Early Forest Fire Detection Before Go Wild from UAV

Currently, most early wildfire detection is usually done by satellite, but it could be hindered by cloud cover. Also, even the most advanced satellite system could only detect after the burning area reaches $18.4\ km^2$.

Instead, a network of IoT sensors and drones or UAV could detect fires that are just $2.5\ km^2$ with perfect accuracy after testing.

This project will be launched mainly for high-risk regions, like California and Australia, where is highly covered with forest to prevent large wildfire.

Time: $60\ min$

Temperature: $-20 \sim 60℃$

Transmission Range: $16km$

Sensing: 6 directional sensing & positioning

Real-time Auto-switching: $2.4/5.8GHz$

Speed: max $25m/s$

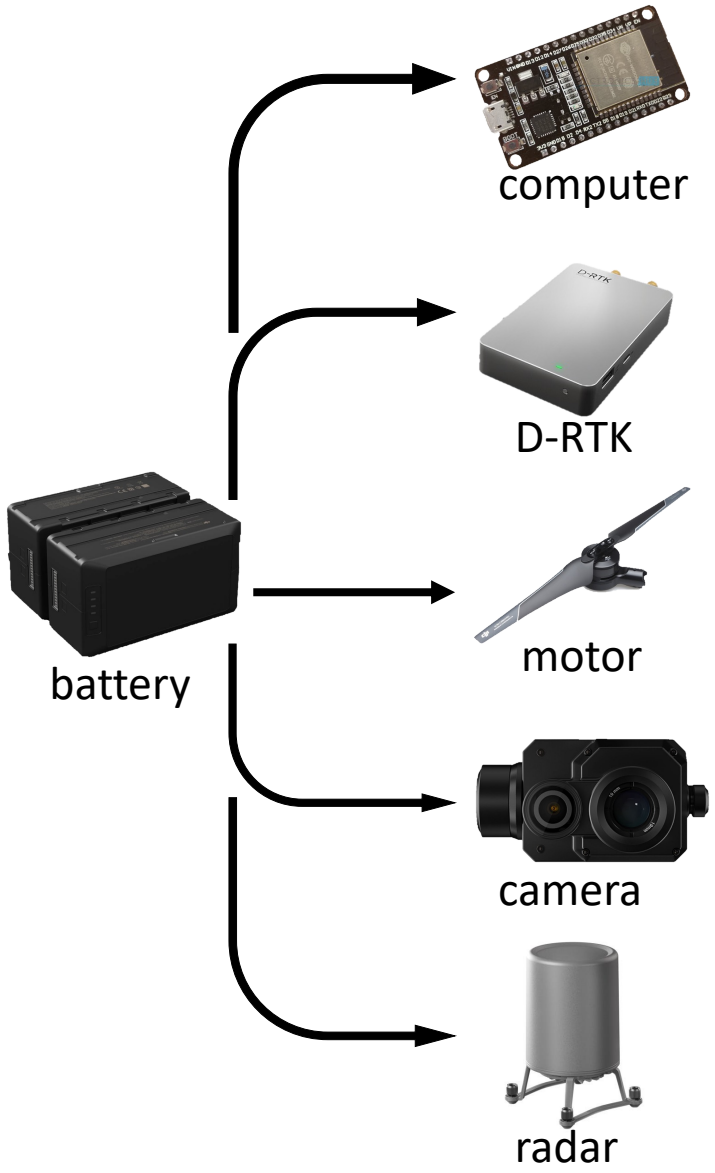
Detection Range: $40m$

Night Scene Supported

Streamlined Communication

Individual Project: Guanang Su

Power

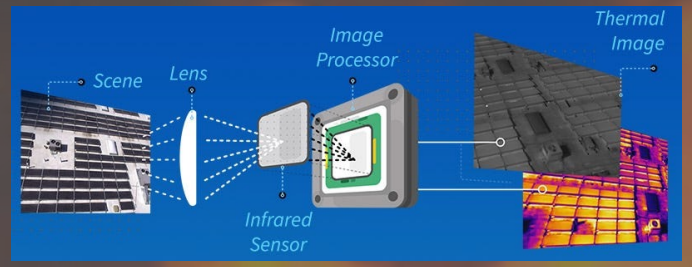


Parts	Power	Weight
RTK-GPS	$5W * 2 = 10W$	$400g$
IMU	$30W$	$40g$
Computer	$20W$	$40g$
Infrared Camera	$80W$	$300g$
RGB Camera	$40W$	$100g$
Motor	$50W * 6 = 300W$	$80g * 6 = 480g$
RTK-CSM Radar*	$12W * 2 = 24W$	$300g$
Total	$\approx 500W$	$\approx 1.2(1.5)kg$

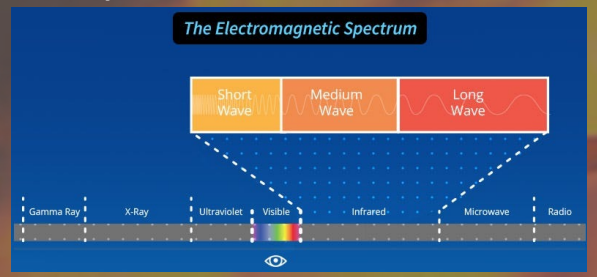
As shown in the calculation, the total power consumption is $500W$, $Battery = 300Wh * 2 = 600Wh$, therefore, the total flight time is about $1\ hour$ (including some power consumption and loaded on UAV).

*: optional part for the system (enhanced fight safety and situational awareness)

Thermal Imaging



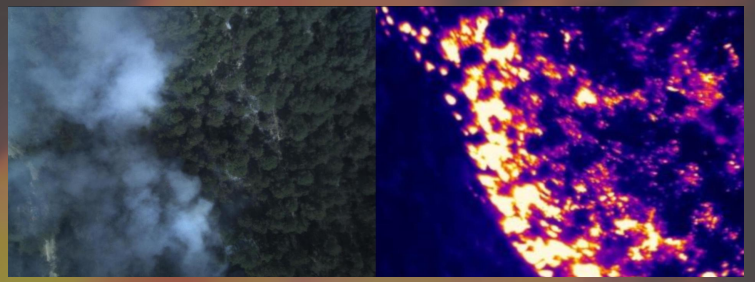
- Spectral Band: $7.5 \sim 13.5\mu m$



1. Flight controller with diagnostic algorithms with data from GNSS unit
2. Precise Control for UAV with centimeter-level accuracy.

GNSS unit

Master Mission Environment:



- IR sensor
- $\pm 5℃$ accuracy in $-25 \sim 135℃$ range

Sensing

Infrared Camera

1. Show detail collection with accurate data in real-time.
2. Alert temperature situation to base station when exceeds a pre-set temperature threshold.

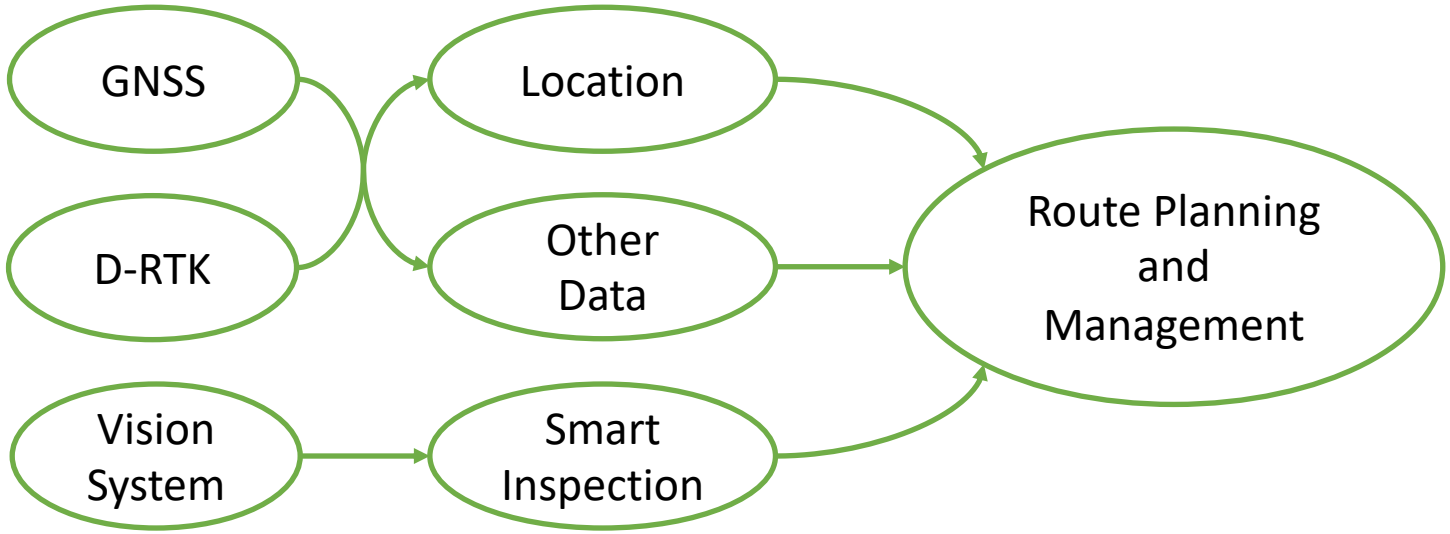
Software Helping

1. Temperature Measurement and Feedback.
2. Deep Learning and Machine Learning method for flame and fire detection in the forest.

RGB Camera

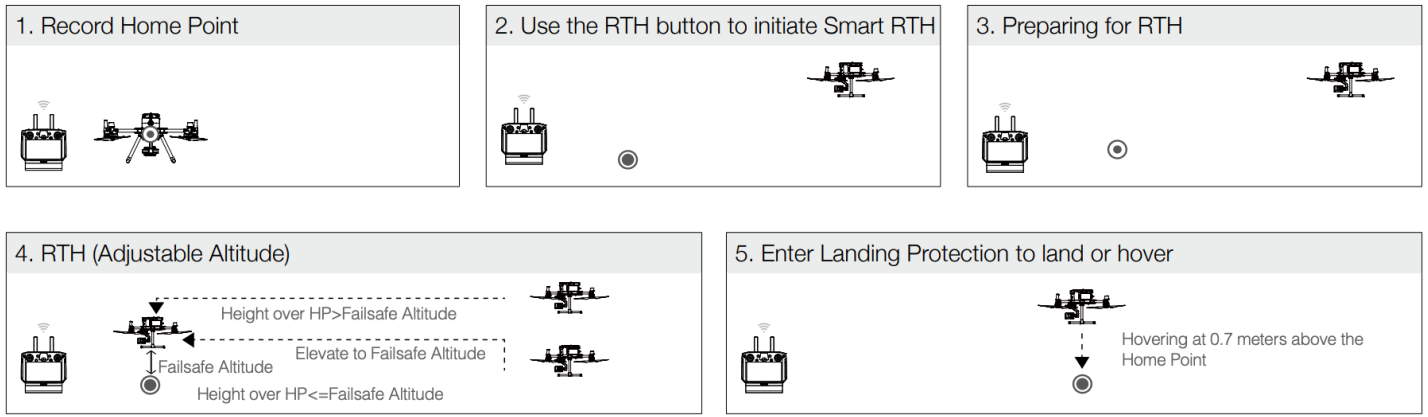
Offer a 2.5D Base Map for terrain awareness and Cloud Mapping for fast mapping.

Navigation



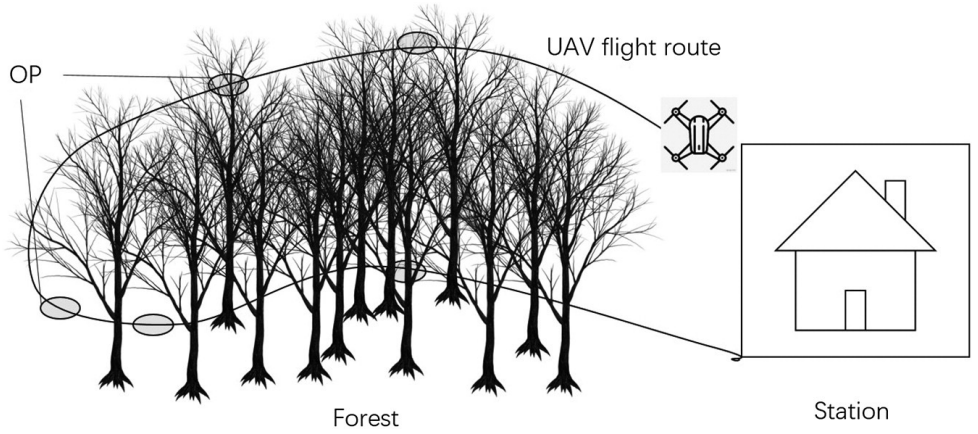
Global Navigation Satellite System provides Global coverage with data of positioning, navigation, and timing (PNT) on the global bias. BeiDou, previous used as compass, will be used for the navigation.

D-TRK will integrate software algorithms with GPS+BDS, provided a **centimeter-level accuracy** both horizontally and vertically.



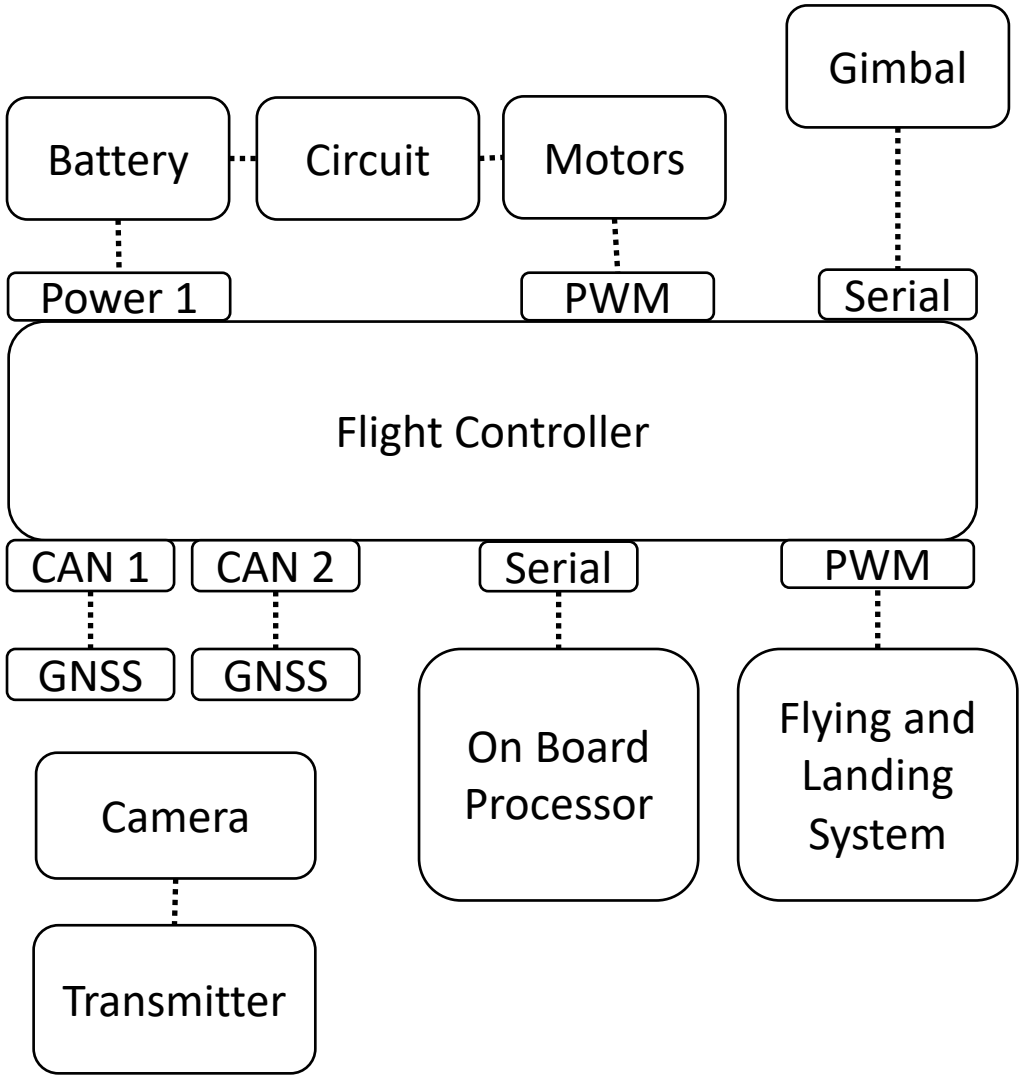
Smart RTH (return to home) navigation with low battery or severe situation detect.

Avoid obstacle during flighting (flying above tree at normal time) $\approx 10 \sim 25m$



Software & Hardware Setup

Computing Platform (Block Diagram)



Software Setup