Individual Lab Report 6

Team: H

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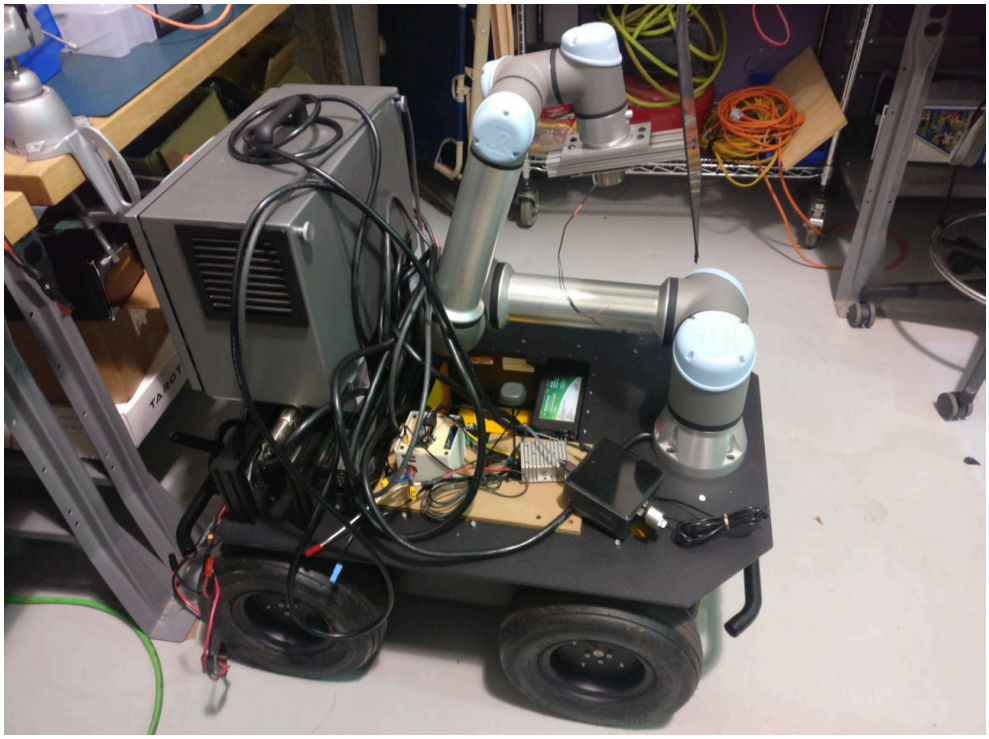
1. Individual Progress:

I mainly worked with Shubham to integrate the inertial sensor (3DM-GX5-45 GNSS/INS) on the Husky and simulated a naive local path planner by using the data from this inertial sensor. The 3DM-GX5-45 we used has independent IMU (AHRS stream), GNSS, EKF outputs, and it has high performance accelerometer, and adjustable sampling rate up to 500 KHz. So these make the Husky able to navigate both indoor and outdoor in a quite accurate level.

We have also integrated the Husky-UR5 arm-camera. Below is the picture showing the integral Husky with UR5 arm mounted:



In the following, the navigation methods for both indoor and outdoor are explained:

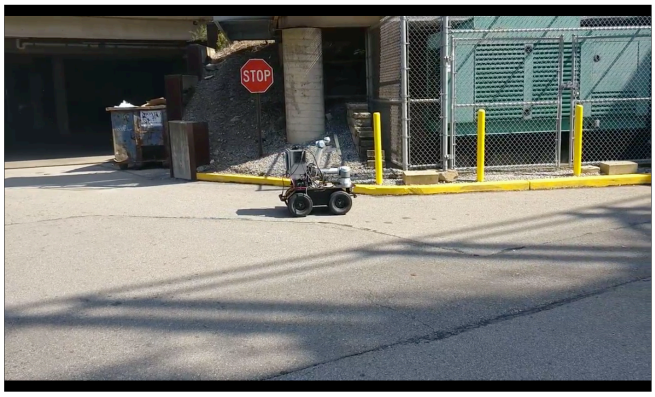
- **Indoor environment:**

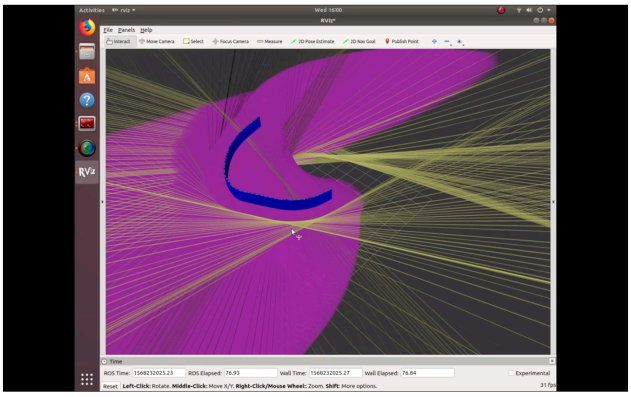
In the indoor environment, the GPS signal can hardly be captured. So we directly feed the AHRS stream from the IMU data to the Husky's localization node (EKF filter), to help Husky localize itself. And then, based on the localization information, try to navigate in the environment.

- **Outdoor environment:**

In the outdoor environment, as we are now able to get the GPS signal, we can directly get the state estimation from the 3DM sensor (after EKF fusion). By using multiple sensor data, we are able to get a more accurate localization for the Husky.

Below shows a snapshot of the Husky in navigation and its map visualization:





Basically the Husky is able to follow the predefined trajectory with a little bit of drift. It shows that by using this inertial sensor, the robot can actually do a pretty good navigation.

2. Team Work

Me and Shubham worked together to get the inertial sensor integrated while also implemented the navigation using this sensor. Akshit and Parv worked together to implement the opening detection.

3. Challenge

First challenge is that we need to get a clearer idea of how the underlying 3DM ROS package works, as it can help us better utilize different sensor information for more accurate indoor and outdoor localization.

Second challenge is that we need to experiment with different thresholding parameters to test which one is the best to give us accurate opening detection rate.

Third challenge is that it's better to transfer our code from Python to C++ in order to get a higher performance.

4. Future Work

1. Implement Local path planner and controller for the Husky
2. Equip Visual Servoing skill to align drone with respect to the opening
3. Implement Entering-the-opening Skill for UAV
4. Implement Entering-the-opening Skill for Husky