Team F

Individual Lab Report 10

Progress Review 11

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1 Individual Progress

For this PR, I worked on the Bebop 2 integration and writing the global A* planner for the Husky.

1.1 Bebop 2 Integration

Bebop 2 integration was mostly testing-focused. The most important part of integration is ensuring that the Bebop 2 operates the same way on the Husky minipc as it does on my laptop. This consists of several aspects including: latency, processing power, and configuration issues. Previously when we tested the Bebop 2 code on the minipc, we saw many latency issues. However, this semester we have switched to the Ubiquiti network mesh which helped us achieve better results. In addition, the minipc needs to be configured to run the Bebop 2 driver and the result of the code. We wanted to ensure that it could do that successfully.

Testing the drone consisted of the same test procedure as we showed in PR 10. That is, we took it outdoors and allowed it to detect and find paths toward a GPS location. Overall, the testing was a success and we did not notice any significant issues with the performance. We have a video of this testing which is linked below. However, I also note that the processing power and configuration issues noted above cannot be conclusively closed. At the moment, we have only tested the Husky and Bebop 2 controllers individually but not together. Thus, there many be processing limitations when both systems are running simultaneously which can result in latency issues. In addition, there may be configuration incompatibilities when both services are running together. These are issues that need to be addressed in the next PR.

1.2 Global A* Planner

In contrast to the Bebop 2, the planner for the Husky needs to abide by the edges of the graph. The Bebop 2 currently explores the node that is closest to destination regardless of its current location. There are not aerial obstacles that prevent it from moving directly to a destination. However, there is such a constraint for the Husky. As a result, we need to construct an A* planner that finds the shortest path for the Husky.

Admittedly, given our test environment and the scope of our project, using an A* planner isn't going to make a huge difference. However, we would like to keep this system as general and impose as little assumptions on the test environment as possible.

Some code for the A* planner was developed in the past. This PR, I have finished developing that code and am ready to test it on the actual system. Due to unfortunate weather, I was unable to test the system outdoors for this PR. It is my goal to do so this weekend. Below is a diagram demonstrating how the whole system would work.

Videos:

1. `https://drive.google.com/open?id=1SWl9igwo6OgrauYVymVYkbkGksKixvk2`

2 Challenges

As was the same the previous week, the biggest challenge has been with testing the drone outdoors and managing everyone's time. Testing the drone outdoors requires good weather and minimal bystanders. The weather was horrible (especially for April) and there's always people on weekdays. Additionally, testing now requires the entire system to be assembled and this is more work than before. It increases the amount of time needed to setup the system and move it outdoors. For the full test, we will need more April Tags so getting them printed is a goal and something that is currently limiting our testing.

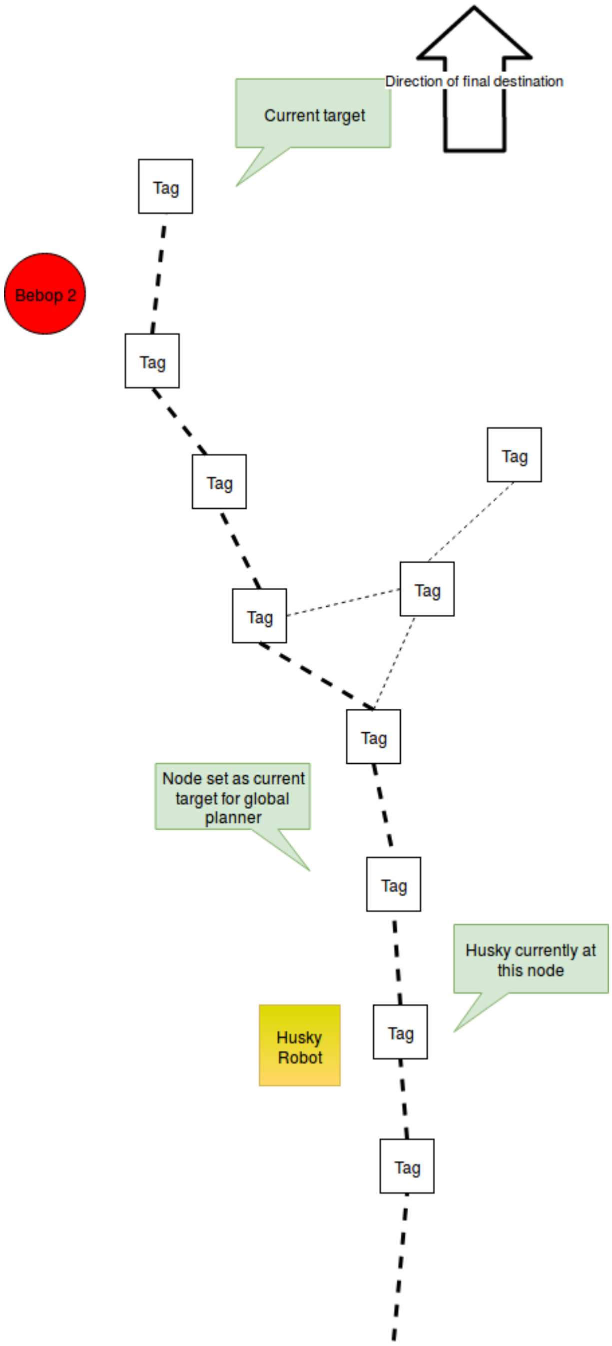

Figure 1: Overview of entire system. Bolded lines means current path. Lines are edges for the graph

At this point, there are not that many technical challenges on the Bebop 2. Most of the code is developed and we have solutions to many of the foreseeable technical challenges. However, managing everyone's time to perform testing is a challenge. Previously, I was able to test solo or with another teammate but now that the entire system needs to be there, more people is required. This is difficult since it's near the end of the system and we are getting less time to focus on the project. Any time that we can spend on it is not guaranteed to be syncrhonized with other's availability. To address this challenge, I will try to make the testing as modular as possible. That is, I will attempt to test as many parts of the subsystem in isolation as I can (using manual control as substitution for autonomous systems).

3 Teamwork

Rahul, Pulkit, Pratibha and Danendra worked on solving GPS issues and integrating the new LiDAR. Pulkit and Rahul worked on resolving the GPS issue. They are still stuck on it however. Pratibha got a new 2D Hokuyo LiDAR that is designed for outdoor use and tried to integrate that with our system. However, it did not work out. Fortunately, Danendra was able to convert the 3D point cloud data from the Velodyne into the 2D format required by the Husky package.

4 Future plans

Progress on the drone is mostly complete - all that is left is system integration. Thus, most of our work will be focused on the Husky. I will procure more April Tags for the drone since the current ones that we have are insufficient in quantity and quality. This will necessitate testing to ensure that their reflective properties are usable. In addition, I will start testing the global planner for the Husky. I will let the drone find a path by itself and manually drive the Husky. At each point, I will manually confirm that the specified *next node* is correct by verifying it against the April Tag layout.

Pulkit and Rahul will continue to work on the GPS integration for the Husky. They have verified that the GPS is working correctly and something is incorrect in the configuration. Currently they suspect it is the IMU. Danendra and Pratibha will help me with the testing and the integration of the Bebop 2 subsystem.