LineAlert

Taking the power out of wildfires

Power Line Monitor for Wildfire Detection and Prevention

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The Problem

California catches on fire a lot. Power line failures are a major contributor to our wildfire problem, and the fires are only getting worse. LineAlert is an innovative solution designed to eliminate or reduce the impact of power-line-related fires. It has a suite of sensors that provide information about the real-time conditions on the power line, reducing the need for manual inspections and better informing decisions regarding preventative blackouts.

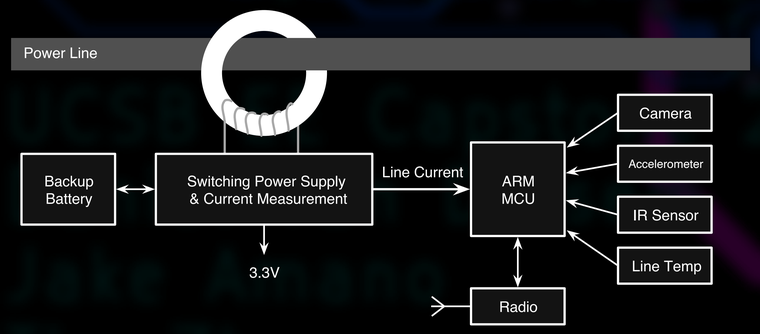
Design Overview

LineAlert devices can be placed on the spans of high voltage power lines in high fire risk areas. They are inductively powered and use LoRa for self-contained communication, so they do not need to be within range of cell towers. Once clamped around the power line, sensors can quickly detect and report the location of the following anomalies before they spark an uncontrollable fire.

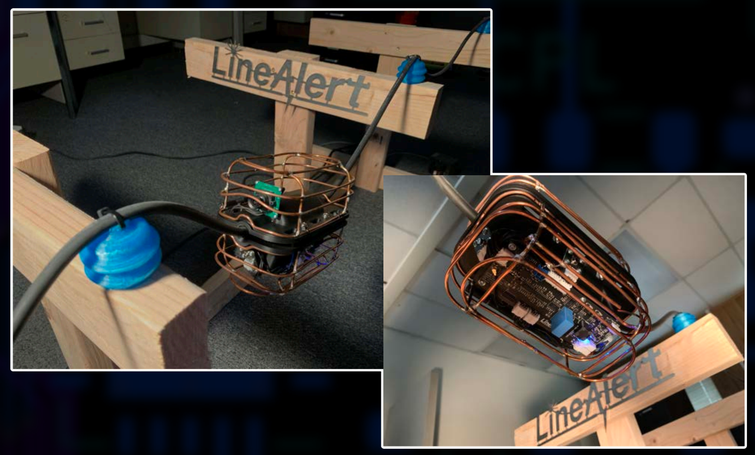
- Visible wear/damage to infrastructure
- Short circuits or arcing
- Nearby fires
- Line sag
- High winds

The platform can easily be expanded to accommodate more sensors if needed. The collected information is relayed back to a substation where it can then be used to immediately notify first responders or perform remote inspections of power lines.

Block Diagram



Final Product



LineAlert device installed and drawing power from a mock-up power line

Hardware

Camera
Enables remote inspection of support structure of power line

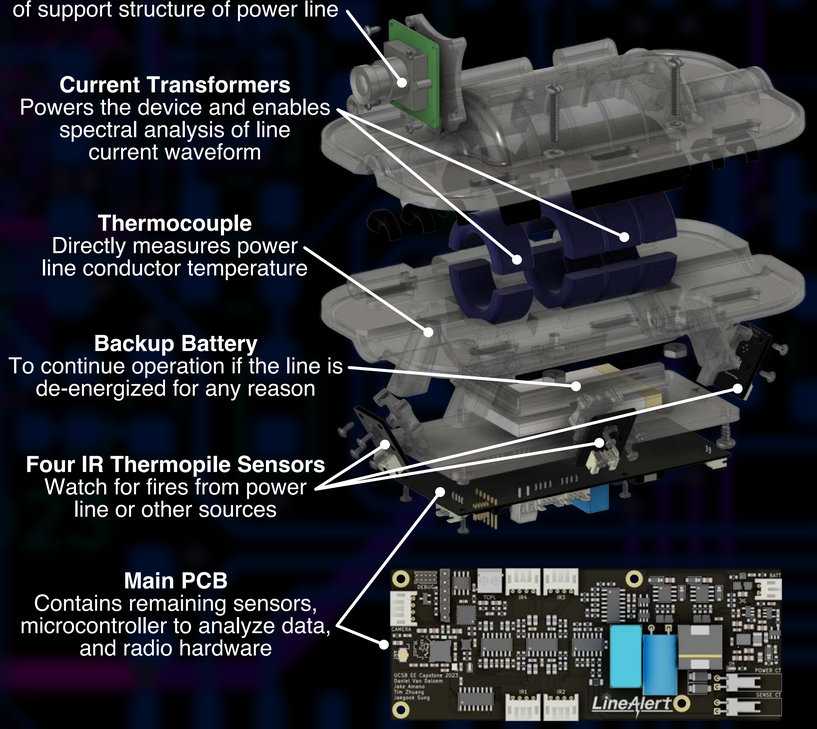
Current Transformers
Powers the device and enables spectral analysis of line current waveform

Thermocouple
Directly measures power line conductor temperature

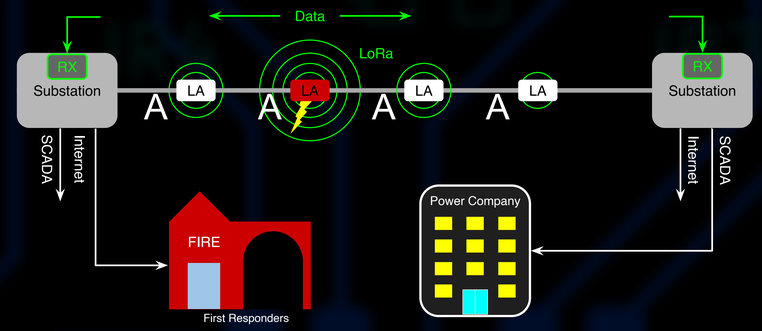
Backup Battery
To continue operation if the line is de-energized for any reason

Four IR Thermopile Sensors
Watch for fires from power line or other sources

Main PCB
Contains remaining sensors, microcontroller to analyze data, and radio hardware



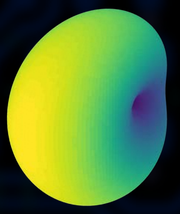
Data Flow



- LoRa protocol in the 915MHz ISM band
- Data relayed through multiple devices back to substations for collection
- Unique device IDs and packetized data structure optimized for minimum header overhead
- Message signing using public key cryptography for message authentication and network security

Integrated Antenna

Antenna constructed in openEMS



Simulated radiation pattern

Common monopole antennas are not suitable for use on high voltage power lines as charge concentration at the sharp point will cause significant corona discharge. A Faraday cage was designed to protect the device from the power line's electric fields, and an inverted-F antenna was built into the side of the cage. The DC short of the radiator element additionally protects the radio hardware from damage.

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