ILR 10

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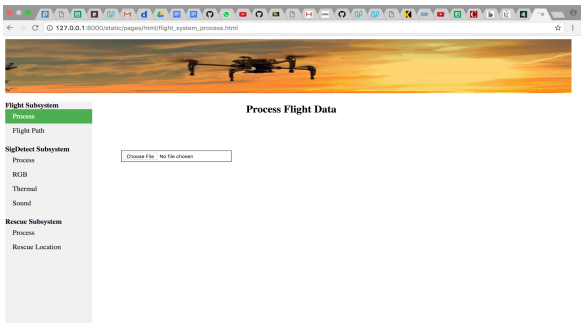
Project : Autonomous System for Aerial Search and Rescue

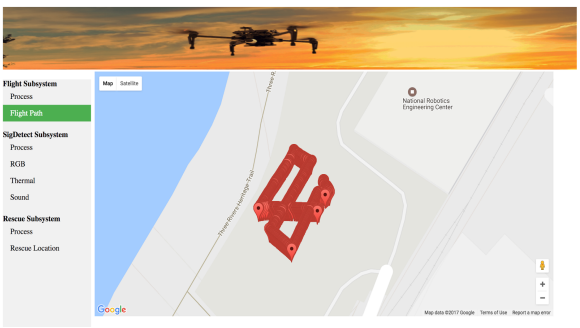
Progress

This review cycle was spent with the team on conducting outdoor tests at the NREC site, debugging and resolving some of the issues that were found, and adding more functionality to the backend processing pipeline. While analyzing data from the spring break, we discovered a couple of issues. One of the issues was that the GPS data generated by the drone had some gaps in it. Incompleteness in GPS results in the system not being able to predict the location of the signatures accurately and could have turned out to be a major problem. But after thorough testing by conducting close to 10 flights and not being able to reproduce the problem, we concluded that the issue was an intermittent one that could have been caused due to the screen being locked and the server not being able to receive data.

The second issue that I was involved in was, to debug the issue with incorrect mapping between the timestamps generated by the camera and the drone. The system relies on the camera and the drone having complete alignment in terms of the timestamps of the frames and the GPS locations of the drone. This is because, in order to detect accurate location of the signature, the signature location detection uses the GPS location of the drone at the time the frame was taken. After investigating the issue, the problem turned out to be with the camera. The camera was creating the video frame with a 6s delay and after going through the manual, we realized that the camera had to be synced with a mobile app each time before operation.

The third issue I worked on was the backend processing pipeline. Screenshots from the pipeline are shown in Figures 1 below. The sequence for processing would be to accept the GPS coordinates for flight path, RGB and thermal videos as input and use them to invoke the signature detection algorithms to process the data and detect signatures. These signatures along with GPS coordinates is provided to the signature location detection component which would then compute the GPS location of the signatures. A fusing algorithm would then weigh each location and come up with the best rescue location. This location would then be used to conduct the rescue operation.The processing sequence is shown in the video in Figure 2.





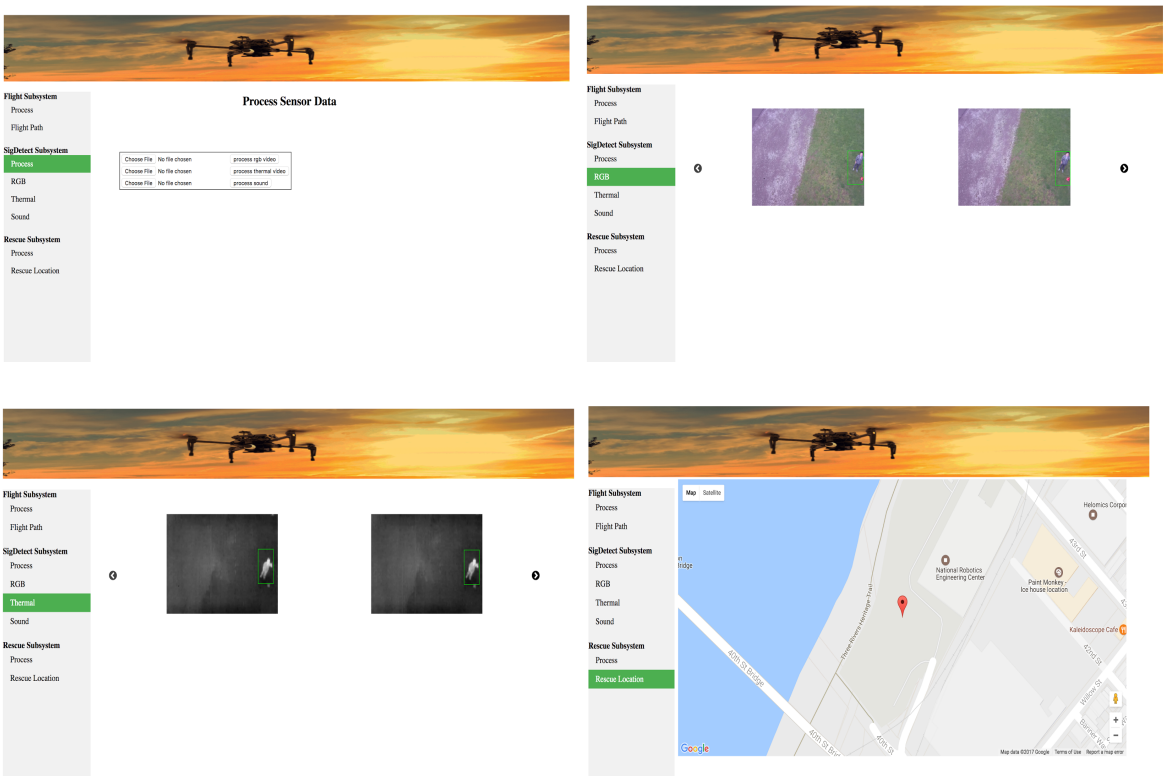


Figure 1. Console images

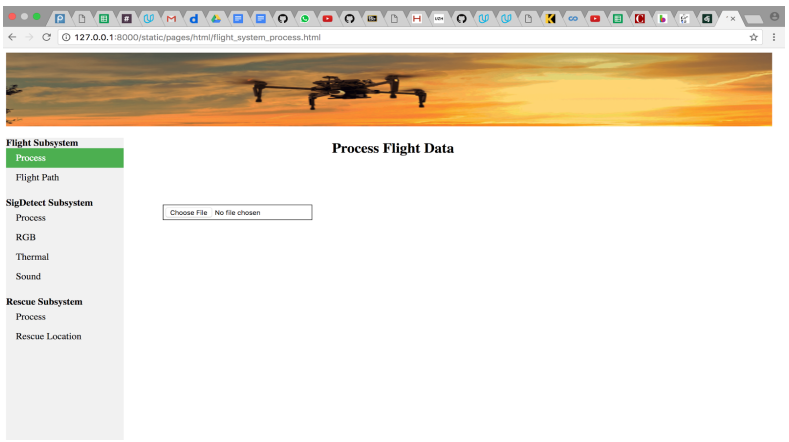


Figure 2. Processing video

Team Progress

The team as a whole spent most of the time resolving issues from data collected during out test flights at the NREC site during Spring. Sumit continued working on the module to compute the location of the signatures using GPS triangulation. Xiaoyang worked on finding issues with bounding boxes misalignment between thermal and visual photos. Juncheng worked on migrating the code to python for final integration.

Challenges

This week we faced a lot of challenges with the data. As mentioned in paragraph 1, there were synchronization issues between the timestamps of the drone and the camera which was investigated and resolved. We noticed issues with misaligned bounding boxes between thermal and RGB videos. Though a static fix has been put in place by adding a shift to one of the images, the underlying cause still needs to be investigated. We also tried to calibrate the two cameras and while calibrating the RGB camera seemed straightforward, calibrating the thermal camera seemed a challenge. After meeting with our sponsor, we found a way to do the same using a setup that our sponsor already has. We shall be calibrating the thermal camera next week. Going forward, the main challenges are going to be to ensure the end to end system meets the requirements and works without a glitch. One issue we noticed on and off was to do with the suction mounting mechanism for the camera. It seems like suction mount needs a really smooth surface to work well and this implies, we need to fabricate a new base that can mount both camera as well as the servo motor for the rescue package drop mechanism. This still needs to be printed and hopefully we should be able to get it done this week.

Goals for next ILR

My individual goal for the coming week would be to complete the basic backend system end to end and continue working with the team on fixing any open issues and prepare the system for a SVE rehearsal. On the side, I shall continue working on testing my implementation of the classifier with our collected data. Yet another thing I want to try out is to run our data through YOLO based deep learning pipeline to see if it's accuracy is better than our system. One of the things we noticed is that our algorithms though have a high recall, have a somewhat poor precision. While the team plans to work on improving precision this week, I also want to explore YOLO to see if the precision is better than SVM+HOG and explore using it in our pipeline.