

FlySense



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Team C: FlySense

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Individual Progress

For this progress review, my main goal was to collect flight data in mission like scenarios i.e. flying near obstacles. I was also responsible for integrating FPV code developed by Nihar, coloring code developed by Hari and develop pilot stick override code to be able to later add the capability of obstacle avoidance. Following sections describe these in detail:

Collect flight data in mission like scenarios:

It was very important to complete this task as early as possible as this was holding other code development namely coloring of bird's eye view and sound warnings. We conducted a flight in flagstaff hill, Schenley Park. The aircraft was flown near trees and poles. These obstacles were approached sometimes head-on and sometimes from the lateral direction.

Figure 1 shows how quadcopter was flown between the trees:



Figure 1: Data Collection flight at Flagstaff hill, Schenley Park

The aircraft was flown for 9 minutes with really good data collected which we have been using to test and tune coloring node. Another flight was conducted outside of Newell-Simon Hall which is also an obstacle rich environment.

Debugging and integration of coloring code

I supported Hari in debugging and integration of the coloring node. The code was found to be crashing when no point cloud data was being input. After fixing a few minor bugs we were able to get the code working. The bag file

collected in flight was run to tune parameters to make the colors in the Bird's eye view image more realistic. The results are shown in Fig 2:

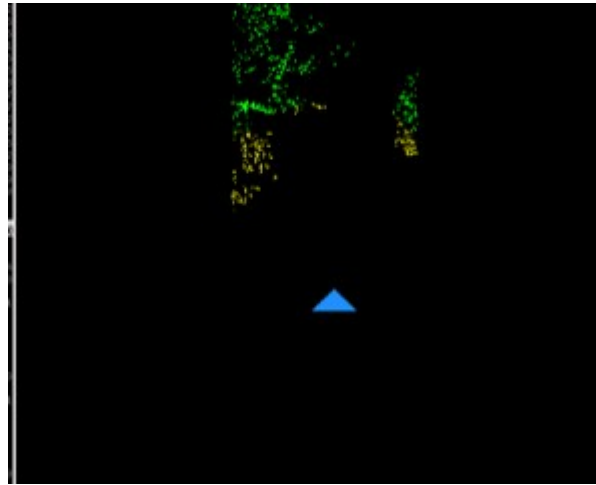


Figure 2: Bird's eye view image with colors showing warning levels

Integrate FPV code and flight test

The interface to the FPV camera and merging Bird's eye view with the FPV camera video was done by writing another node in Python. I helped Nihar in getting this code integrated into our onboard software.

After testing the system in lab we flew the system with FPV camera and the video stream was transmitted live to a laptop. Figure 3 shows the Bird's eye view Image fused into the FPV video.



Figure 3: Bird's eye view fused with FPV video

Implement Flight dynamics algorithm v2:

The algorithm to calculate flight envelope was modified based on feedback received from NEA. In version 2, the envelope dimensions are calculated based on max vehicle velocity which is a function of weight and other vehicle parameters. If aircraft is flying slow, a minimum dimension of window is used. This code was tested in simulation.

Feasibility of Pilot stick override via DJI SDK:

We wanted to complete the pilot override interface by this Progress review. But this objective was pushed to next progress review due to the challenges faced in getting DJI Virtual Sticks API working. After exchanging a few emails with developers at DJI, it was found that this API was deprecated in Dec 2017 and is not officially recommended. Instead, they recommend using one of the available flight modes which are:

1. Position control mode
2. Velocity control mode
3. Attitude control mode

We will be using Velocity control mode as it allows us to stop the aircraft gently with our obstacle avoidance logic.

Challenges faced

- Implementing Pilot stick override was a challenge due to inconsistent documentation of DJI SDK. Online it was mentioned that they support Virtual Sticks API. But it was not available in the code. An earlier version of the DJI SDK supported Virtual sticks but working with that version would have required us to modify a major part of the DJI interface code.
- Flight testing in cold weather. We have been facing an issue where DJI flight software prevents us from taking off if battery temperature goes below 7 deg C. This has led to less productive flight tests and time wastage.

Teamwork

Name	Contribution
Nihar Tadichetty	<ul style="list-style-type: none">• FPV camera interface and video recording• Bird's eye view fused with FPV video
Joao Fonseca Reis	<ul style="list-style-type: none">• Coloring code completed• Sound warning code v2 complete• Obstacle detection in 2d completed in simulation
Harikrishnan Suresh	<ul style="list-style-type: none">• Implementation of coloring, sound warning code• Improve Bird's eye view image to add arrow instead of red square dot• Implemented pass through filter to get rid of point cloud hits on ground.
Nicholas Crispie	<ul style="list-style-type: none">• Project management and procurement• Flight testing• Helped Hari in coloring code implementation• LIDAR simulation in Gazebo

Plans

Goals for Next Progress review:

- Live sound warnings in a flight test
- Complete LIDAR simulation in Gazebo
- Flight to evaluate stop functionality
- Fully integrated flight test on Flag staff hill

My tasks:

- Pilot stick override in simulation and in flight test
- Support Hari and Nick in software integration
- Conduct flight tests