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Team C: Fly Sense
Teammates: Shivang Baveja, Nicholas Crispie, Joao Fonseca, Sai Nihar Tadichetty
ILR11
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1. Individual Progress

For the past two weeks, I focused my efforts on improving the bird's eye view coloring and sound warnings. I worked with Joao in finalizing the setup for both the above elements of the bird's eye view. The earlier version of coloring had the obstacles collapsed in the Z-dimension and treating everything as planar. While this makes sense in a 2D image perspective, it is false information that we are conveying to the pilot. To overcome this, the code was modified to consider the height of the obstacles and determine the severity in 3D. An opacity factor was also added to the coloring scheme based on the height giving more brightness to the points that lie about the same height as the vehicle. This gives the pilot some sort of 3D perspective view and true information about his surroundings. To implement the same, the point cloud data in ROS message type was converted to the PCL standard format. This made it possible to use the PCL helper functions to determine the maximum and minimum values in the Z dimension without looping through all the points. The old and latest setups of the coloring code are shown in Figure 1 and 2 respectively. As seen in the figures, uneven surfaces such as trees will have multiple colors associated as branches are at totally random heights. However, the plane surfaces like ground will have a uniform color.

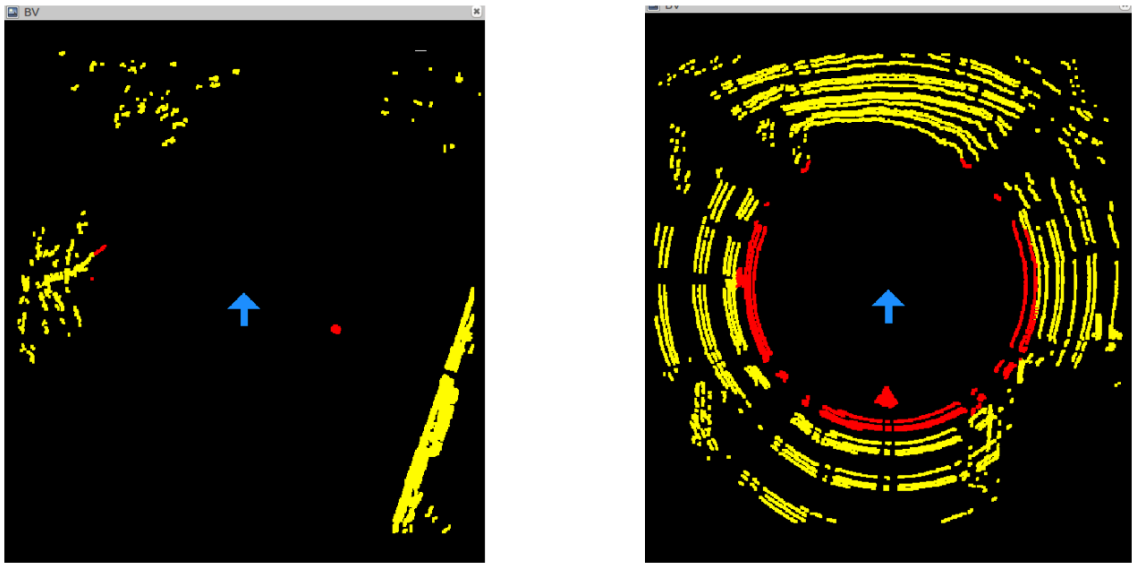

Figure 1: Old coloring setup - All obstacles are planer

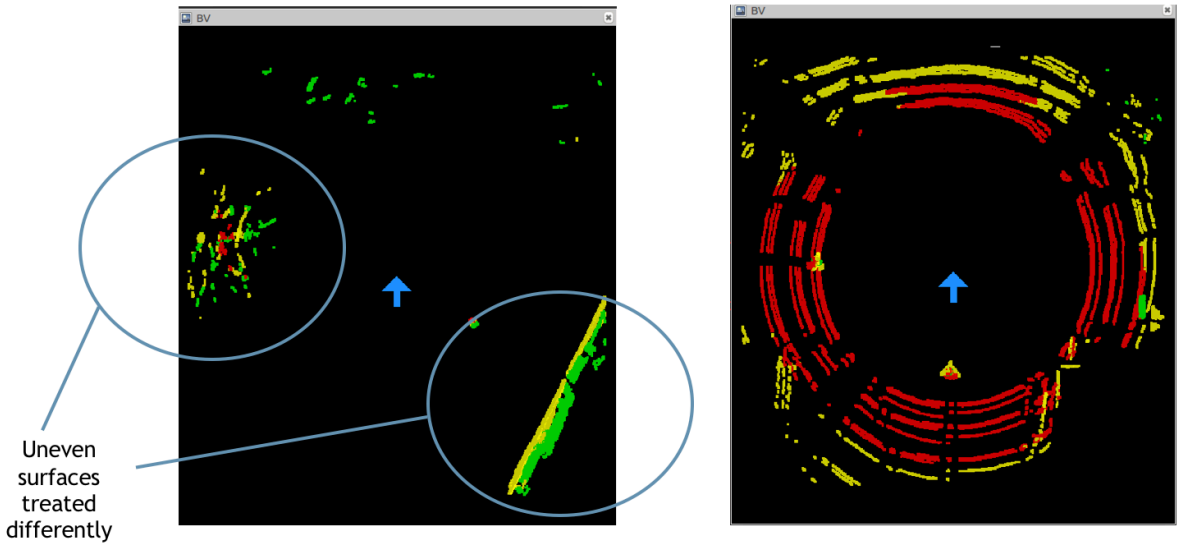

Figure 2: New coloring setup - 3D perspective with opacity

The sound warnings code was also improved and fully integrated into the software stack. The earlier version had a bug where the obstacles were considered in the body frame while the vehicle's position was considered in the global frame. After correcting the bug, it was seen that the sound warnings became more frequent. To understand the source of the sound warnings, a marker is published in Rviz that depicts the most dangerous obstacle. The same is reflected in the bird's eye view as a white square that conveys information to the pilot. This is along the lines of one of the pilot's requirements to have the most dangerous obstacle blinking in the bird's eye view. Blinking seems to be a huge challenge especially with the critical obstacle changing position so frequently. As a result, we have decided to descope that portion from the requirements and instead have a small white square. Figure 3 shows the bird's eye view rendering and the Rviz output for the above setup.

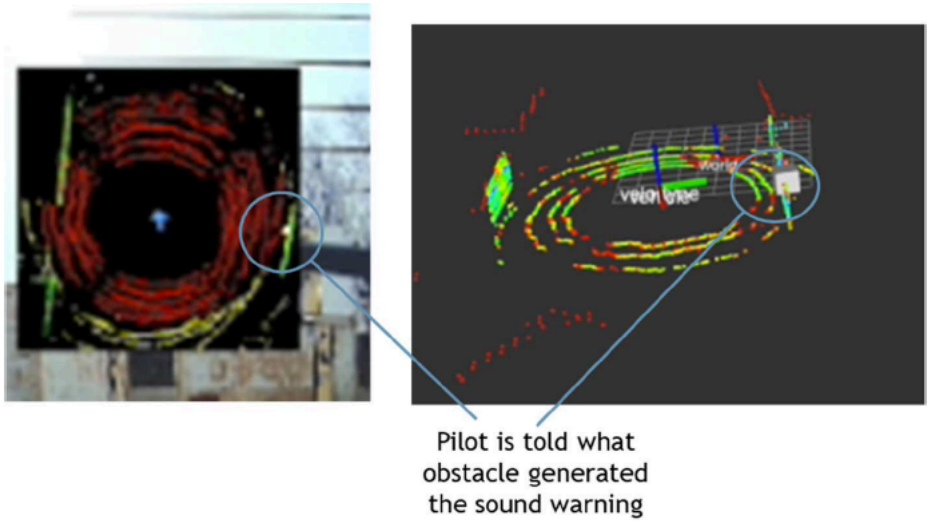

Figure 3: Most dangerous obstacle in the bird's eye view (left) and Rviz (right)

The first official flight test with NEA's pilot, David Murphy happened on April 6th. We had to overcome a lot of challenges like rain and heavy winds to finally execute the flight test. The flight test was a huge success as the pilot was very excited to use the FlySense system. He provided a lot of positive feedback and suggestions for us to improve the system, which will be addressed before the 2nd flight test and the SVE. Figure 4 shows the pilot flying the drone just using the FlySense system.

Figure 4: David Murphy wearing the FlySense system

It was an extremely productive 2 weeks as I was able to complete all the tasks I had planned for this semester. Adding to that was the NEA pilot's reaction after using our system during the flight test, which proved that all our efforts were in the right direction. I also started work on the final project video keeping in mind the demo for the National Robotics Week. A small portion of that was shown during progress review 12.

2. Challenges faced

- The weather was really bad during the week of our flight test, and we confirmed the flight test only on 6th morning. During the flight tests, there was heavy wind which disrupted our plans.
- We are unable to stream the whole output of the software stack on both the Epson and the tablet. This is mostly an issue with publishing huge amount of video data over Wi-Fi. For the SVE, the plan is to reduce the publish rate from 25Hz to 10Hz and lower the quality of the video and try to display it in two devices.

3. Team work

Team Member	Contribution
Shivang Baveja	• Improvement in obstacle avoidance • Camera simulation in Gazebo • Collaborated with Nick on DJI Flight Simulator integration with Gazebo
Nick Crispie	• DJI Flight Simulator integration with Gazebo • SVE test planning
Joao Fonseca	• Collaborated with me in finalizing the coloring and sound warnings code • Worked with Shivang on the obstacle avoidance code
Nihar Tadichetty	• Integrated the sound warnings code with the Epson

4. Tasks

Team goals

- Complete obstacle avoidance and test thoroughly in simulation
- Test obstacle avoidance in flight
- Reduce lag in FPV video streaming

- Prepare the system for the National Robotics Week demo
- SVE Dry-run at Flagstaff hill

My goals

- Assist in conducting more tests with the final interface
- Improve various elements of the FlySense system based on internal tests and the pilot feedback
- Prepare the system for the National Robotics Week demo
- Work on official project video for the National Robotics Week demo