Fly Sense

Team C – ILR11

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Work done these past 2 weeks

Over the past two weeks

a) We have done the final setup for both sound (three levels of severity) and coloring (three levels of severity and opacity factor determining how bright an obstacle should be depending on its distance to the xy plane)
b) Processed all feedback from NEA pilots (e.g. inclusion of a blinking dot marking the location that generated the sound warning in the bird's eye view)
c) Stabilized the response of the obstacle avoidance code in simulation
d) Deployed the Gazebo environment on our code

The next steps are:

a) Integrate the Gazebo environment with the sound warnings output (which yields the most dangerous point in the environment given current pilot input)
b) Include the pilot warnings on what constraint the obstacle avoidance is doing on pilot input (e.g. constrained in moving forward)

Individual achievements for the past 2 weeks

In the past two weeks my individual work has been small and limited to fine tuning the setup parameters with the bulk of the efforts concentrated on integrating the algorithms with the rest of the system.

This work is by definition a team effort and is the majority of the work needed for the stage we are in: final integration.

Team achievements for the past 2 weeks

In the past two weeks I have been working with the rest of the team on:

- With Hari: Integrating the new coloring and sound code with the bird's eye view (the new 3D sound warnings, the new 3D coloring including opacity factor and the marking in the bird's eye view of the obstacle that generated the sound warning)
- With Nihar: Processing the sound warnings based on the messages generated from the Core our system
- With Shivang and Nick: Integrating the obstacle avoidance code with the simulator and the Gazebo environment

<u>Real Time Coloring and sound warnings with Hari</u>

We have implemented, as per our requirements, color warnings dependent on what the pilot can do and sound warnings based on what the pilot is trying to do. The first set of warnings does not depend on pilot inputs (it is computed based on the maximum possible inputs in any direction and the current state) while the second set of warnings is dependent on what the pilot input was (it takes into account the current state and the pilot input to project a path into the future).

We have upgraded the coloring to reflect a 3D world:

a) The previous setup where coloring was based on the xy plan position was upgraded to reflect coloring based on position in xyz (from ellipses to ellipsoids)
b) Given the upgrade made on the coloring rules, we started having multicolored section on an obstacle (e.g. an uneven surface such as a tree will have multiple colors associated as different brunches are taller than others). To ensure that the pilot's attention is kept focused, we have also included an opacity factor. This fades the colors when they are further away from the plane (red will be brighter than green that is further away in z axis).

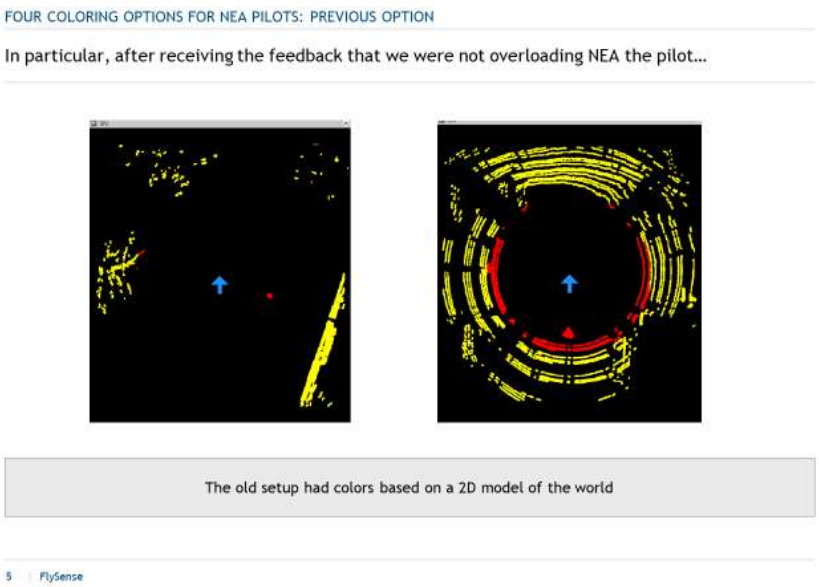

Figure 1: Previous setup for the bird's eye view (2D coloring)

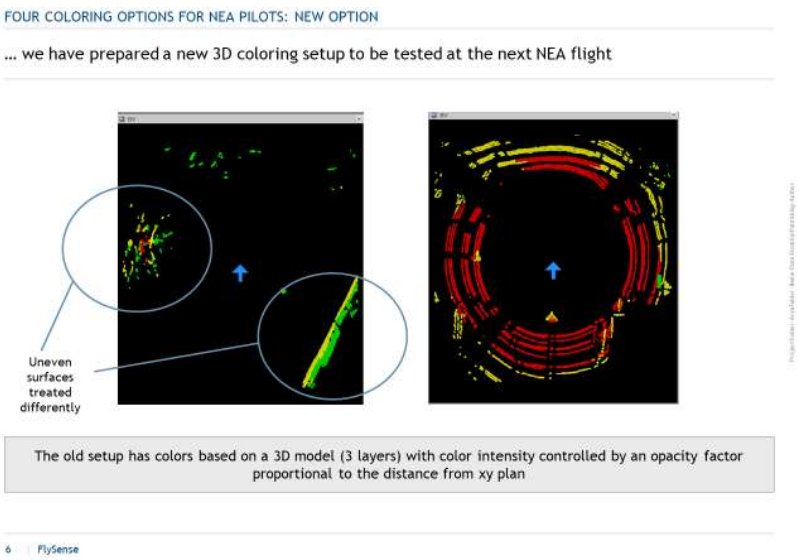

Figure 2: New setup for the bird's eye view (3D coloring with opacity factor)

In line with the feedback from the NEA pilots, we also included a blinking dot indicating the source of the sound warning. This was added to the bird's eye view and tested in RVIZ. We did not get any feedback to include a projection of the entire trajectory from current state to the obstacle, but we can do so if we are asked for that at our next NEA flight.

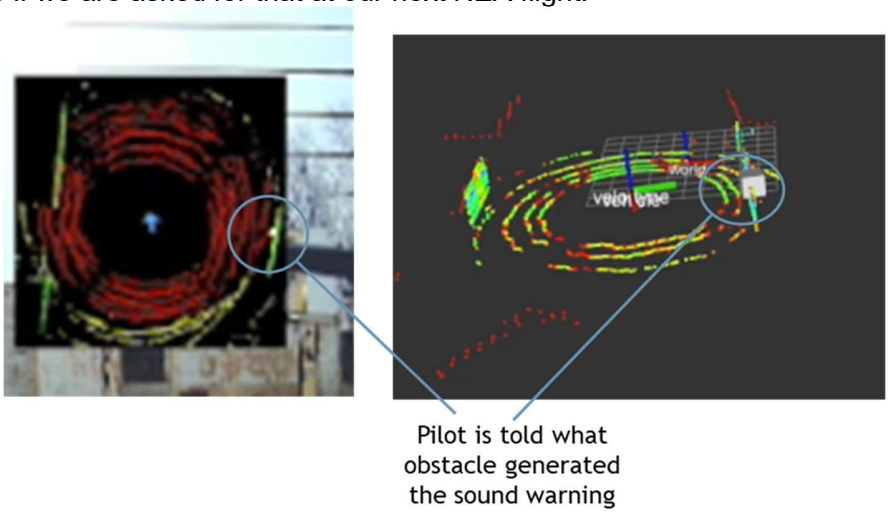

Figure 3: Blinking dot indicating source of current sound warning

Obstacle avoidance with Shivang and Nick

All the obstacle physics was deployed in the Gazebo environment, and the pilot inputs are passed through to the DJI simulator before arriving in the Gazebo environment. We are now able to "fly" in this world and even collide with obstacles (that depending on their mass may or not move after the collision).

We can see the first-person view, the RVIZ representation of the quad position/LIDAR hits and even generate the bird's eye view with the different coloring.

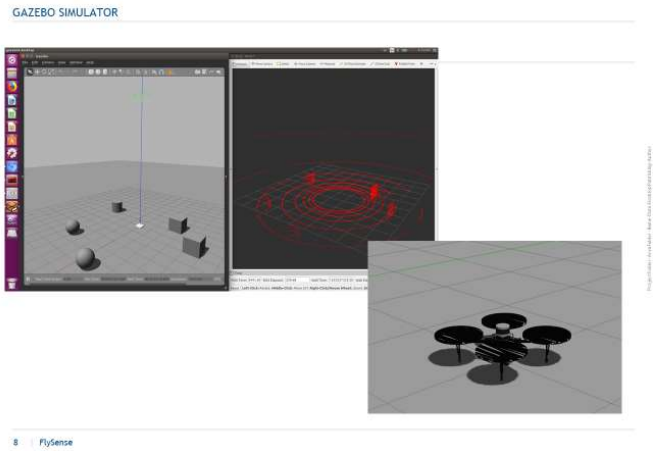

Figure 3: Gazebo print screens. From left to right: An overview of the environment, an RVIZ representation of the LIDAR hits on the environment obstacles and the quadcopter.

Milestones for next two weeks:

Our next big milestone is the next flight at NEA's Nardo field. The pilot will experience the new 3D coloring, the sound warnings, the blinking dot at the obstacle responsible for the sound warning generation and the obstacle avoidance code.

Problems Faced these past weeks:

The biggest problem is preparing the ILR. Every week the nature of the work changes (some weeks are more individual work based like the algorithm write up during spring break, some others are more group work such as the last two weeks of integration).

On both occasions I lost points on my ILR:

a) The first for not referring extensive group work
b) The second for not referring extensive individual work

I believe that here you are pushing it a bit too far. The nature of the work changes from week to week and is never the same, so you should reflect that in your grading sheet guidelines. This of course if you want these reports to reflect reality instead of having information fabricated exclusively for the purposes of getting a good grade on the report. Just an opinion.

Key risks:

The project risks have somewhat decreased on the last few weeks as we got most of the things done. The risks until the end of the semester are:

a) Technical risks
    - Finalizing the integration of the obstacle avoidance code
    - Testing the obstacle avoidance code integrated with the Gazebo simulation
    - Testing the obstacle avoidance code integrated with a real flight (using virtual obstacles added to the seen)
    - Finalizing the pilot warnings when the obstacle avoidance code is integrated (e.g." You have been overridden on this type of inputs")

b) Non-technical risks
    - Crashing the quad on a windy day (our worst nightmare)
    - The heavy course load (all courses seem to have endless homework and a dedicated project at the end....)