

THE PROBLEM

- ▶ Traditional helmets are purely passive — no environmental sensing.
- ▶ Workers can't detect toxic gases (CO, SO₂, O₂) without handheld tools.
- ▶ Fall alerts (standing → sudden hour response compromised).
- ▶ Wi-Fi & cellular fail in tunnels — solves this.

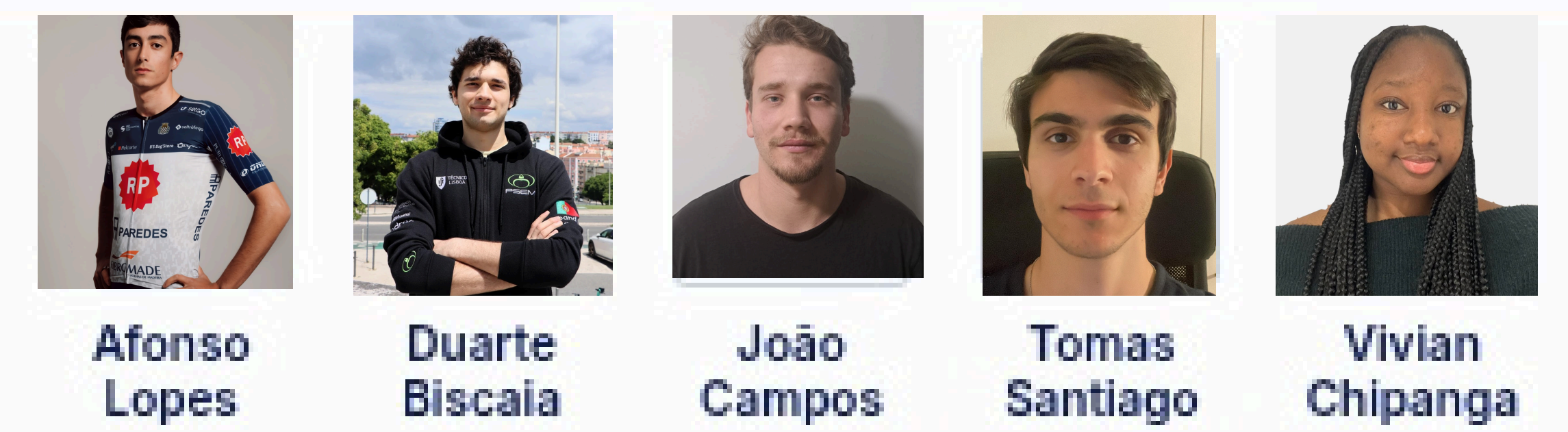
1M+
INJURIES / YEAR

60
MIN RESPONSE DELAY

0
EXTERNAL NETWORKS NEEDED



OUR TEAM



PARTNERS

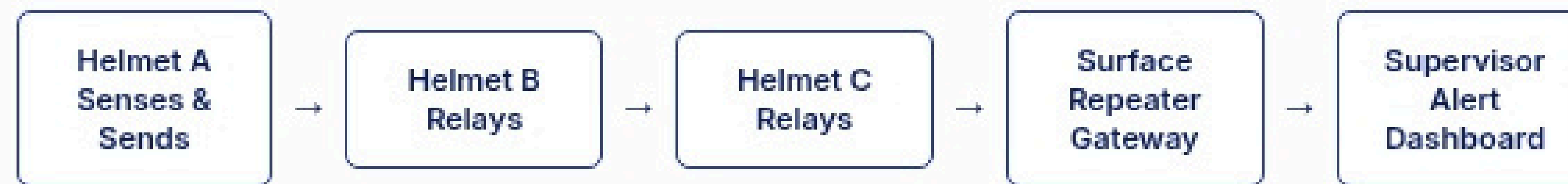


TECHNOLOGICAL SOLUTION

VertexShell integrates sensor fusion with a self-healing LoRa Mesh network — every helmet acts as a router, hopping alerts through nodes to supervisors even with zero Wi-Fi infrastructure.

LoRa Mesh EPOS CO • SO₂ • O₂ IMU Fall Detection LED Alerts Buzzer

SYSTEM ARCHITECTURE — SELF-HEALING MESH



Helmets self-heal if any node drops • No single point of failure • 100% underground

KEY FEATURES

Fall Detection

IMU triggers instant autonomous SOS on impact

Toxic Gas Detection

Continuous CO, SO₂, and O₂ monitoring with alerts

LoRa Mesh Comms

Self-healing — works underground, zero Wi-Fi needed

LED + Buzzer Alerts

Color-coded LEDs & buzzer for high-noise areas

Swappable battery

12h+ target with low-power firmware (sleep modes)

ESP32-based core

Power-aware firmware with sleep modes

PROTOTYPE & HARDWARE



Custom hardware for gas detection, fall detection and LoRa mesh communication.

BENEFICIARIES

- Mining workers in underground environments
- Construction & civil engineering teams
- Adventure tourism & tour operators
- Industrial safety managers & companies

COMPETITIVE EDGE

GuardHat

Wi-Fi dependent — fails underground. No gas detection.

Proxy SmartHat

Video-streaming focus. No mesh or hazard sensing.

WakeCap

BLE tracking only — no offline capability or alerts.

VertexShell

Self-healing mesh • gas/fall alerts • 12h+ battery
Zero external networks needed

RESULTS & METRICS

SOS

VIA RELAY NODE

12h+

BATTERY TARGET

SENSOR VALIDATED

FIELD TESTED

- ✔ Battery-powered standalone prototype
- ✔ Works in signal-blocked environments

MORE INFORMATION

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