Individual Lab Report – 11

Progress Review 12

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Team F – Falcon Eye

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Individual Progress

I was responsible for fixing the Husky ROS navigation stack issues.

Husky Outdoor Navigation

We tested Husky inside and the EKF is working perfectly fine (Fig 1). But outside we are facing issues the whole EKF output was jumping around with the GPS. I also tested the GPS independently to check it's accuracy, but the plotting shows that it is within 3m. It was well within our expected range, but we were still not able to pinpoint the issue.

We tried using various combination of sensors. We thought that may be due to calibration issues of some sensor we might be having this issue, so we tried to use phone IMU and GPS. Also we tried another IMU, but none of it was giving desired results.

Finally, two things which I feel worked for us. I can't say for sure that these two only, because we changed covariances and tried to recalibrate things. Firstly, changing everything from map frame to odom frame was very helpful, the jumping around of the EKF with GPS reduced by changing things with respect to the odom frame. There are small drifts but the impact is not that huge on EKF. The reasoning which I found for the same was that odom is base_link -> odom transform which changes very smoothly, although in a long time it'll accumulate error and will not be that accurate, in our case, it'll work fine. While the map is odom -> map transform, which has sharp jumps and is not very smooth. So we made the changes inclusion in our map more smooth and closer to base link changes, so we were able to get a better EKF. In addition to this, we were not averaging GPS values over a longer period of time and so we were not giving very good approximated GPS input. We observed that GPS increases to a certain value and then it starts to decrease, and we then start to take the average of the minimum and the maximum value and input that as a final GPS location. Also, the weather was pretty good for two days and we were getting good GPS readings also. So, all these factors helped in debugging the Husky waypoint navigation (Fig 2).

We can write multiple GPS locations in a text file and Husky reads them one after another and executes them. So in our testing, we gave 4 GPS readings 5 times and Husky was reading one GPS location and navigating towards that at the same time avoiding the obstacles. After reaching the first location, it was planning its path for another location. So independently the functionality of Husky is complete. We need to find a way to average out and write the values of GPS we are getting from bebop, which will tell husky the traversable path.

Fig 1 : Indoor autonomous navigation by Husky

Fig2: Outdoor GPS waypoint navigation by Husky avoiding obstacles(chairs)

Challenges Faced

Some of the Challenges are:

1) One of the major challenges is testing husky outside. We were able to test Husky outside for only two days, with a good weather. It plays a huge role in the GPS values we get. we were getting pretty stable GPS values for these two days.

2) It's difficult to pinpoint the issue when you're actually testing on hardware. We were trying to debug imu, changing covariances and testing with various options, but the issue was very different from that. And then there are issues because of weather which we can't debug and fail to realize the impact of the same.

3) Another major challenge in overwhelming coursework, as I'm taking Deep learning and SLAM. Assignments for Deep learning, SLAM and robot autonomy are released almost together, so it's like 4 assignments to be worked on in two weeks and all of them have good difficulty levels.

4) A similar situation is faced by rest of the team members, which causes stretched working hours.

Team Work

Since debugging husky was the major issue, Pulkit, Rahul, Danendra and I were working on it only. We had to do extensive testing outside, it's easy to say one issue that to actually debug it.
Yuchi worked on increasing the height at which bebop can flight and reliably detect the April tags. Rahul and Danendra were working on and off with him on testing. They are also able to fly higher without compromising on quality or speed of detection.

MRSD Project Progress and Future Plans

We have to work on the following tasks:

1) Pulkit, Rahul and I will work on reading the data on Husky from the bebop and writing it in the desired format and desired rate on the Husky GPS test file.
2) Yuchi and Danendra will work on giving the desired averaged out GPS values to the Husky.
3) We are yet to decide that with what frequency bebop will give the values to husky. We are still weighing the options like bebop will keep on publishing the GPS location and husky will only subscribe to it when it wants or bebop will check the Husky's location and if it has reached one goal hen only it'll get a second value etc.
4) We have to do this complete integration and extensive testing to ensure that our system is able to complete all the functional requirements.
5) We have to make a video of the complete run as the weather is very unpredictable and, we won't be able to do the test run if the weather is not good.