EPRI ARTIFICIAL • INTELLIGENCE

360-Degree, AI-Based Imaging for Wildfire Situational and Locational Awareness

Startup
Pano AI
San Francisco, CA

Host
PG&E
Portland General Electric

Technology Solution

To improve situational intelligence and emergency response for ignition events and wildfires, utilities, government agencies, and other stakeholders seek new and improved methods to rapidly detect incidents, confirm their locations, and assess risks to critical infrastructures and communities. Current methods rely on many data sources, with incomplete coverage, significant noise, and no single source of truth. Fire starts can go unnoticed for too long, and quickly determining whether reported incidents are real fires, identifying exact locations, and evaluating risk factors can be difficult.



Pano AI stations deployed on existing towers (left) deliver live-feed images that are analyzed for smoke detection (right) and wildfire risk assessment.

This project was launched to demonstrate Pano AI's Rapid Detect platform, which applies continuously rotating cameras sited atop existing mountaintop towers to capture live images across broad areas, backed by AI-based methods for automated smoke detection, risk assessment, confirmation, and alerting. The cameras rotate 360 degrees every minute, delivering ultra-high-definition images that cover the entire field of view. The platform's web interface stitches images together into panoramas that can be simultaneously viewed and manipulated by multiple users. Features such as incident location triangulation and mapping relative to utility infrastructure and other GIS layers help users quickly assess whether individual alerts require further investigation.

Project Overview

The specific objective of this pilot demonstration was to assess the capability of Pano AI's platform for rapid and accurate detection of new wildfire threats and delivery of valuable situational awareness intelligence to help inform utility response and incident escalation decisions. The project team included Pano AI as the technology developer, Portland General Electric (PGE) and Pacific Gas & Electric (PG&E) as host utilities, and EPRI as technical advisor. In addition, a group of peer utilities—including Southern California Edison and Xcel Energy—participated in a series of project check-ins.

Site identification, analysis, and selection included drone-based audits of existing towers to assess camera mounting requirements, as well as reviews of physical accessibility, power supply, connectivity, permitting, and other needs. The PGE pilot included installation and web-based access to two Pano Stations. The PG&E pilot included access to 13 stations in the utility's service territory.

Each pilot ran through the end of the 2021 fire season and included support from the Pano Intelligence Center (PIC), which applies machine learning across data collected from all Pano Stations—a total of 23 in the western United States during 2021—to confirm smoke sightings and validate each incident and its risk before issuing alerts.

Metrics of success for the project included the following:

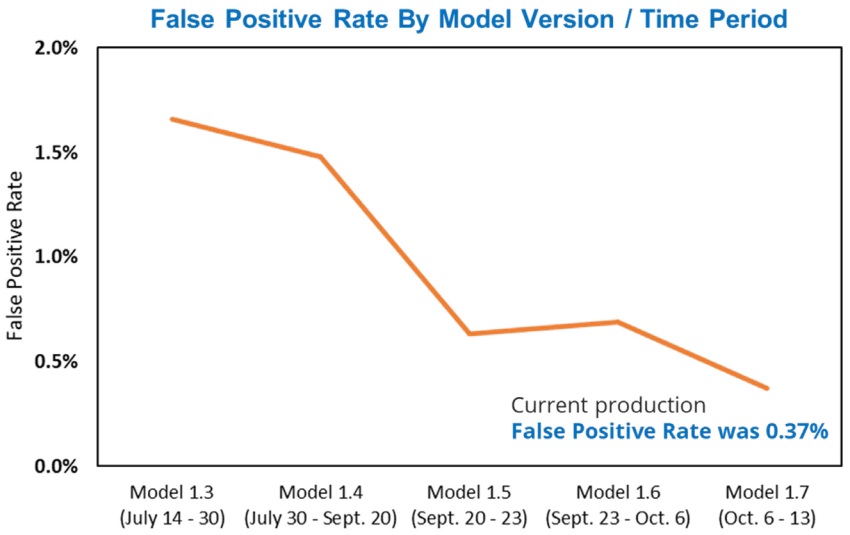
- **Time to detection for each incident with visible smoke:** Compare time to detection by Pano AI's system relative to when the smoke becomes visible in camera images, to the earliest known detection time, and to alerts received by utilities subscribing to the Integrated Reporting of Wildland-Fire Information (IRWIN) service.
- **Accuracy of detection:** Characterize accuracy of detection for wildfires caught during the 2021 fire season, accounting for false positives, true positives, false negatives, and true negatives.
- **Incident intelligence and software functionality:** Demonstrate triangulation (smoke location) accuracy, intuitiveness of the platform, and ongoing improvements to functionality and performance based on team feedback.

Results & Learnings

Although the recommended spacing of Pano Stations is about 10 miles (16 km) to facilitate incident triangulation, Pano AI's platform demonstrated wildfire watch and risk assessment capabilities spanning 360 degrees out to distances of about 25 miles (40 km) on clear days.

Because each camera rotation takes 1 minute, the fastest possible time for a confirmed detection would be for an imaged location to have no visible smoke, followed by a detection of smoke 1 minute later and a PIC confirmation of smoke on the next rotation. Throughout the pilot, the time to detection improved. Based on the final November production model and a control group of test vegetation fires, Pano AI's platform was able to detect 60% of the test fires within 4 minutes from the time smoke was first visible and 85% within 10 minutes.

Also, the number of false positives decreased throughout the pilot as the AI-based models improved. As shown in the figure, the false positive rate was about 1.6% in late July, declining to 0.37% in early October. Across more than 50 wildfire alerts sent to utility customers during the pilot, the alerting accuracy rate was above 90%.



Learning by AI-based models reduced the false positive rate during the pilot project, helping utility analysts focus attention on actual incidents posing potential wildfire risks.

For the Round Fire in northern California, which started in a recreational vehicle and eventually spread to vegetation, Pano AI detected smoke and issued an incident alert before the fire was reported to first responders. The PIC played a key role throughout the pilot in reducing the noise from false notifications by successfully pre-screening false positives attributable to industrial smoke, geyser plumes, dust clouds, and more.

The ability to apply a network of Pano Stations to accurately triangulate an incident's exact location and view its proximity to utility infrastructure helped analysts quickly assess whether detected incidents should be escalated, in terms of a deeper investigation or a rapid response—for example, reducing transmission line ratings or de-energizing circuits.

To facilitate their analyses, users took advantage of the software's customizability to add their own visual intelligence layers. The project team also identified a number of new functionalities that were implemented by Pano AI. This included a bearing scale and compass and map view widgets to enhance locational awareness while looking at images, as well as time-lapse and look-back features and email incident updates to improve situational awareness.

Implications & Next Steps

This demonstration highlighted the value of 360-degree imaging and AI-based tools for improving wildfire awareness by reducing the need for manual

monitoring and confirmation while decreasing the time required for smoke detection and incident alerting. Pano AI's Rapid Detect platform is now commercially available, and the company is working to build partnerships with utilities, forest managers, and state and local fire agencies.

A key lesson learned from this project is that confirmed incidents need context that can be quickly assimilated to decide which events should be monitored to closure and which events need to be escalated. The platform's ability to overlay detected incidents on maps displaying infrastructure and other features proved particularly valuable for informing utility decisions. EPRI and other project participants are exploring opportunities for integrating Pano AI's system and its results with other wildfire information sharing and dissemination platforms.

Resources

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TESTIMONIAL: Pano AI

Because minutes matter in wildfire response, our vision is to make the jobs of situational awareness teams, emergency dispatchers, and first responders easier while improving their effectiveness. As demonstrated in this pilot, we're deploying Pano Stations and improving our AI-based tools and intuitive software to help prevent small flare-ups from becoming massive infernos—and help save lives and avoid destruction.

TESTIMONIAL: Portland General Electric

Leveraging technology to enhance wildfire situational awareness is essential to help combat the increasing risks utilities and communities are facing due to climate change. Early detection from AI-enabled cameras promises to help locate and inform response to fires before they become uncontrollable.

TESTIMONIAL: EPRI

While fixed and panning cameras are commonly applied for wildfire detection, Pano AI's innovation delivers a 360-degree view that provides minute-by-minute situational and locational awareness on fire outbreaks—up to 25 miles out in all directions!

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