

Drone-based Advanced Situational Awareness for Airborne Firefighting Executive Project Summary

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Oftentimes in wildfire situations, the environment is too dangerous to bring pilots into them to seek out hotspots. Extreme conditions often restrict the view of airborne firefighting efforts which forces them to fly through extreme conditions to drop flame-retardant payloads. Fire tanker planes must also be supported by an additional spotter plane that raises the overall expense of firefighting efforts. This project seeks to provide advanced situational awareness to aerial firefighters through the use of a remotely controlled drone that will geolocate hotspots within the fire and provide their location to a pilot via an augmented reality heads up display. The software will perform image processing to allow the pilot to see the hotspots superimposed over their view out of the cockpit. This project will greatly serve aerial firefighters by providing them with an intuitive sense of their surroundings and will allow them to more safely and effectively put out fires. The project will be paired with and sponsored by Collin's Aerospace, who will provide the engineering team with access to a drone, thermal imaging camera, and head mounted display (HMD). Collin's Aerospace focuses on aviation based projects, including military-grade HMD headsets and commercial flight systems.

This project is composed of three main phases: retrofitting the drone with a thermal camera and other relevant hardware, developing software to georeference hotspots and matching them to a remote pilot's point of view, and developing the interface between the drone and the pilot's view. These phases will be able to be worked on simultaneously, with the progress on each planned and recorded via a Gantt chart as to best divide the engineering team's time and effort. Once the drone has been retrofitted with the relevant hardware, the software can be tested to determine the effectiveness of the image processing at georeferencing a hotspot. After successful testing of the drone and software, the system will be integrated into the HMD. At the end of this project, a remotely piloted drone will be able to operate the drone around wildfires, while hotspots are geolocated, tagged, and transmitted to a remote server for viewing. This information will then be processed and sent to an aerial firefighter so that they may most efficiently target fires. The drone will provide advanced awareness of the environment to the aerial firefighter, allowing them to stay safer and more effectively put out fires.

Initially, we ran into some problems right at the start of the project. Within the first few months we had gone from a combined group of 6, to two split teams with a ECE and CS subteam, and then finally back together as a group of 5 as the project developed and we lost a team member. After getting situated with our team, we worked to split up responsibilities and coordinate with our project partners to develop requirements. By the end of Fall term we had our initial requirements developed and began to work on completing the different blocks. At this point it was discovered that the project was mainly CS, so there was a slight learning curve for the two ECE students to

adjust to the project parameters. As Winter term ended, each team member had completed their share of the blocks and were starting to work to combine them together into the final implementation. One major difficulty for this project was the fact that we did not have access to the drone or the Nvidia Xavier until around the second to last week of the project timeline. However, our team was able to successfully rise to the challenge and had success with implementing the code and hardware that we had developed onto the DJI drone.

The main lessons that we learned as a team all fall underneath project management. In the beginning we were fairly disorganized and were not as communicative with our project partners as we should have been. In future projects, we have learned to communicate clearly and ask for the necessary hardware as soon as we realize that we need it. Doing this would have helped with some of the stress that our team had near the end of the project.