FlySense

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Team C: FlySense

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Individual Progress

For this progress review, one of my goal was to get DJI flight simulator working alongside Gazebo simulation environment so that we can test our system in simulation. The other goal was to improve the obstacle avoidance function by making the pilot override control smooth. Following sections describe these in detail:

DJI Flight Simulation working alongside Gazebo:

We wanted to setup simulation for our system for two reasons:
1. To test obstacle avoidance thoroughly before testing it in flight.
2. As a training platform where Pilots can get used to the functionality before using it in flight.

Until last progress review, we were able to setup a Velodyne LIDAR and DJI M100 in Gazebo environment but it was not integrated with DJI flight simulator. When we started using the two simulators together, the code kept crashing immediately. So, Nick and I started working on debugging and cleaning up the code. We started by just simulating LIDAR in static conditions and then moving it in gazebo environment using pose estimates from one of the bag files.

Next thing was to run both the simulation softwares live and test. We encountered a bunch of problems related to simulation in ROS. After some more debugging and testing we were able to get simulation working. Essentially the pose published by DJI simulator could be used to change the pose of lidar in obstacle rich Gazebo environment.

Camera simulation in Gazebo:

To simulate full system functionality we also needed to simulate first person view (FPV) camera. I implemented this functionality by modifying the urdf file which describes the sensors being simulated and their configuration. The camera was attached to the Lidar so that they move as one single unit. The FPV camera image is published as an camera/image ros topic, which is same as what we have been using in our system.

Figure 1 and 2 show simulation in action. In both the figures, left image shows the simulated FPV camera view and right image shows the Bird's eye view generated using the simulated Velodyne LIDAR.

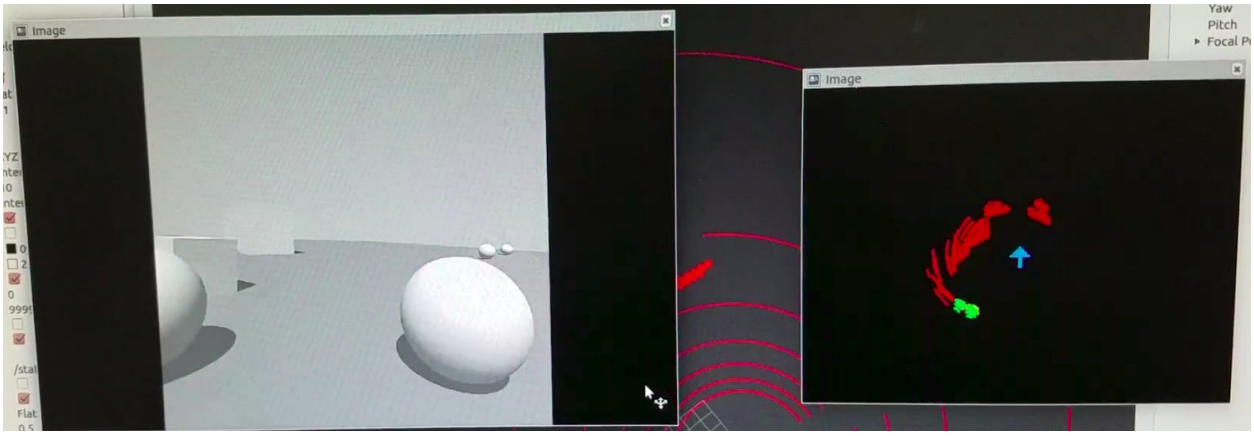

Figure 1: Flight in Obstacle rich simulation environment. (Left: FPV, Right: Bird's Eye View)

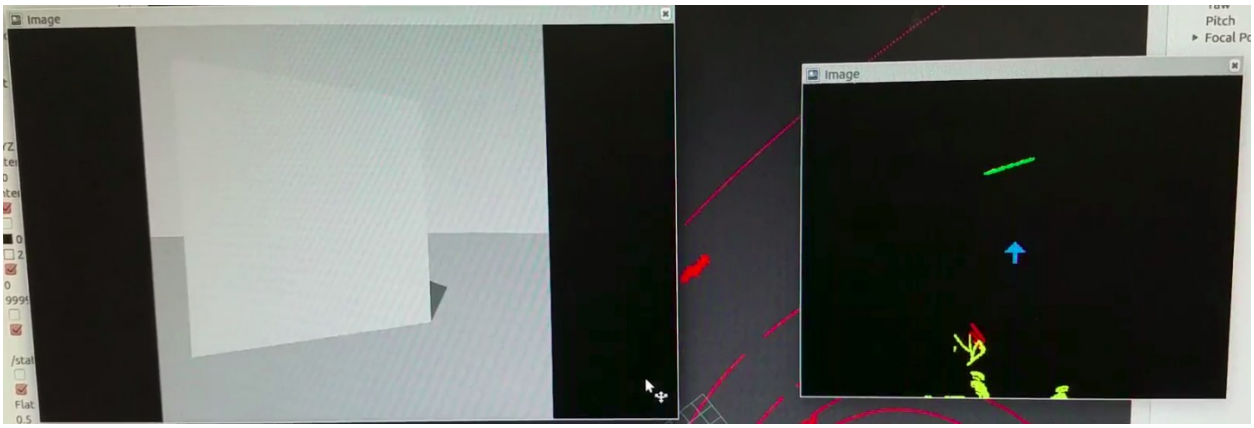

Figure 2: Flight in Obstacle rich simulation environment (Left: FPV, Right: Bird's Eye View)

Improvement in obstacle avoidance:
As of last progress review, we were able to implement obstacle avoidance algorithm alongside a DJI custom flight mode to provide a safe way of testing the functionality.

After further testing it was found that the braking functionality has a lot of jerks and the pilot override control was not smooth. This was addressed during this progress review. I recorded a bag file of flight data from DJI flight simulation environment which was used to tune our flight dynamics model by running regression. The resulting values gave much smoother output. We did further parameter tuning to ensure the control is smooth and would work in actual flight.

Challenges faced

- Getting Gazebo environment to work alongside DJI flight simulation software took a lot of debugging and testing.

Teamwork

Name	Contribution
Nihar Tadichetty	• Sound warning interface improvement
Joao Fonseca Reis	• Coloring code improvement • Sound warning algorithm implementation • Obstacle avoidance testing and tuning
Harikrishnan Suresh	• Coloring code improvement • Sound warning code implementation
Nicholas Crispie	• Gazebo + DJI Flight simulation environment • SVE test planning • Project management

Plans

Goals for Next Progress review:

- Complete obstacle avoidance and test thoroughly in simulation
- Test obstacle avoidance in flight
- Fine tune coloring and sound warning
- Reduce lag in FPV video streaming
- SVE Dry-run at Flagstaff hill

My tasks:

- Complete obstacle avoidance and test thoroughly in simulation
- Test obstacle avoidance in flight
- SVE Dry-run at Flagstaff hill