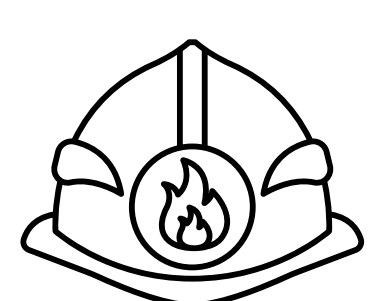


THE PROBLEM

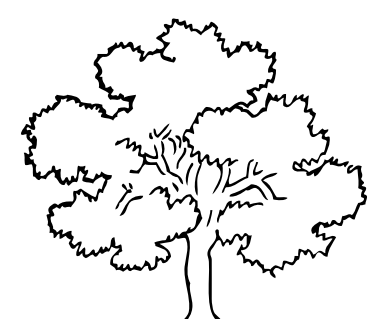
Portugal is one of the European countries most prone to forest fires. On average, around **100 000 ha/year** are burned.

In **90%** of citizen reports, the exact location is not provided. Detection still depends on human surveillance, which limits speed and accuracy.

SOLUTION BENEFICIARIES



Firefighters and Civil Protection



Forestry and economic sector



Local populations

SOLUTION REQUIREMENTS

89% Real-time GPS alert
≤50m deviation
67% rated max importance

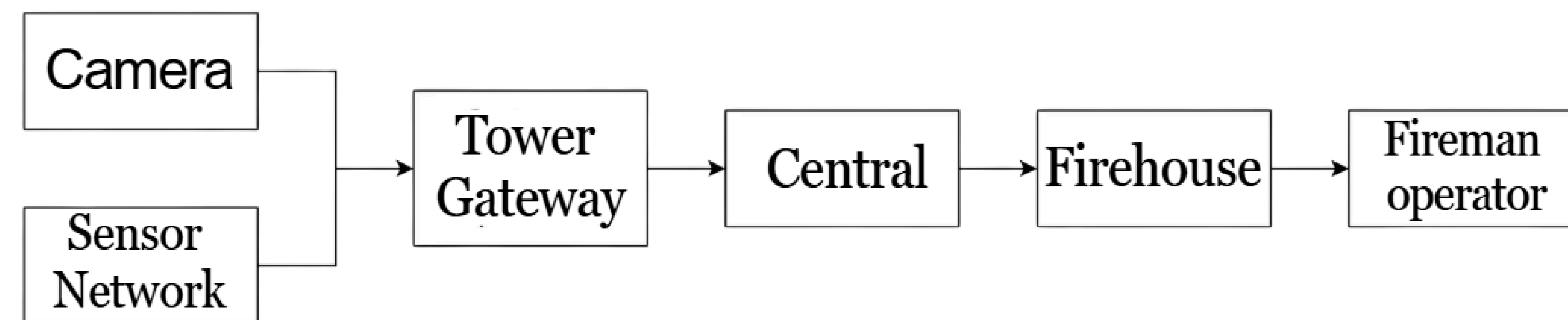
48% Real-time image/video
Visual confirmation before dispatch

0 GSM Shadow zone coverage
LoRaWAN mesh replaces mobile network

79 Responses from Portuguese firefighters

39% Mountain operations

SOLUTION

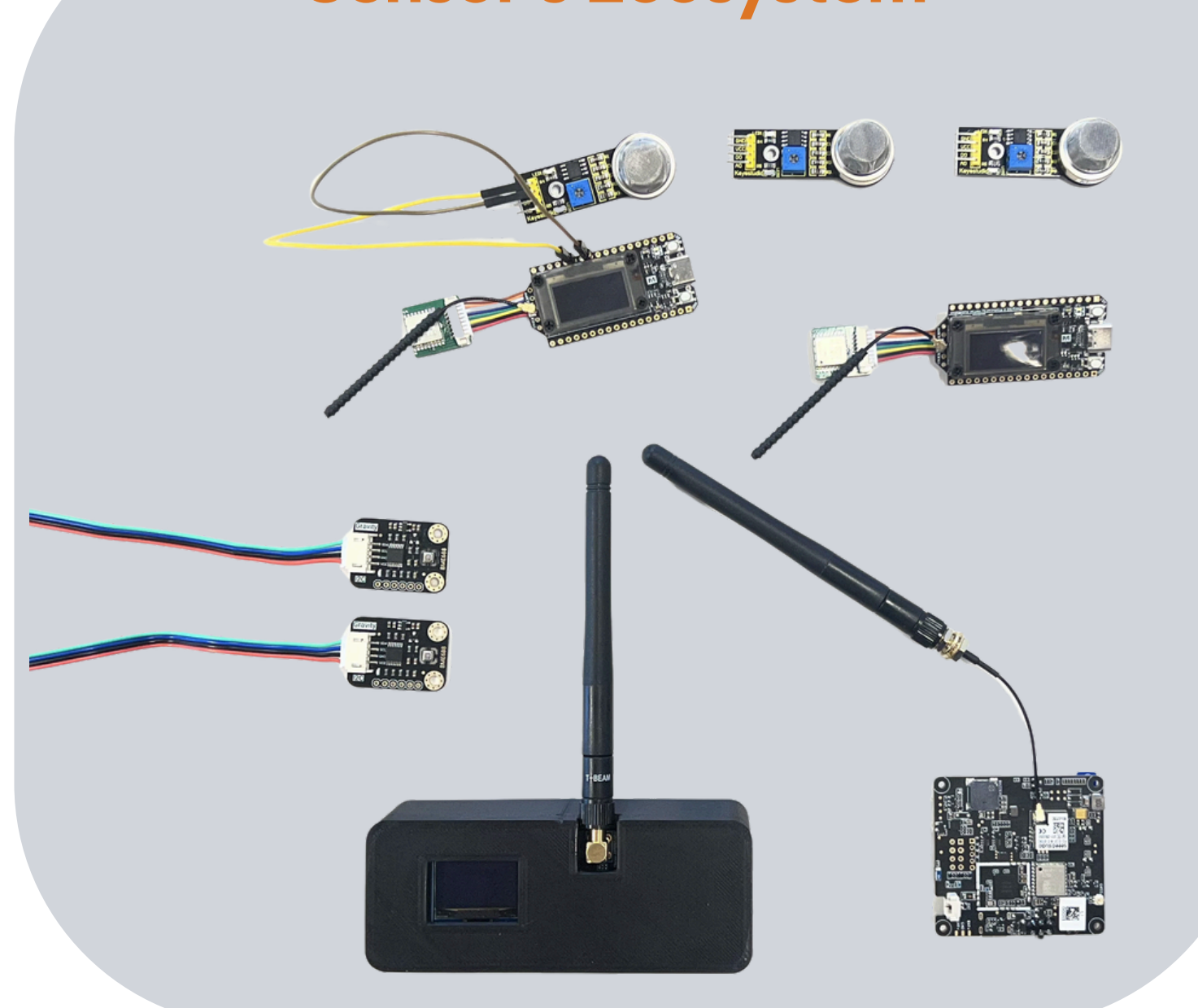


Tower's Ecosystem

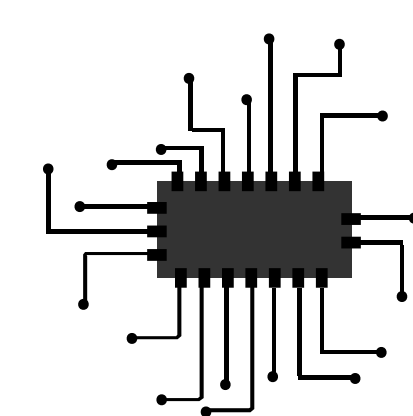


- Raspberry Pi 4
- Router
- Camera 360°
- Power supply

Sensor's Ecosystem



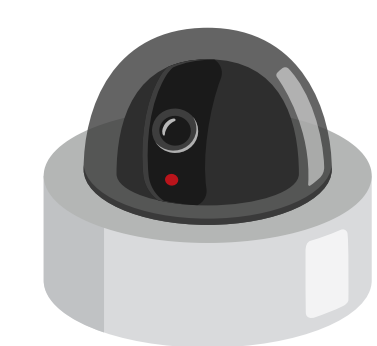
- LILYGO T BEAM
- Heltec V4
- Wio Tracker L1
- MQ-135
- BME-688



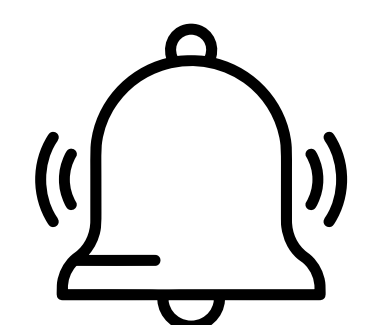
Sensorized Detection: BME-688 and MQ-135 sensors monitor gas and smoke levels in the soil, obtaining local meteorological data.



LoRa Mesh Communication: Using Heltec V4 nodes, data transmits via multi-hop routing between nodes until securely reaching the gateway tower.



360° Camera: Optical detection and image transmission, providing visual data for processing by the Raspberry Pi 4.



Alert: Upon receiving a notification from the nodes via MQTT, the Raspberry Pi 4 automatically repositions the camera toward the affected area.

DETECTION RESULTS



0,84

Max Confidence
YOLO fire score

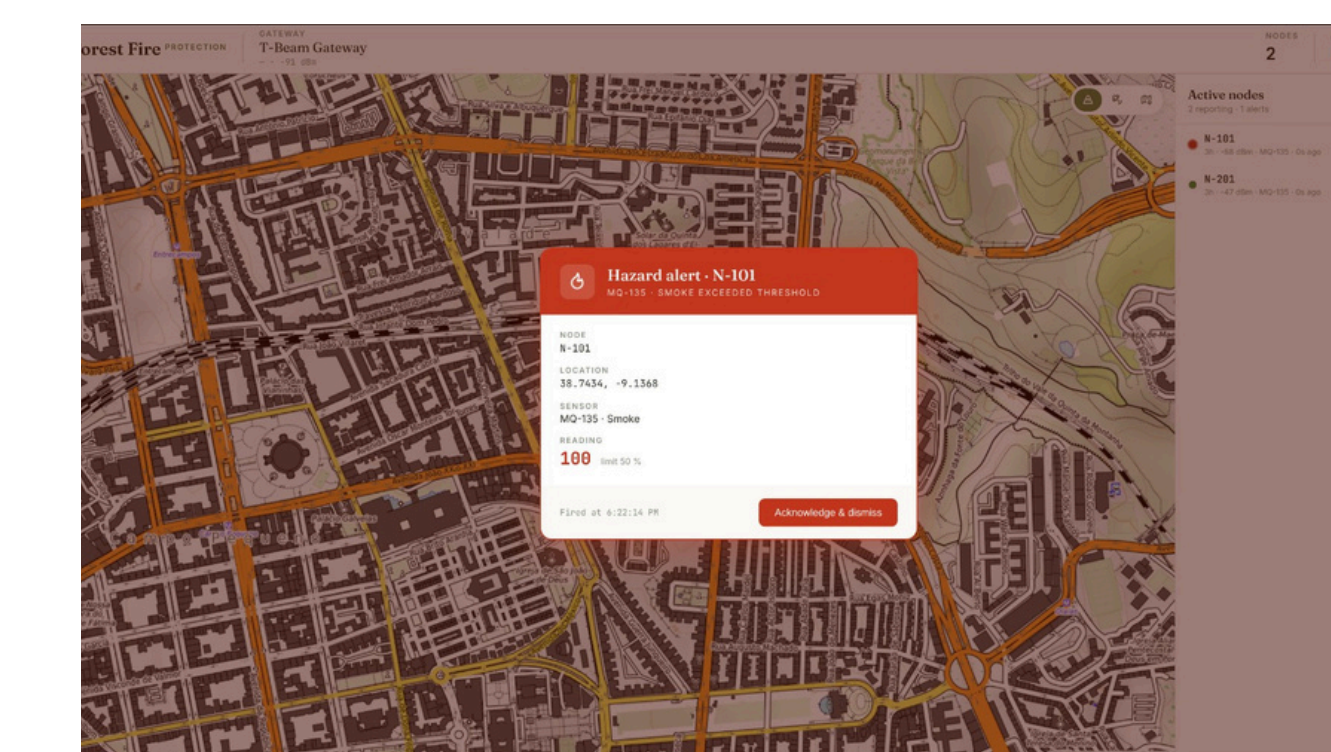
- ✓ Real-time image/video with Visual confirmation before dispatch



25m

GPS deviation

- ✓ Real-time GPS alert with coordinate deviation ≤ 50m



Multi

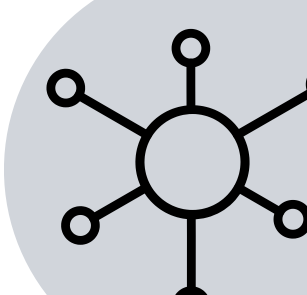
-hop mesh
LoRa P2P + mesh

- ✓ Shadow zone coverage

CONCLUSIONS



High Precision: GPS coordinates and real-time video field-validated.



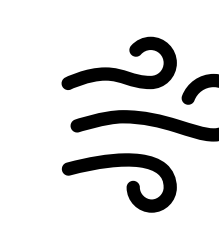
Network Independence: Guarantees detection capabilities even in areas with low or zero network coverage at the sensor level.



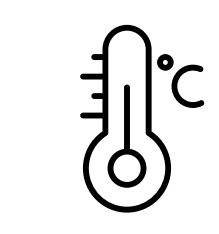
Independent Surveillance: Fully autonomous, eliminating the need for human monitoring.



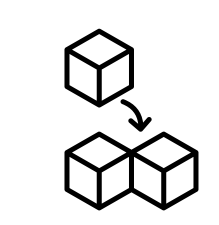
PROPOSED ENHANCEMENTS



Wind direction sensor for fire evolution prediction.



Infrared camera for night-time detection.



Modular architecture enables easy component integration at low cost.

PATH FORWARD



Integrate GPS alerts into FEB Monitorização platform used by firefighters.

QUOTE

“Our response is predominantly reactive, at the expense of a prevention culture, which is regrettable.”

- Rúben Filipe
2nd Commander
Vendas Novas Fire Department

Team 2:



Bárbara Trigueirão



Carolina Rodrigues



Diogo Vicente



Gonçalo Caetano



Marco Mendonça



Salvador Carvalho

Partners:



INOV

