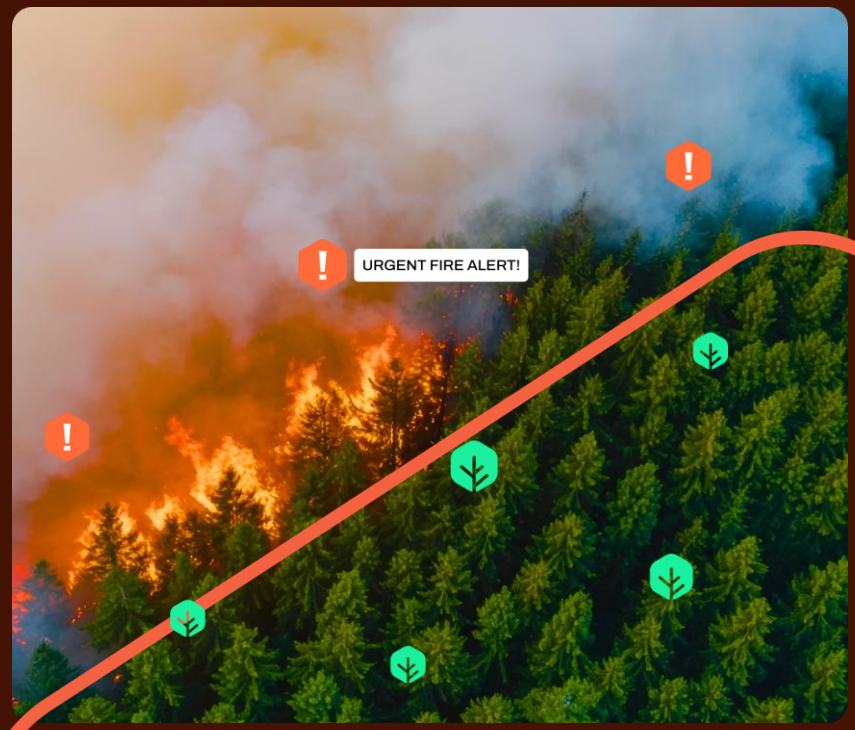
DRYAD

AI, IoT & LoRaWAN: Transforming Ultra-Early Fire Detection for Forestry, Infrastructure, and Climate Resilience



Sohan Domingo

ARCIA
Australia's Radio and Critical Communications Association

Bushfires are expensive, catastrophic & getting worse

Every year, bushfires destroy ecosystems, cripple economies, and accelerate climate change.
The numbers speak for themselves:

$4.4Bn+
Estimated loss in tourism revenue due to bushfires (2019-2020)

$2.32Bn+
Insurance claims from the 2019 – 2020 fires

5,900+
Structures lost – Including 2,800 homes (2019-2020)

96Mn
Hectares burned – Forests and land destroyed (2023-2024)

173
Lives lost – Black Saturday bushfires (2009)

7Bn
Tonnes CO_2 , ~20% global carbon emissions from wildfires annually

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The Black Summer bushfires left a scar on Australia—devastating communities, wildlife, and livelihoods.

These images are a stark reminder that early detection isn't just prevention; it's the difference between disaster and survival.

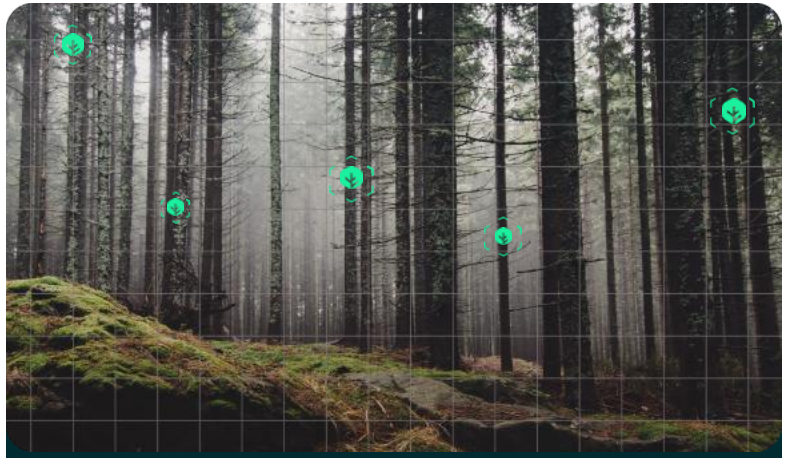
Role of AI, IoT & Networks in early fire detection

AI-Powered Data Processing

The data collected from IoT sensors is processed & analyzed using AI algorithms.

AI plays a crucial role in

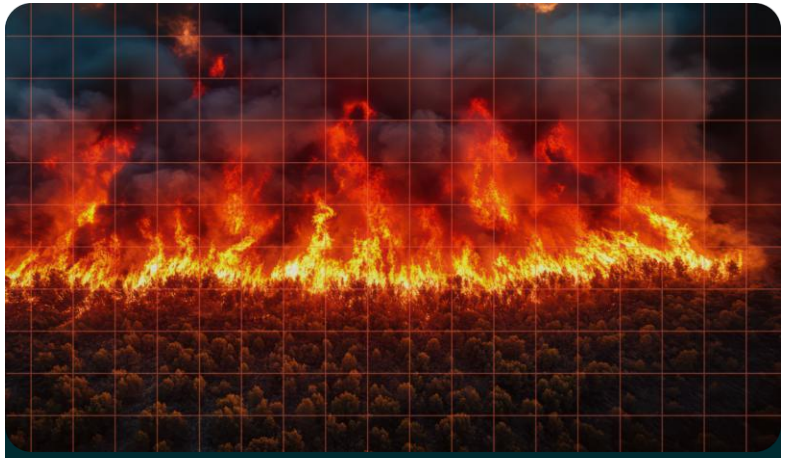
- Identifying fire risks
- Predicting fire behavior
- Minimizing false positive between regular environmental changes & actual fire threats



IoT Sensor Networks

IoT-based sensor networks designed to monitor environmental conditions in real-time.

This data is transmitted in real time to central processing systems, where it is analyzed & used to detect unusual patterns that may indicate a fire

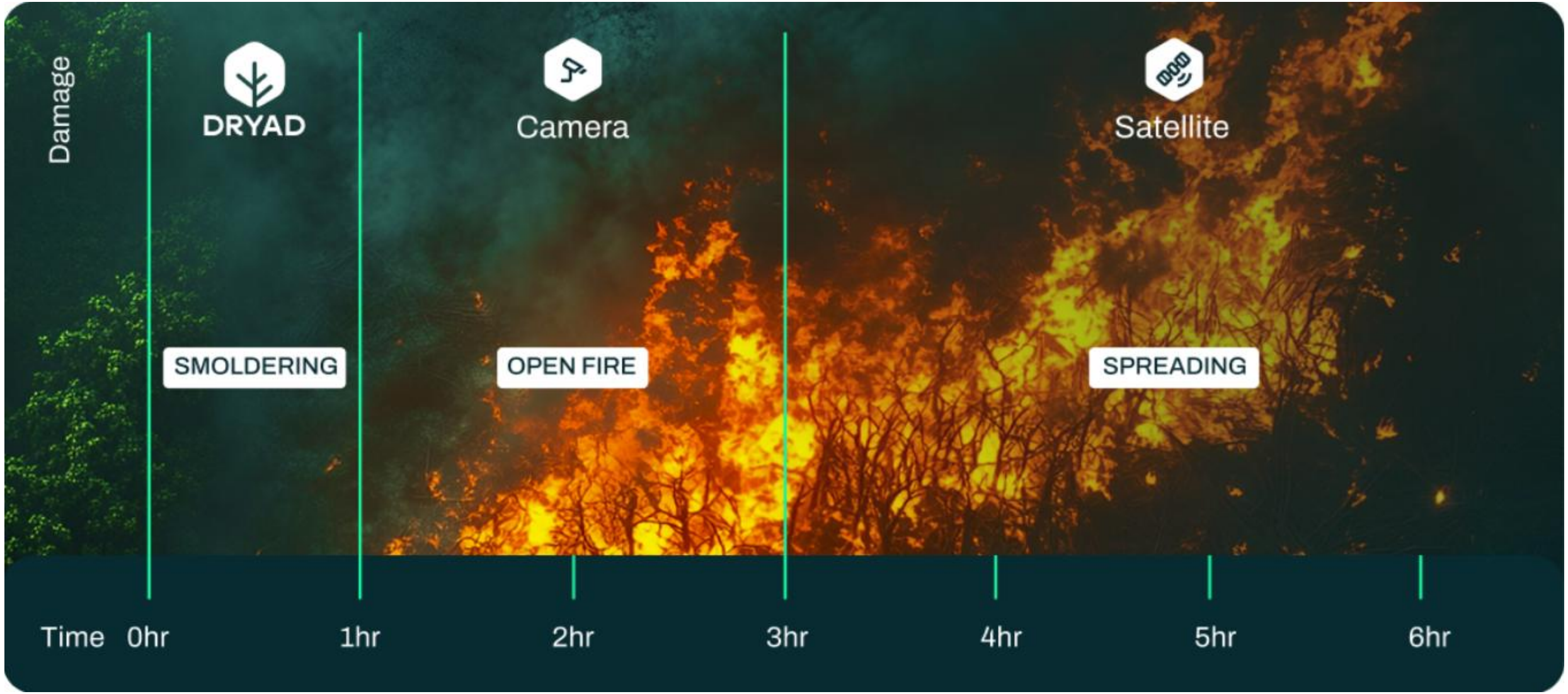


Networked Fire Detection Across Large Areas

A distributed, networked system that covers large areas that may not be accessible through traditional monitoring methods.

Enables fast alerts & proactive response coordination

Time is of the Essence



We protect the pulse of the forest.

Silvanet: A revolutionary sensor network

Detect Wildfires Before They Spread—In Minutes, Not Hours

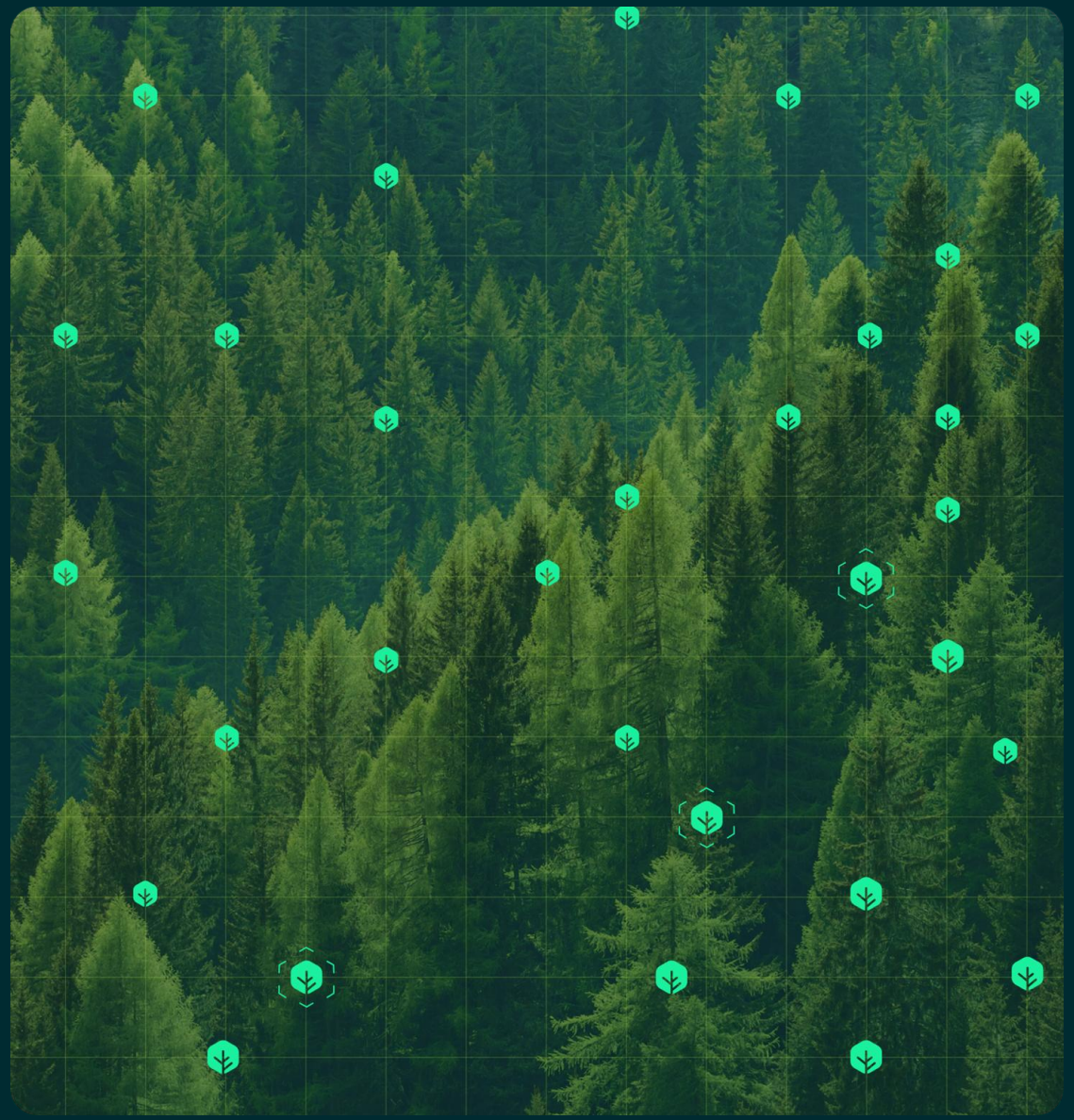
- Our solar-powered gas sensor detects wildfires within minutes & triggers for timely action
- Detects fire at the smoldering phase, before flames spread
- Uses AI-powered edge computing to analyze air composition
- Operates maintenance-free for 10-15 years using supercapacitors

Silvanet is unique

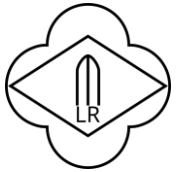
Using Silvanet we are building a smart, self-sustaining network: Internet of trees

This network includes

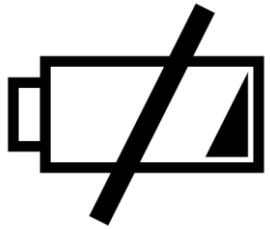
- Ultra low cost solar powered sensors
- Patented LoRaWAN mesh gateway covering vast areas
- Border gateway for internet connectivity & remote firmware updates
- Real time alerts & analytics gathered on cloud platform for remote monitoring



The Backbone for Large-Scale, Sustainable Monitoring - LoRAWAN

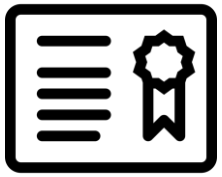


Long-Range Communication



Low Power Consumption

Scalable & Flexible



No Licensing Fees

Secure & Reliable

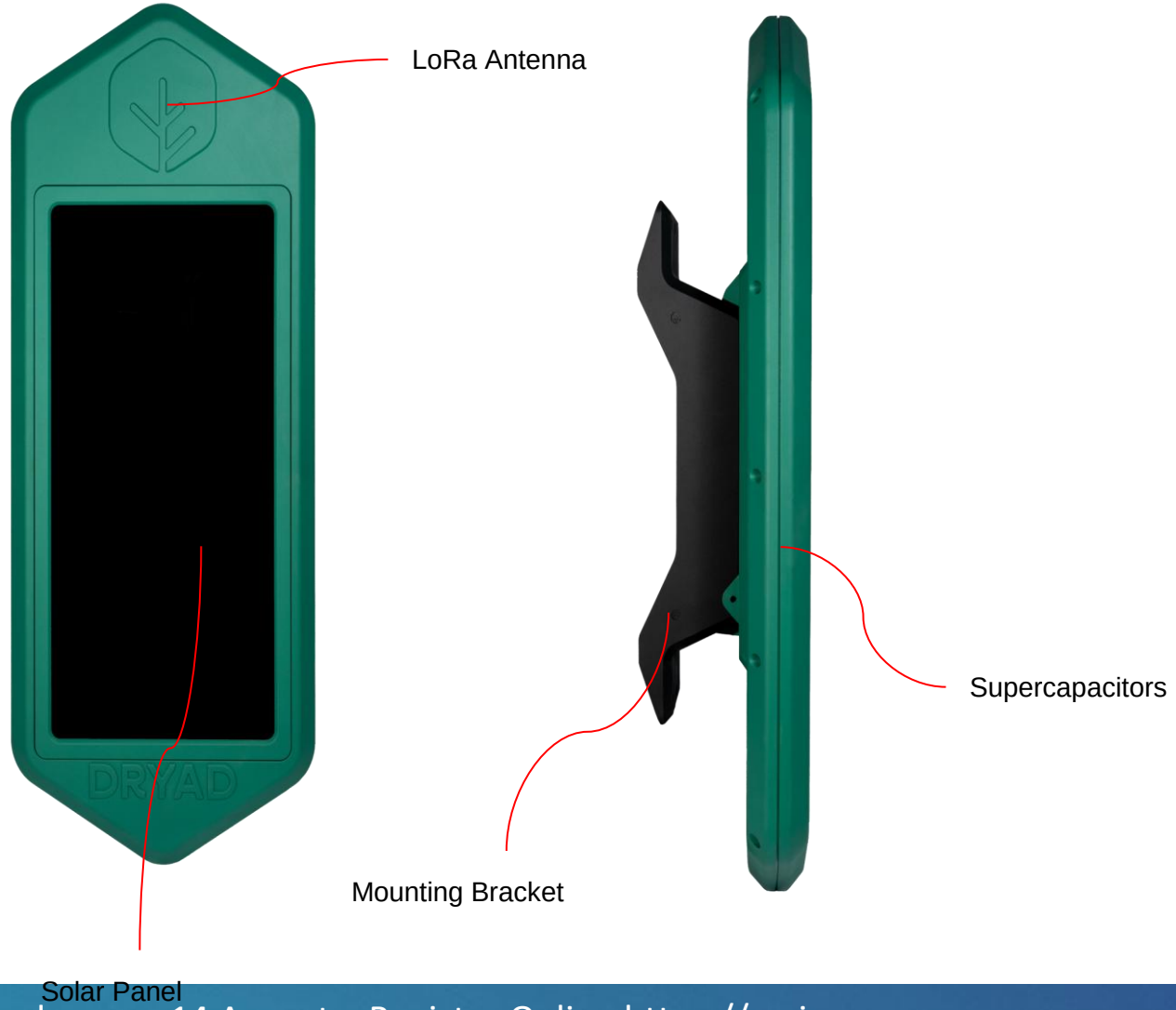
Remote Firmware Updates

AI/IoT - Gas Sensor

Solar-powered gas sensor ‘smells’ fires within minutes from ignition.

- Detects fires at smoldering phase
- Runs on solar power & supercapacitors
- Low cost, high volume deployments
- 10-15-year lifespan maintenance-free
- AI-powered EDGE computing
- IP67 waterproof

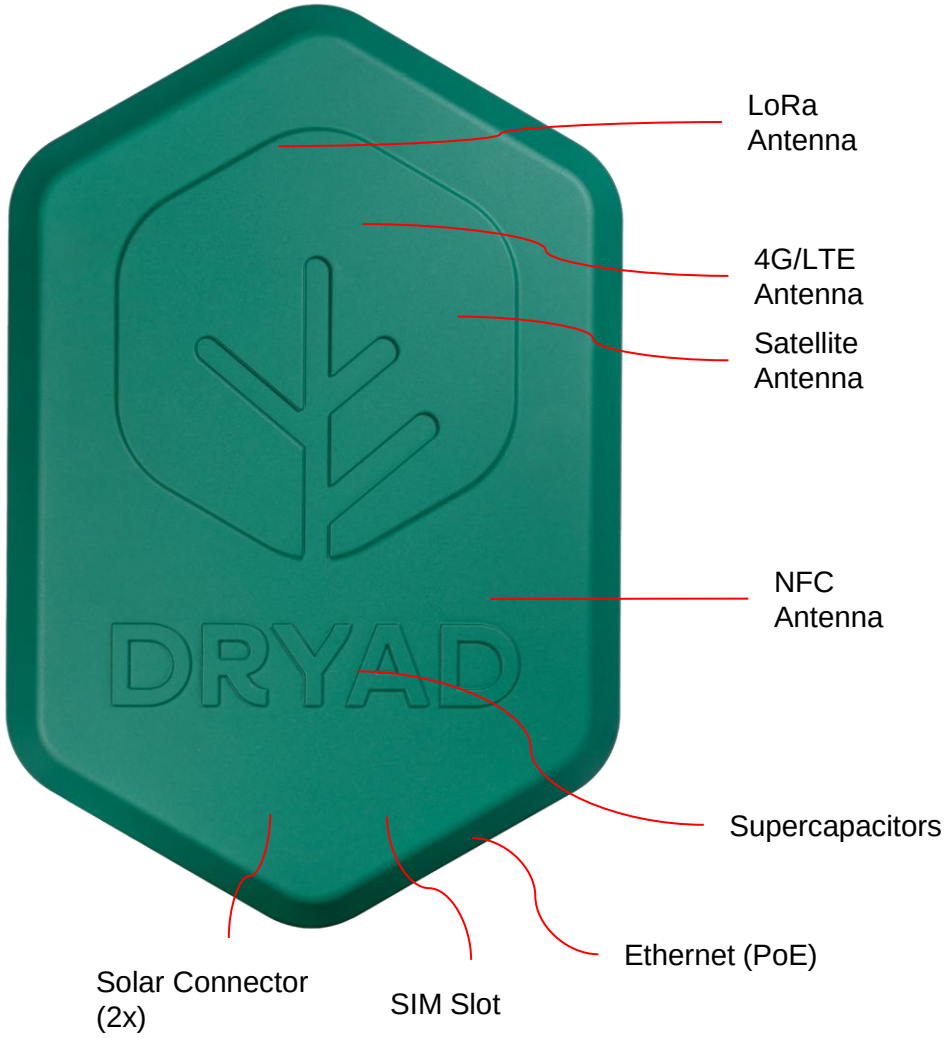
Mesh Gateway



Network Range Extender

- Mesh Gateways cover 2-3 km radius
- Multiple gateways can extend the range
- Up to 10 hops to Border Gateway
- 100 sensors per Mesh Gateway
- Solar-powered, no lithium-ion batteries
- Supercapacitors for energy storage
- IP 67 waterproof

Border Gateway



Connectivity for the Network

- 4G/LTE with GPRS fallback
- Built-in satellite connectivity
- Ethernet (POE) for wired connectivity
- Up to 10.000 sensors per network
- Solar-powered, no lithium-ion batteries
- Supercapacitors for energy storage
- IP 67 waterproof

Dryad's technology operating mechanism

1. FIRE STARTS
(smoldering stage)

2. SENSORS DETECT
GAS ANOMALIES

3. LoRaWAN NETWORK
TRANSMITS DATA

4. USERS GET AN
EARLY ALERT.

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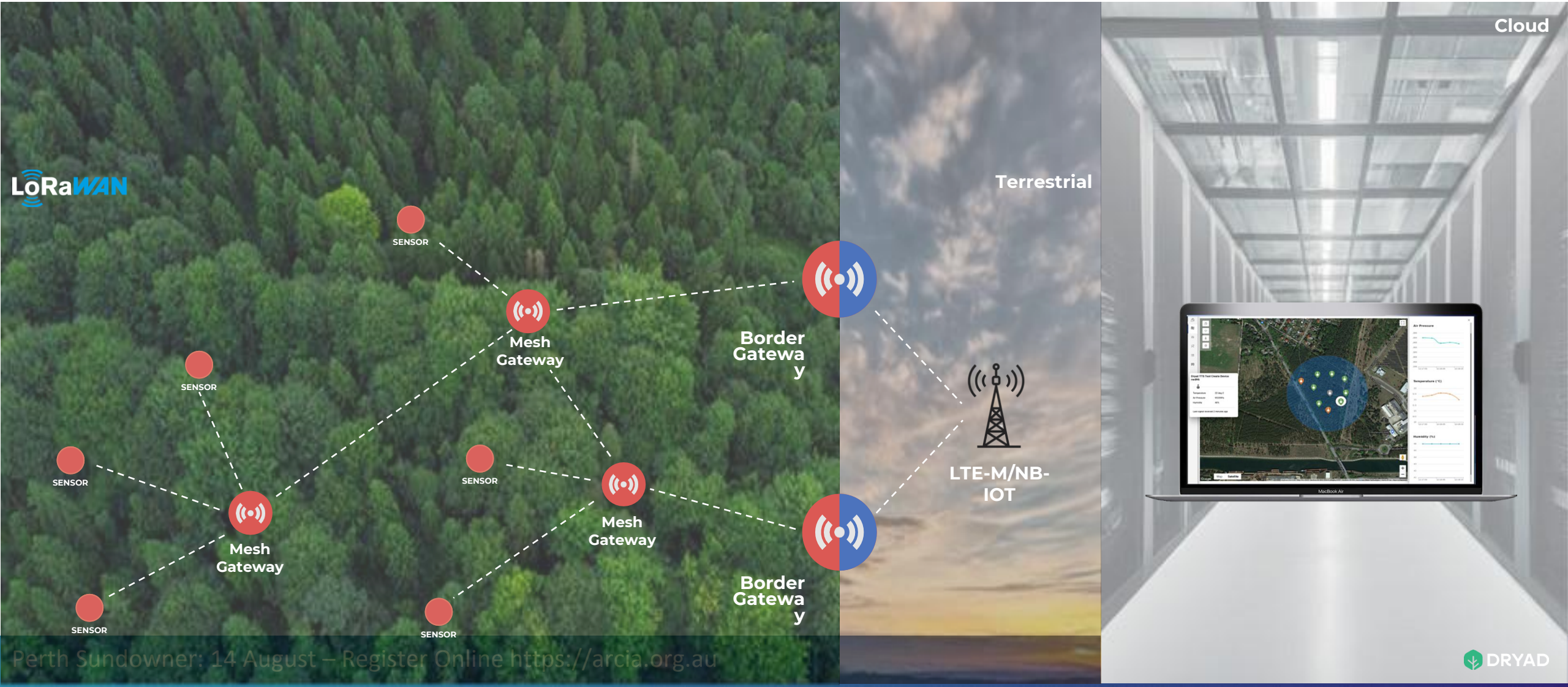
Large-Scale IoT Mesh Network for Forestry



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AI Driven IoT Sensors stand out

Dryad	Cameras	Satellite	Constellation
Ground Sensors and Network	Ground Cameras (circulating 360°)	1 HEO Satellite (Highly Elliptical orbit), 600km, IR	100 HEO Nanosatellites, IR cameras
SMOLDERING FIRE			
OPEN FIRE	**OPEN FIRE**	**OPEN FIRE**	**OPEN FIRE**
TEMPERATURE		**TEMPERATURE**	**TEMPERATURE**
HUMIDITY **OZONE** **SOIL MOISTURE** **SAP FLOW** **TREE GROWTH** **CARBON FOOTPRINT**			
Ultra-early fire detection (within minutes during smoldering phase)	Can detect smoke plumes from afar, up to 16 km radius	Covers **large area**	Covers **large area**
Provides forest health data		Ultra-high resolution IR camera system	Possible data processing in space to avoid high transmission costs and delay
Large number of (inexpensive) **sensors** required.	**Does not work at night** (relies on visual recognition of smoke plume).	Can take hours to detect fire. IR resolution limited from space. Clouds impact images. Ultra-high resolution cameras limited by military regulation. Images sent to ground for processing causes delay and cost.	Can take hours to detect fire. IR resolution limited from space. Clouds impact images. Ultra-high resolution cameras limited by military regulation. Images sent to ground for processing causes delay and cost.
	Can detect fires only if a large smoke plume is visible.	Takes 90 minutes to circle earth, not geostationary. Satellite launch expensive, high CO2 emissions.	Large number of satellites. Expensive to deploy. High CO2 emissions from rocket launches.

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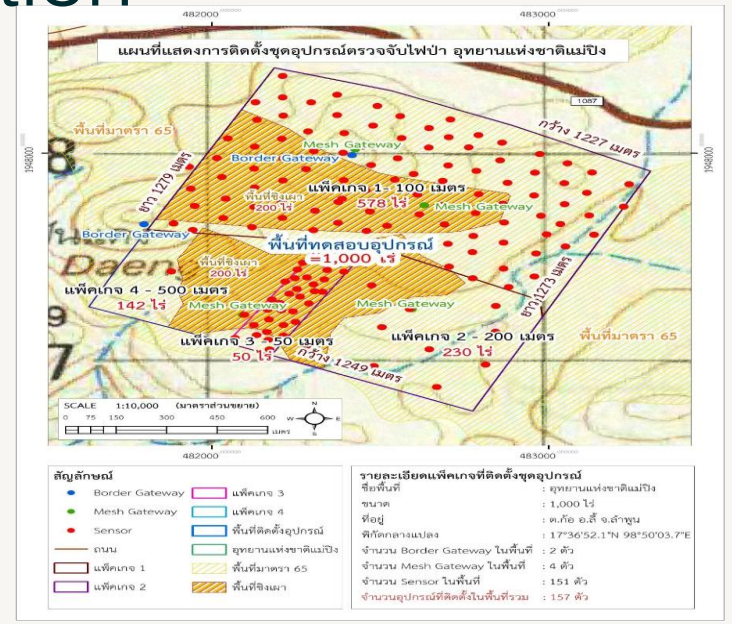
Optimizing Wildfire Sensor Deployments

Case Study: AI-Powered Wildfire Detection in Siam International - Mae Ping National Park



Pilot Deployment Overview

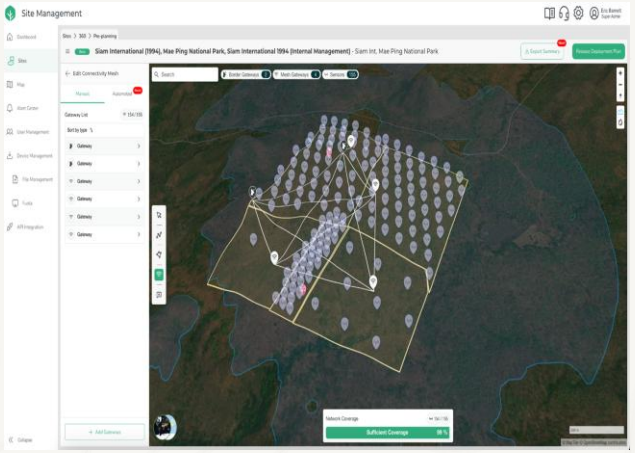
- **150** AI-Powered Sensors for wildfire detection.
- **6** Mesh Gateways.
- **2** Border Gateways.

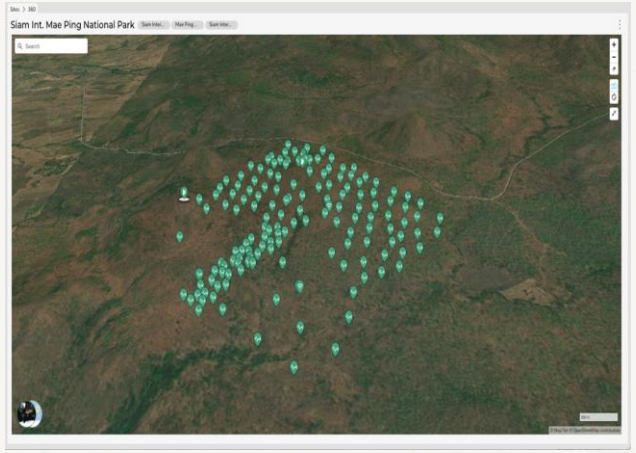
Smart Planning

- **Cloud-based** mapping for optimized placement.
- **High-risk zone** prioritization with dynamic density.
- Automated geolocation for **precise installation**.

Fast Execution & Scalability

- Tree-mounted sensors (3m height) for **optimal coverage**.
- Full deployment in 15 days, ensuring **scalability**.





Mae Ping National Park, Lamphun, Thailand
Deployment area - 160 hectares

Installation of Dryad Silvanet: Building a Proactive Fire Defense

Case Study: Validating AI Driven Wildfire Detection

Controlled Burn Test (19.02.2025)

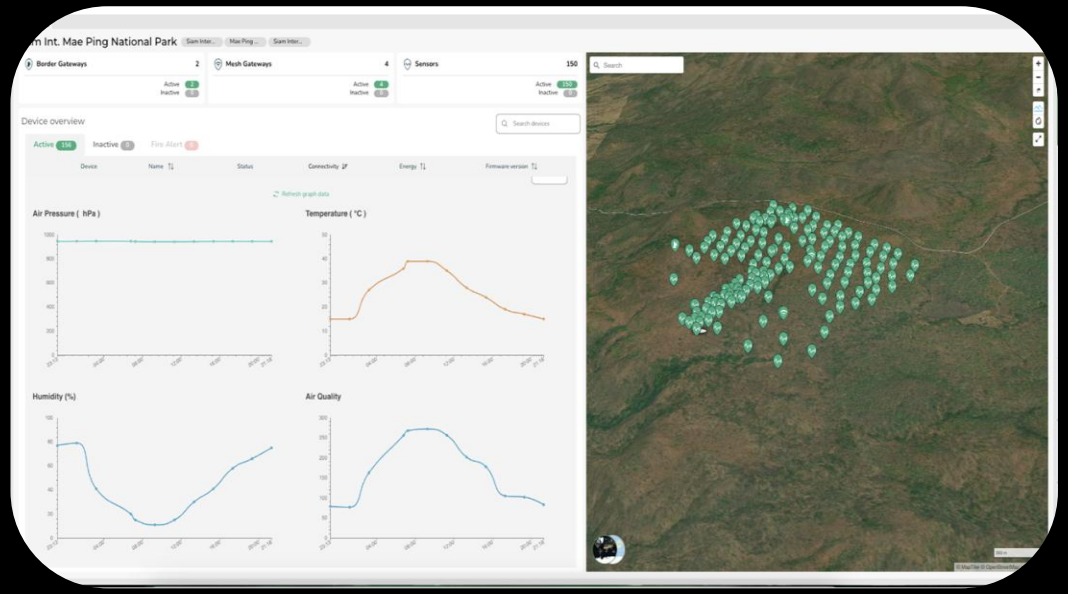
- Test Area: **3ha**
- Burn Duration: **2.5 hours,** closely monitored.

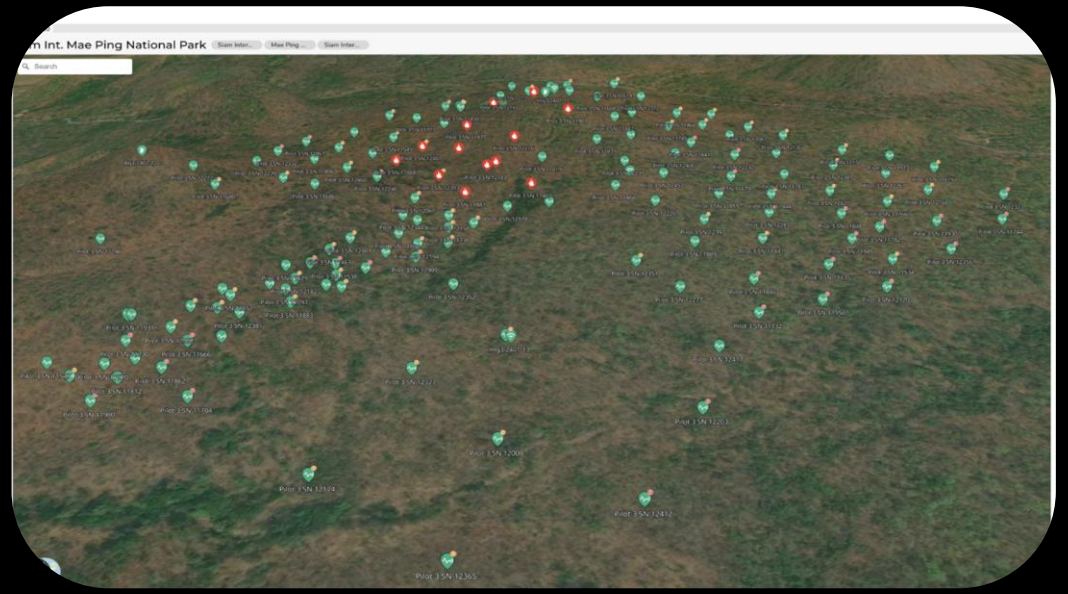
Detection Performance

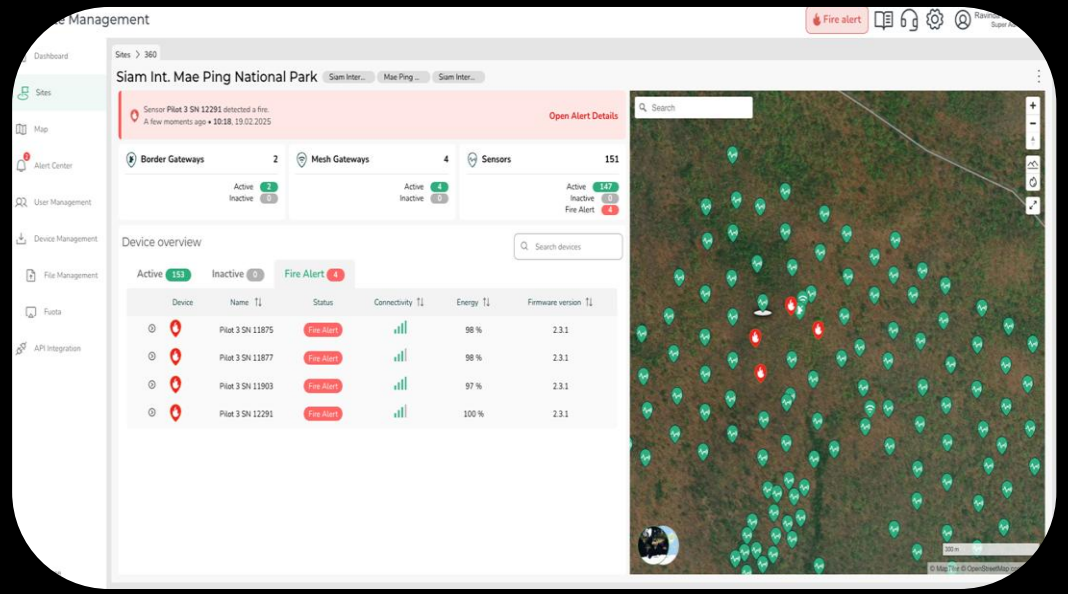
- First sensor detected fire within **7 minutes** of ignition.
- **13 sensors** triggered alerts, confirming system responsiveness.
- All gateways & sensors remain operational post-burn.

Key Takeaways

- Ultra-fast detection minimizes fire spread risk.
- System resilience validated in extreme conditions.
- Scalability for future wildfire prevention efforts.







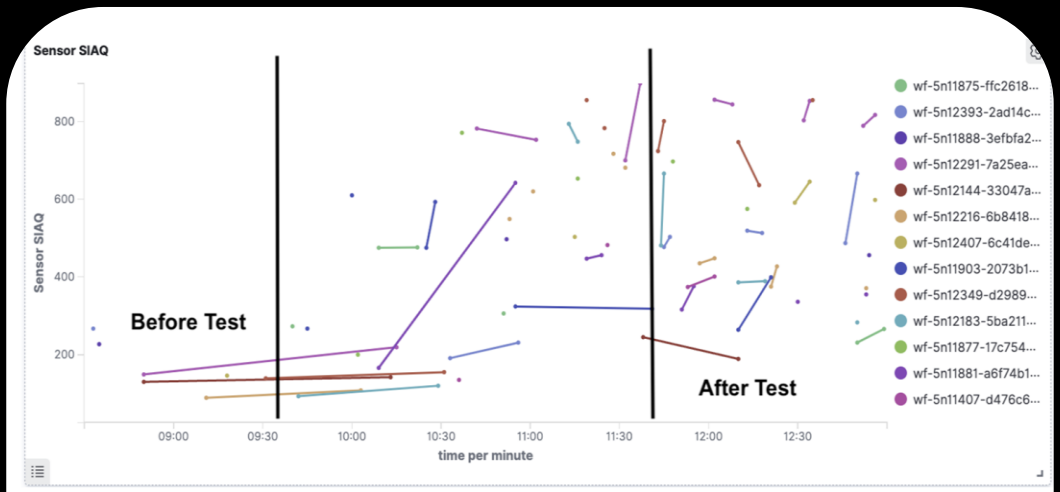


Figure X: Sensor air quality (SIAQ) readings over the test period, showing a decline in air quality. A maximum AQ of **898** was recorded, with both sensors detecting the change.

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Live Detection:Outside Of Planned Fire Testing

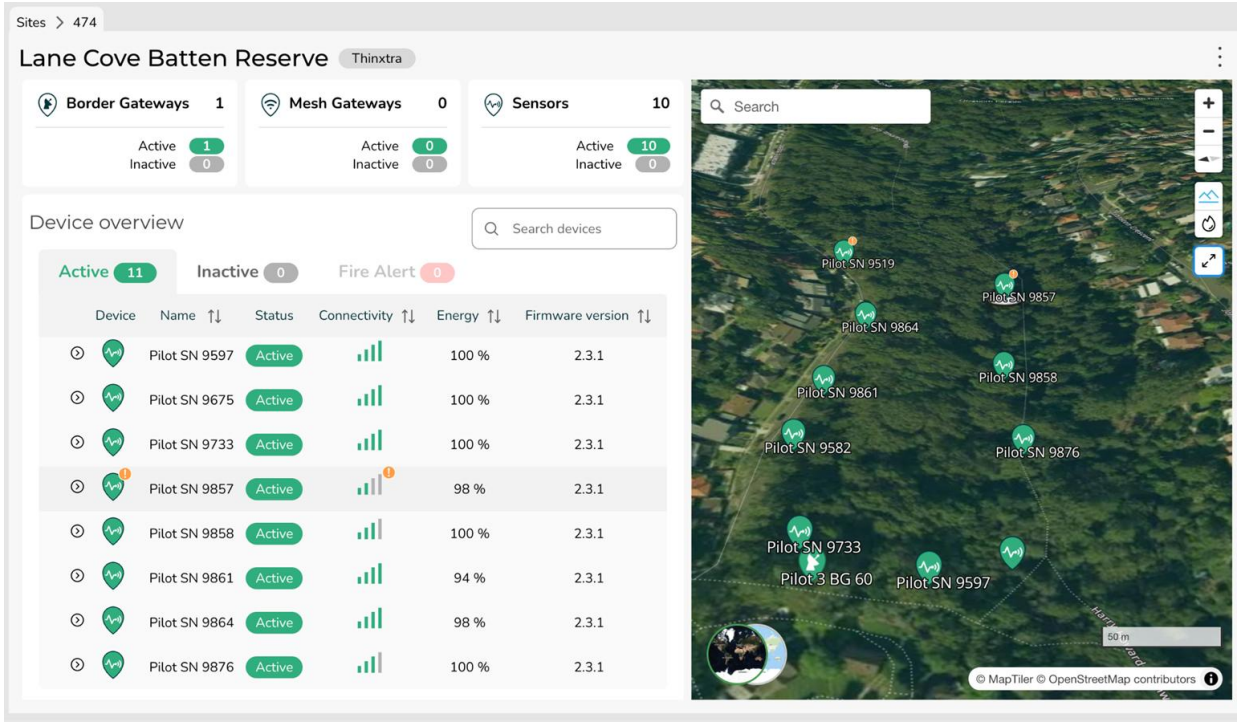
Unplanned Fire event (20.02.2025)

- Sensor detected smoke on **09:17:29**
- Detected a **slow-burning dead tree** with no visible flames
- Confirmed on-site **at 3:00 PM**
- Showcased the system's sensitivity to **early-stage combustion.**

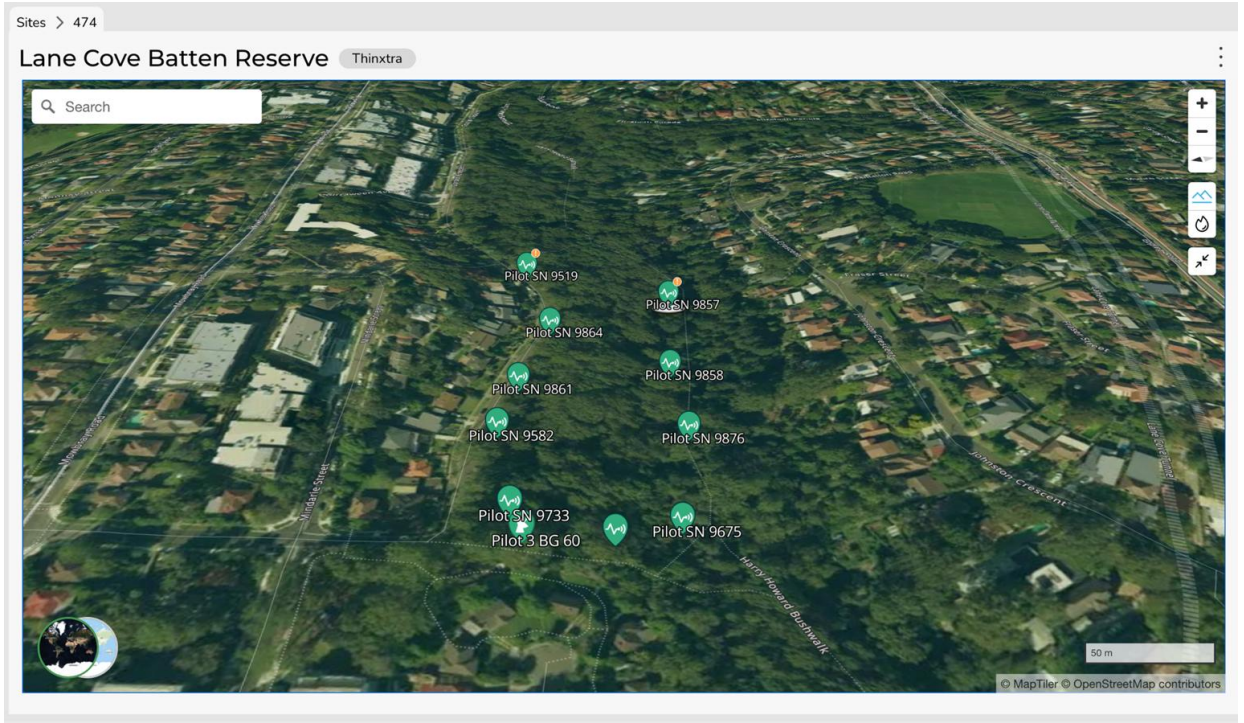
Key Takeaways

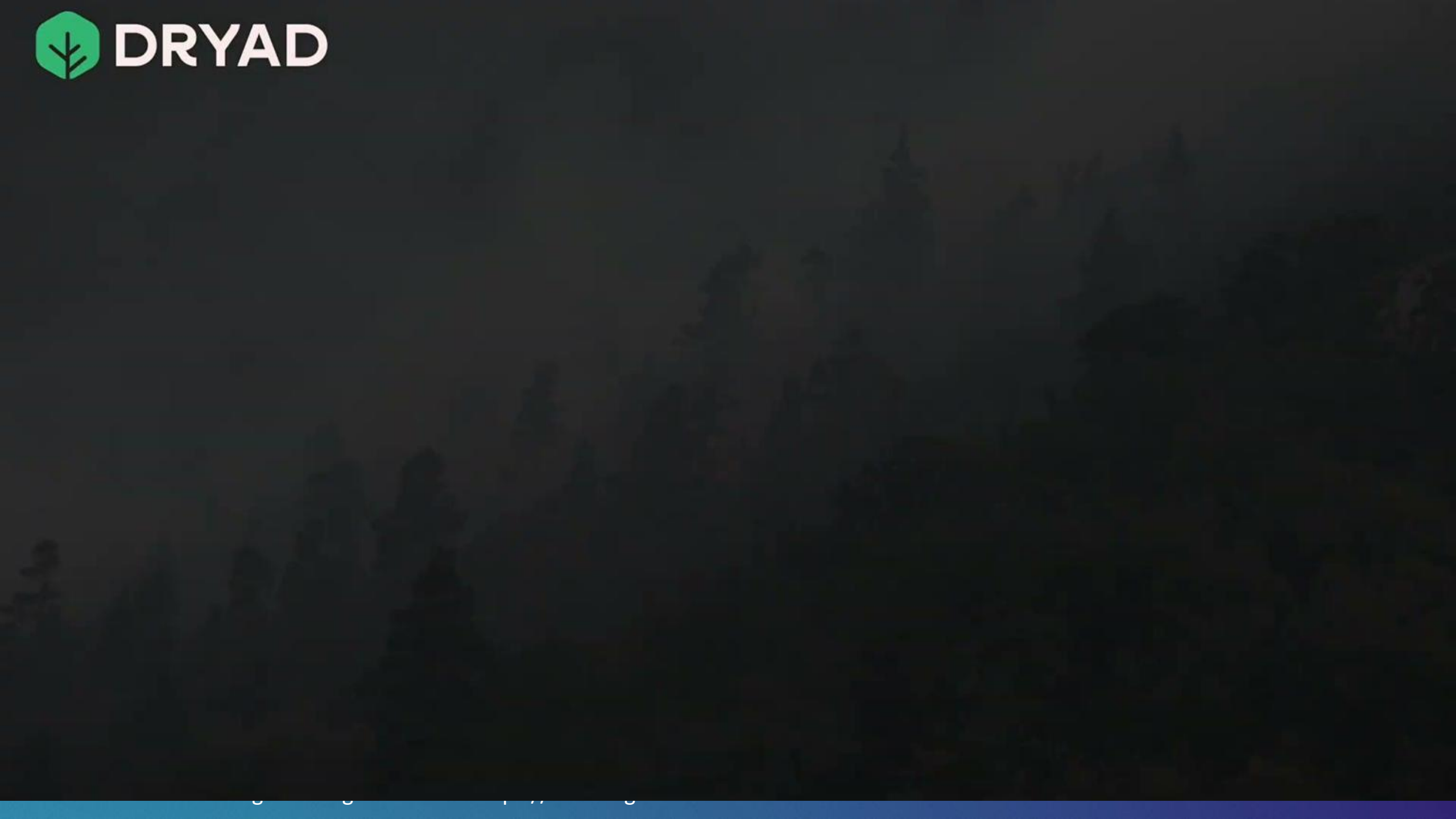
- Silvanet is **highly sensitive** to fire indicators—even in low-intensity or unexpected scenarios.
- System offers valuable insights into both g**enuine fire risks and environmental triggers**.
- Reinforces system's readiness for **real-world wildfire** conditions.

Lane Cove Batten Reserve NSW



- 10 sensors
- Border Gateway
- Monitors environmental data
- Demo

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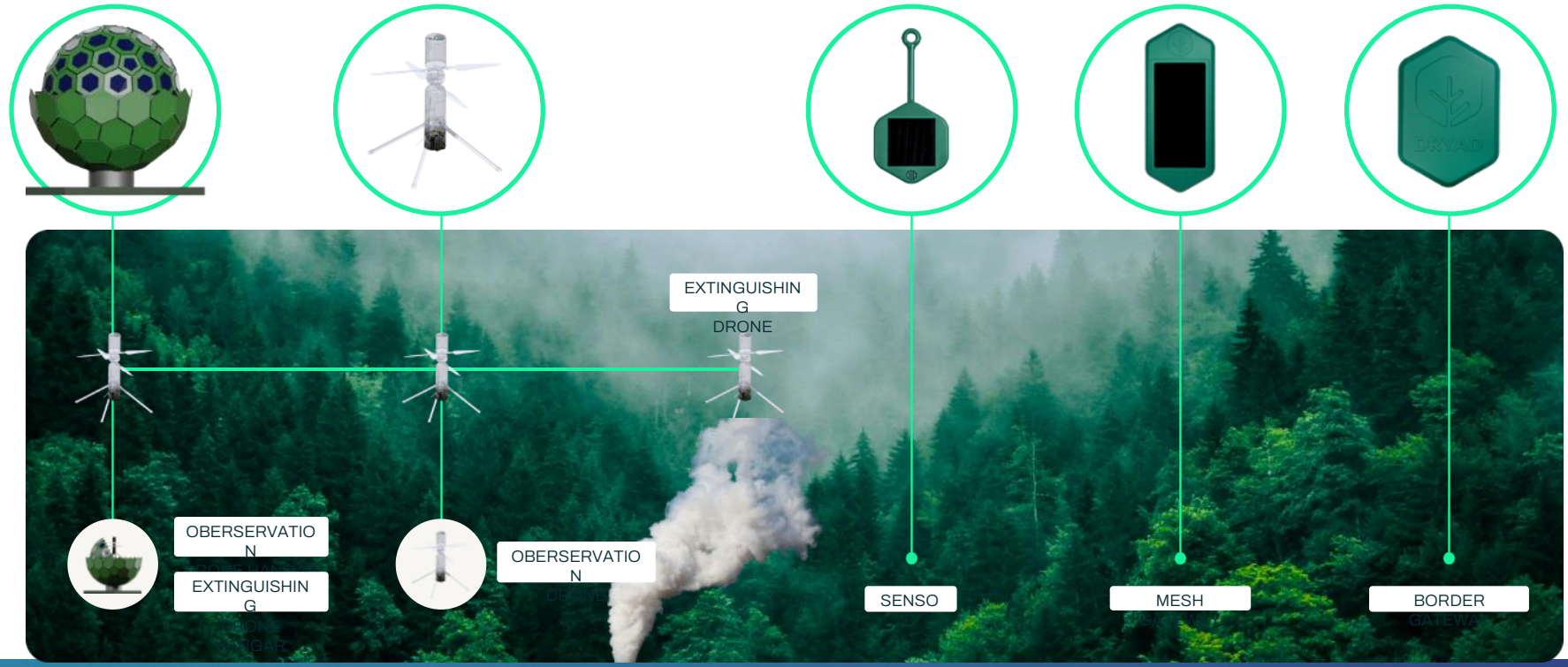
SilvaGuard Bushfire Suppression System

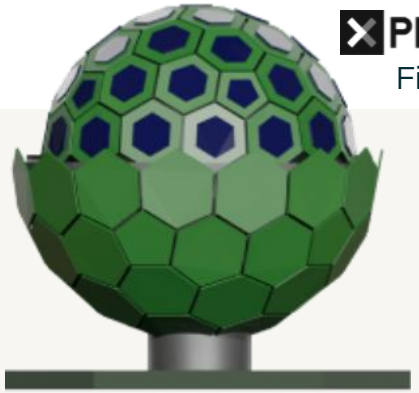
Autonomous fire suppression drone compliments Dryad's Silvanet ultra-early wildfire detection.

Innovation: SilvaGuard is a revolutionary drone-based solution for early fire suppression using acoustic waves.

Problem: current systems rely on human operators, require significant power, data, stable communication.

Solution: fully autonomous drone system to fast fire response.

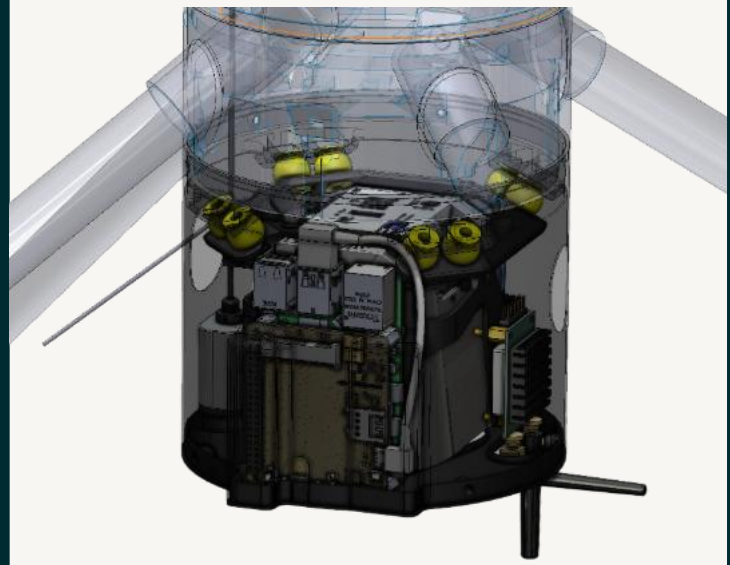




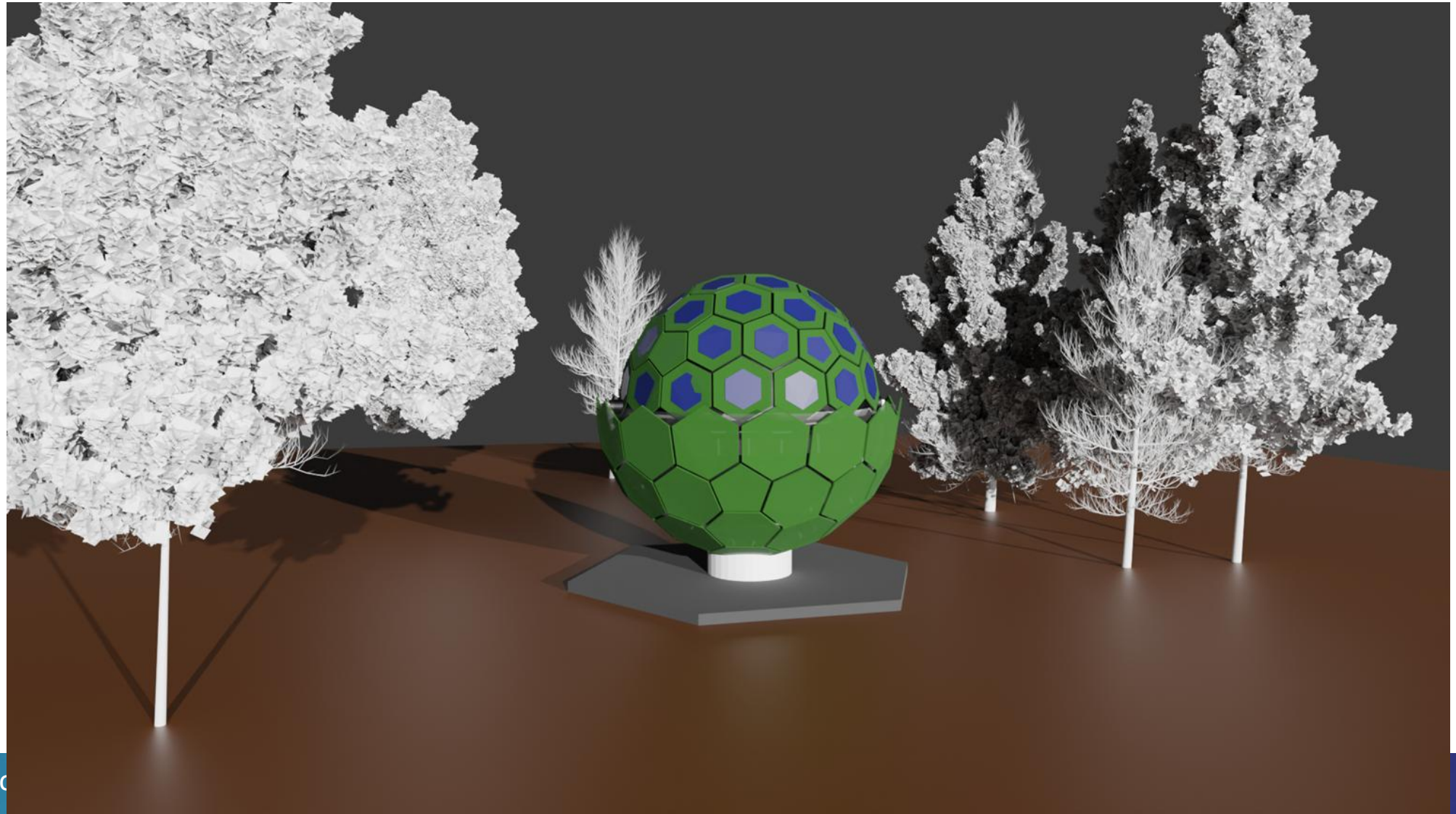
XPRIZE Finalist

Silvaguard Unique Approach

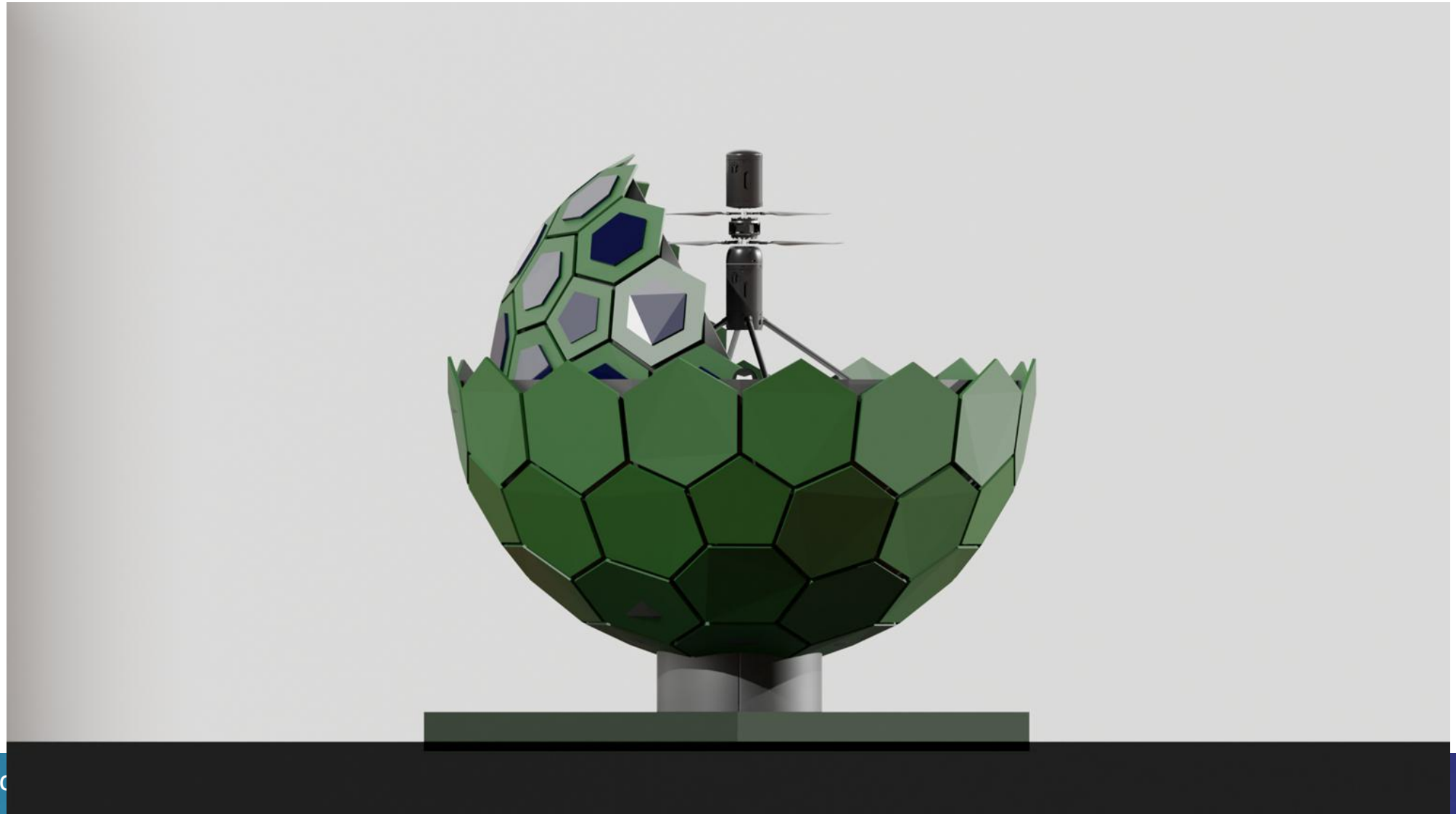
- Fully autonomous operation
- Acoustic Fire Suppression
- Solar-Powered Drone Hangars
- Event Cameras for Obstacle Avoidance



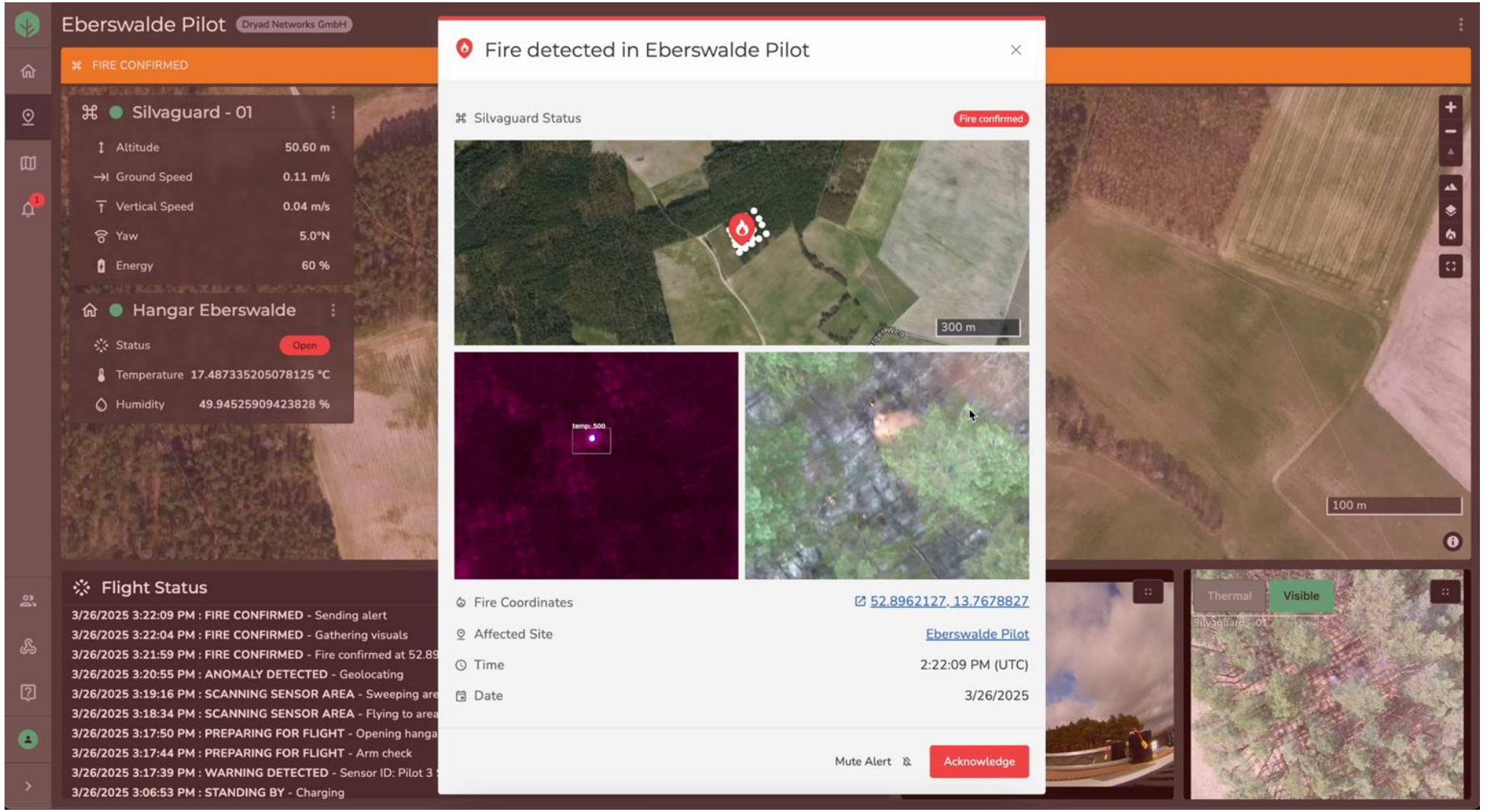
Silvaguard: Solar-Powered Hangar



Silvaguard: Solar-Powered Hangar



Silvaguard: Web Application

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Dryad's Contribution to Net-Zero Initiatives

Dryad combats bushfires with ultra-early detection using AI-powered, solar sensors and IoT networks, protecting ecosystems and communities.

2.8Mn

Hectares Forest Saved From Wildfires

1.1Bn

Tonnes Co2 Emissions Prevented

166Mn

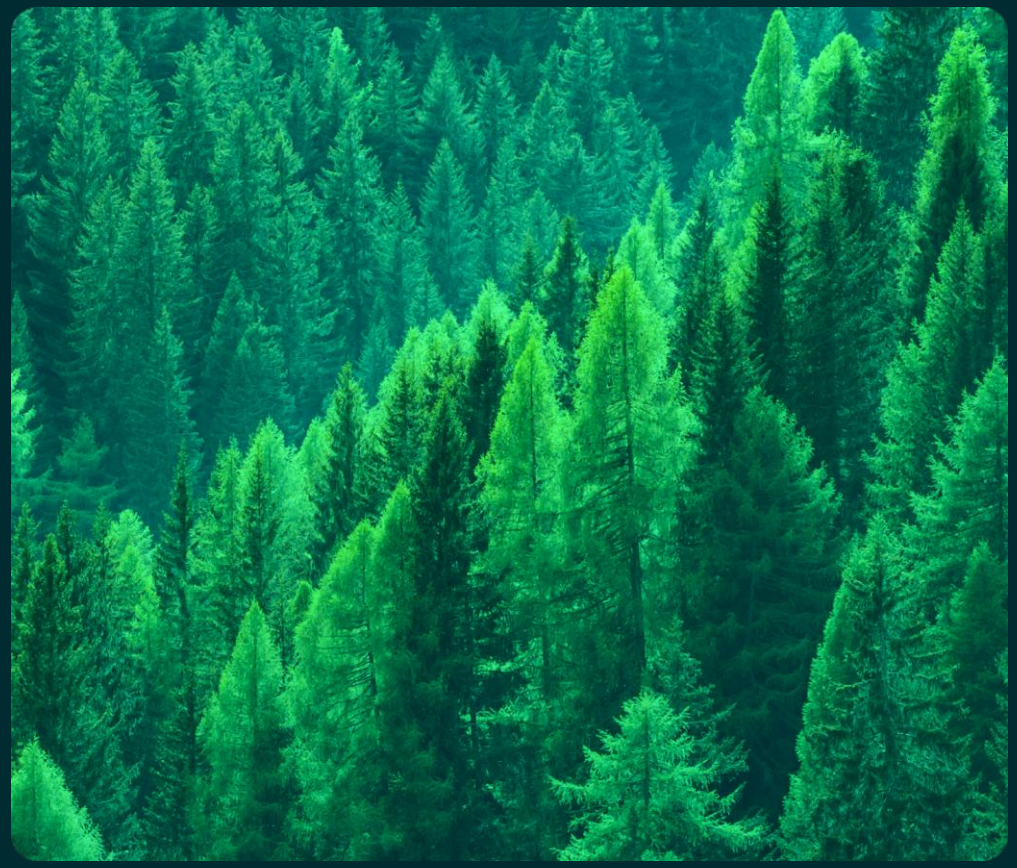
Animals Saved From Wildfires

$21Bn

Protected Economic Loss

Join the fire prevention revolution

Let’s build a shared vision for a safer, greener, and net-zero future.



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