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NSF Project Overview

CSCI 4243W Writing Assignment 1

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The proposed project is a drone tracking and monitoring system. It will ultimately be combined with two others’ projects to include a full error detection and recovery suite. Between four and eight cameras will be placed high along the walls of a room. Each camera will have its live feed streamed back to a central location to be used in generating a 3D model of the monitored room. The surveillance portion of the program will then begin, which will continually scan the room for small, autonomous drones. Once identified, the drones will be tracked and spatially placed in the aforementioned model. The program will use the drone’s location and movement patterns to determine if it is functioning normally and within its operating parameters, which will be provided by another team member’s project. If the program determines the drone’s movement to be inconsistent, this information will be relayed to a different component for rectification.

The project will face two main algorithmic challenges. Firstly, each individual camera in the array must be able to recognize one, or multiple, drones in real time based on a visual feed alone. Painting the drones a specific color and scanning the feeds for that color would be a straightforward approach; however, the system would fail to operate correctly if a bystander were in the room wearing an article of clothing with that corresponding color. Instead, a combination of motion and pattern detection will likely serve the final product. Motion alone cannot suffice, otherwise people would also be detected, so the visual patterns on the drones themselves, such as the shape of the rotors, must also be considered. The second major challenge will be generating a model of the monitored area in software, based on the camera feeds and their staggered locations and viewing angles. This model must be capable of having an associated three-dimensional coordinate system, so as to algorithmically place and analyze the drones in that space. It is likely that the model will be generated at program launch, before drones are being considered. The area itself will not change during runtime, so it is not necessary to constantly rescan and remap it. Once the model is complete, the system will use the image detection suite to locate the drones in relation to the cameras and to each other, if applicable, so their relative location in the area can be determined.

Reports of drones flying alongside passenger airlines, within restricted airspace above sensitive government or military installations, and around airport control towers are just some of the increasing issues with drones that the Federal Aviation Administration is needing to contend with. As drones become cheaper and more commonplace, pressure is beginning to mount on lawmakers to propose regulation on the hobbyists’ devices. Furthermore, drones will likely begin to assume more important roles in society, such as mail and package delivery, fire services, live news broadcasting, and many more. What happens when they inevitably begin to fail while in the air, whether it be due to weather, technical faults, or even outside intrusion? Error detection and security countermeasures will need to be built to ensure that drones remain safe while in the air and can continue to assume critical roles without the risk of catastrophic failure. This project is an early prototype for such a system, and one that can later be scaled up to perhaps involve satellites rather than webcams in order to ensure a global protective system.