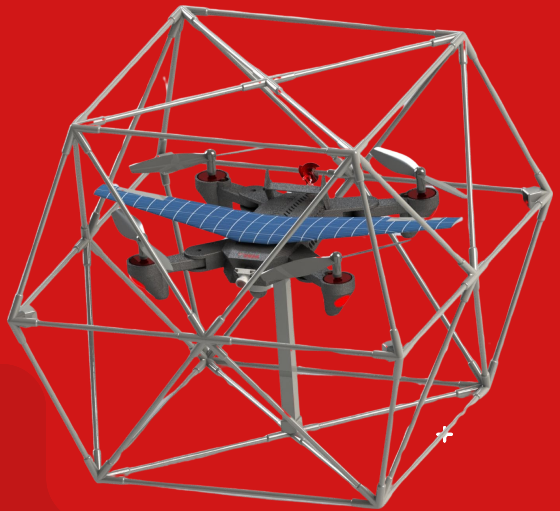
Managing Fire:

Increasing Community-based Fire Management Opportunities

Team: TUNSA Space
Robotics: Task Force 2

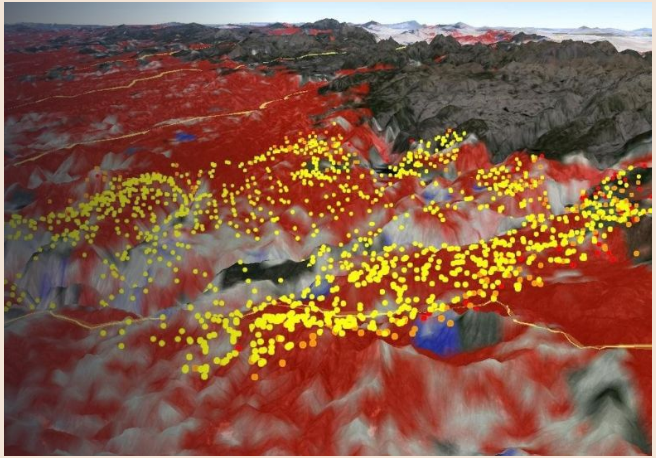
NASA
INTERNATIONAL
SPACE APPS
CHALLENGE

Participants:
Firas RAOUIN
Elyes KHECHINE
Med Yessine KSIBI
Mohamed Aziz NAIFAR
Yasmin LOUKIL

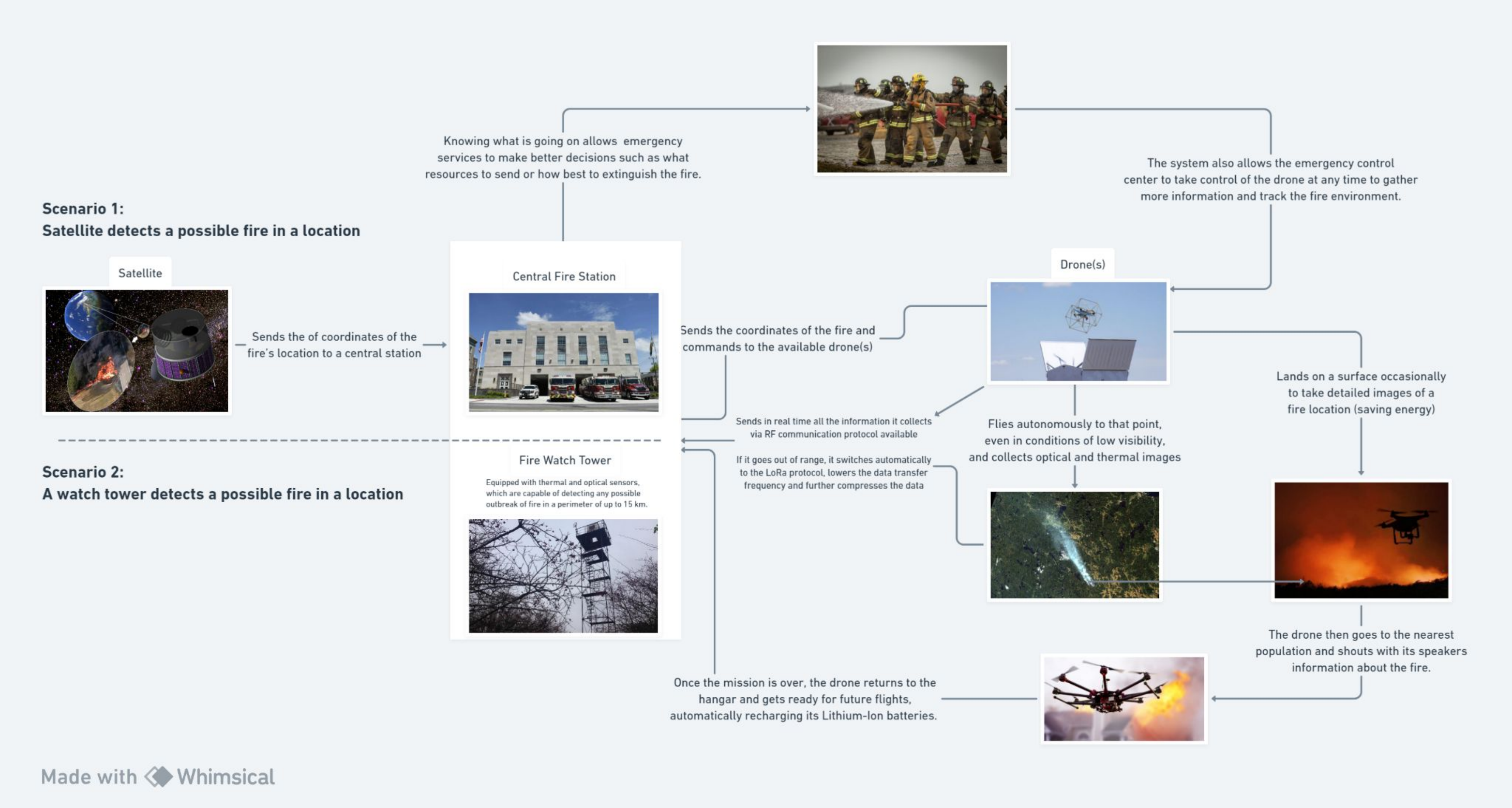


PROBLEM STATEMENT

In the face of increasing wildfires, the need for broader access to satellite-derived active fire data and its utilization by diverse stakeholder groups, including local communities, is pressing. Wildfires have devastating consequences, including biodiversity loss, air quality degradation, soil erosion, and greenhouse gas emissions, often disproportionately impacting communities residing near or within forests. To address this issue, our challenge is to find innovative ways to harness technology and publicly available data for fire and natural resource monitoring, enabling local communities to report and monitor fires, improve current data distribution, and develop community-based forest management solutions.

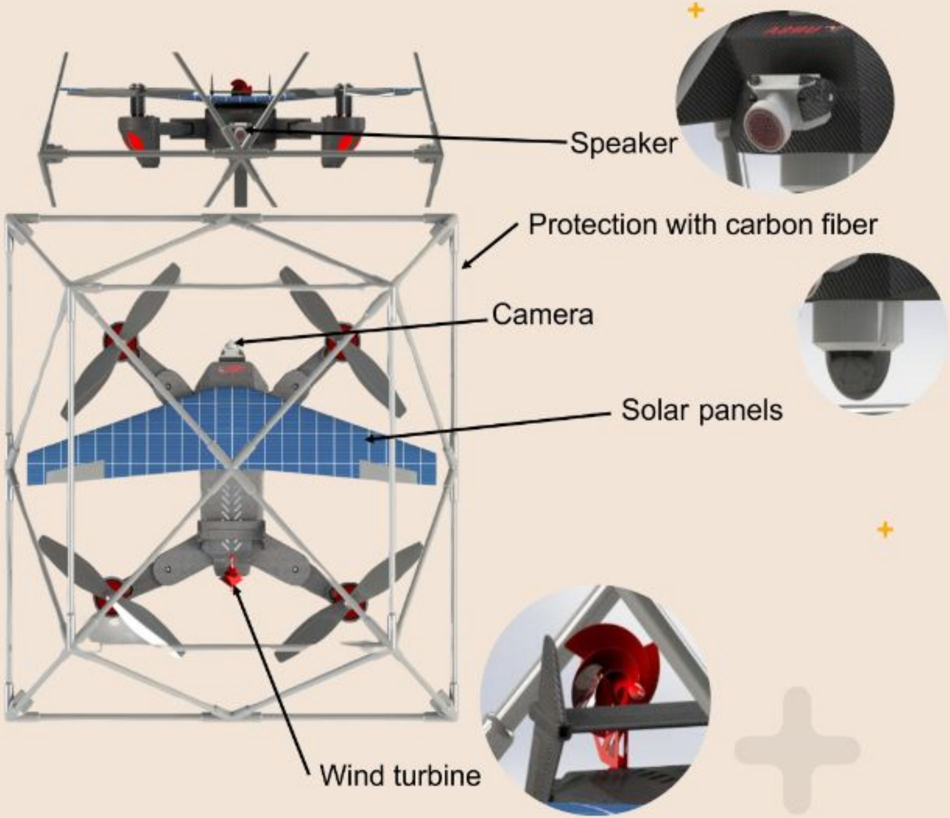


PROPOSED SOLUTION: FireFly Guardian
A Fire Verification, Monitoring, and Rescue Drone System



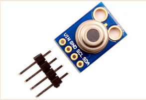
MECHANICAL DESIGN

- **Aerodynamic Wings**: Decreases power consumption during long flights.
- **Solar Panels**: Reduces reliance on the Lithium ion battery.
- **Wind generator**: Further boosts the battery life.
- **Body Cage:** Guarantees safety of the drone and the pedestrians.
- **Carbon fiber body**: Lowers body weight thus increasing flight times.
- **360° camera FOV**: Cost-effective opposite-side 180° cameras for real-time monitoring.



HARDWARE COMPONENTS

LoRa Module: Long-Range Communication, Low-Power

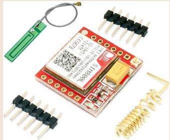


Temperature Sensor: Ambient Temperature, Measurement

Motors: Propulsion, Brushless, Thrust

Electronic Speed Controllers (ESCs): Speed Regulation, Feedback

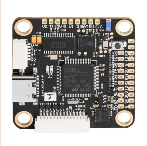
Propellers: Blades, Lift, Rotation



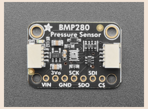
GSM 3G Modem: Cellular Communication, GSM/UMTS

Smoke Sensor: Smoke Detection, Air Quality

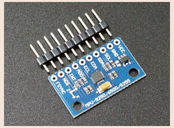
360° Camera: High-Resolution Imaging, Magnification



Flight Controller: Brain, Control, Communication



Pressure Sensor: Atmospheric Pressure, Measurement



Gyroscope & Accelerometer: Measurement of Velocity, and Acceleration

GPS: Positioning, Satellite Signals

Thermal Camera: Infrared Imaging, Temperature

Lithium Ion Battery: Power Source, High Energy

SOLUTION CHALLENGES

Surviving Harsh Environmental Conditions: Drones must endure extreme weather while ensuring the accuracy of sensors.

Navigating Complex Forest Terrain: Precision in dense canopies.

Meeting Regulatory Drone Compliance: Navigate airspace rules.

Gaining Community Acceptance: Addressing public concerns.

FUTURE WORK

★ Optimizing communication for faster and reliable signals.
★ Optimizing power consumption for extended flight endurance.
★ Leveraging machine learning for dynamic flight path planning.
★ Developing AI-driven predictive maintenance algorithms for reliability.
★ Implementing swarm intelligence for collaborative and efficient operations.