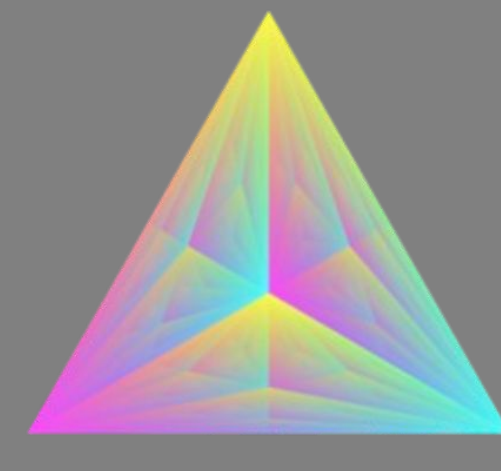


Autonomous Emergency Thermal and High Elevation Drone

Joshua Kraus, Rowan Tarpenning IDEAS



LEHIGH
UNIVERSITY



A.E.T.H.E.R.

MISSION:

AETHER is a partially autonomous UAV system designed to support firefighters by providing critical situational awareness in high-risk environments. Equipped with dual optical and thermal imaging, AETHER enables Beyond Visual Line of Sight (BVLOS) reconnaissance during urban fires and disaster scenarios. Its mission is to give first responders a reliable aerial perspective before they even arrive on scene—helping them assess fire spread, identify hazards, and make faster, more informed decisions. Built with modularity and accessibility in mind, AETHER combines open-source design with practical engineering to create a tool that's adaptable, field-ready, and purpose-driven for emergency response.

AETHER has been developed with current air traffic control regulations in mind, including BVLOS laws and FAA Part 107 requirements. We actively monitor advancements from NASA's ACERO project and the FDNY. Designed specifically for first responders, AETHER prioritizes their needs—our team collaborates with local fire chiefs to ensure the system aligns with real-world operational demands and the psychology of those who rely on it in high-stress environments.

AIRFRAME:

AETHER's frame is constructed out of milled carbon fiber plate, providing superior rigidity and weight compared to polycarbonate options. This allows AETHER to safely contain all critical avionics components within center chamber of the drone, limiting the risks of failure out in the field. Additionally, by nature, quadcopters boast superior handling capabilities compared to fixed-wing counterparts, serving to boost operational efficiency at the cost of flight time.

OPTICS:

AETHER uses a high-resolution optical camera (1080p Arducam) and a thermal infrared camera (Seek Thermal) to give firefighters a clearer view of fire scenes. The optical camera provides a wide aerial perspective for assessing layout and obstacles, while the thermal camera highlights hot spots, fire intensity and direction. Both cameras are mounted to a 2-axis gimbal, actuated by two 9-gram servos. Image tracking is handled using Open CV, identifying a hotspots and locking the FOV to them.

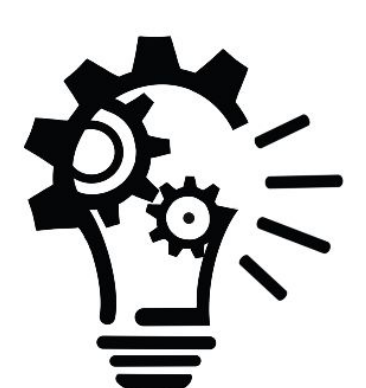


TELEMETRY & GROUND CONTROL:

AETHER streams MAVLink telemetry via UART from the Pixhawk Flight controller to a Raspberry Pi 5, which relays via integrated modem over a Tailscale mesh network secured by Wire Guard encryption. The system auto-starts on boot, enabling BVLOS communication with ground control while preventing malicious interference through end-to-end encrypted channels.

HARDWARE & AVIONICS:

AETHER's avionics integrate a triple-computer architecture: the Pixhawk 2.4.8 handles real-time flight control, a Raspberry Pi 5 manages telemetry and camera systems, and a Sixfab 4G LTE modem processes data transmission—ensuring reliability through system redundancy and task separation. AETHER is running a stable version of Ardupilot, enabling guided GPS routing.



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INTEGRATED DEGREE IN
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