. Danendra and I worked on Power Distribution Board. Yuchi also worked on detection of April Tags.

MRSD Project Progress and Future Plans

Performing successfully all the tests for Fall validation experiment (FVE) is the main focus for the whole team. So, we'll work on the tasks required to complete FVE, which are as follows:

Connect Bebop2 with the common network, as currently, we are facing issues in that. As bebop2 hosts its own network and we are trying to figure out how to make it a client.

April tag localization with Bebop, we can get a stable transform between camera and April Tag0 but the April tag1 w.r.t April tag0 is very unstable and we must fix that issue.

Bebop2 GPS based navigation. We can navigate bebop2 by giving GPS waypoints through the app. But we need do GPS based navigation through ROS.