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Research Title: Sentinel - Security and Delivery Drone

Research Focus: Drone Design and use of Communication Technology

School: California State University, Fullerton

Student Level: Undergraduate

Abstract:

Sentinel utilizes the growing drone community and the tools available for their creation and advancement. Sentinel is based heavily on Titan Providence, another drone designed before Sentinel. The key difference between the two are their applications. Sentinel was built with campus security and payload delivery in mind. The latter of which defined the greatest aesthetic difference, the motor count. Our team attempted to design a drone with eight motors but were unsuccessful due to economic reasons. We shifted our focus to a six motor design, two more than Providence. These extra motors provided the thrust needed to carry heavier loads than Providence. The motors themselves and the extra material required to support these motors did not add much weight to the overall design. Each motor is capable of up to 1880g of thrust with the propellers and battery currently installed. Altogether, the drone is capable of supporting itself and approximately 14 pounds extra. Moreover, our team has just finished tackling potential design flaws that hinder Sentinel's stability. Initially, our flight controller, the Pixhawk PX4, was not as level as it could have been. Therefore, the drone always thought it was misaligned and not leveled. It would attempt to fix itself midair and result in unexpected landings. Due to this, we reworked the configuration of the sensors onboard to improve the center of gravity. At the moment, Sentinel is on its third iteration of reconfiguration. The Pixhawk PX4 is now at the center of the drone, underneath a custom designed shield and atop an anti-vibration stand. In addition, we believe Sentinel may require smaller propellers as the current propellers may provide too much thrust. Our team believes swapping our 15 inch propellers for 13 inch propellers will solve our stability issues. This will decrease the maximum thrust of each motor to 1380g and a maximum load weight of 8 pounds. Currently, this design change is not favored as it greatly cuts the maximum weight we can deliver. Nonetheless, our most recent test flights have shown that Sentinel is capable of stable flight with a slight drift due to the wind. Our team believes the drone is now able to advance to the second stage of our research. The second stage will focus on the addition of a Raspberry Pi 4. This Raspberry Pi will interface with the Pixhawk PX4 to create a server from which we can control the drone via the school's Wi-Fi.