Winter 2025 | Design Review

Team Fire-Flighters | Wildfire Drone

Wildfire Prediction and Mitigation System

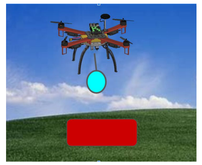
UCI Samueli School of Engineering | Department of Mechanical and Aerospace Engineering

EXECUTIVE SUMMARY

- Our objective is to create a UAV system capable of monitoring these high-risk wildfire areas. We proposed a drone that can survey autonomously, recognize fire and take mitigating action. We successfully designed and created a scalable prototype

OVERVIEW

- User identifies a search area and develops a flight plan for the drone.
- The drone takes off, surveys the area, stopping at each waypoint on the GPS grid.
- If the "fire" is detected, the drone uses a feedback loop to zero in on fire and drop the payload.
- The drone then returns home and lands. It provides GPS coordinates of the fire as well is video.

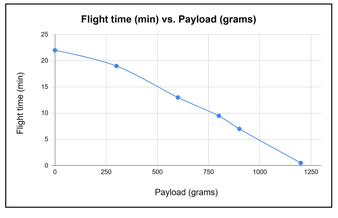


Payload Drop

Test Flight

ENGINEERING ANALYSIS

- Analysis of battery life to weight
- Optimal specs: 600 gram payload with flight time of up to 12 minutes



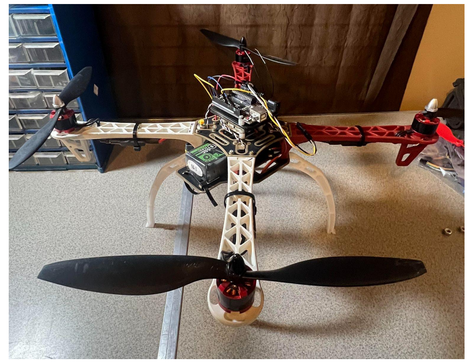
FUTURE IMPROVEMENTS

- Infrared camera to more accurately detect wildfires
- Object detection using secondary camera and AI modules
- Network/swarm system of multiple drones communicating and working with each other

ENVIRONMENTAL CONCERNS

- Extreme weather conditions make it difficult or unable to safely operate drone
- Dense trees that limit drone's ability to reachwildfire

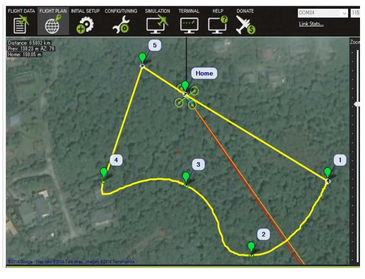
FINAL DESIGN



Actual model

CAD model

AUTONOMOUS FLIGHT/SURVEY



Simulation

- SpeedyBee F405 (hardware) & Ardupilot (software) is used
- Commands like waypoint, takeoff, and landing are used to autonomously control drone
- Accurate GPS and compass connection is required
- Visual simulation allows for flight plan to be reviewed before actual flight

Waypoints

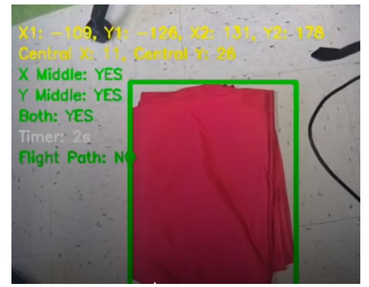
WP Radius 2 | Loiter Radius | Default Alt 100 | Absolute Alt | Verify Height | Add Below | Alt Warn 20

	Command					Lat	Long	Alt	Delete	Up	Down	Grad %	Dist	AZ
1	WAYPOINT	0	0	0	0	-35.0407928	117.8277898	100	X			95.7	104.5	1
2	WAYPOINT	0	0	0	0	-35.0406786	117.8260410	100	X			0.0	159.7	275
3	WAYPOINT	0	0	0	0	-35.0417239	117.8251612	100	X			0.0	141.2	215
4	WAYPOINT	0	0	0	0	-35.0428395	117.8259873	100	X			0.0	145.1	149
5	WAYPOINT	0	0	0	0	-35.0427165	117.8274572	100	X			0.0	134.5	84

Flight Plan

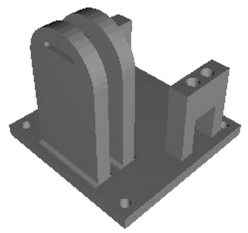
CAMERA DETECTION

- Raspberry Pi 5 is used
- Uses RGB scale to detect color from the pixels
- Creates a mask around solid object of wanted color
- The coordinates from the mask are used for feedback for flight controller and payload servo



Camera Feed

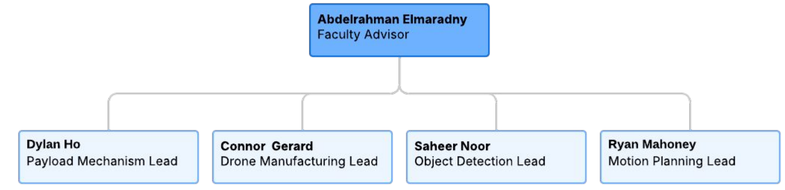
PAYLOAD MECHANISM



Final Iteration

- 3D-printed mount to house servo that performs payload drop
- Payload consists of a reusable water balloon
- Payload mechanism is mounted underneath drone and is actuated by Raspberry Pi

ORGANIZATIONAL CHART



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TIMELINE