Wildfire Sensor Technology

Science and Technology

FROM THE LAB TO THE FIELD: WILDFIRE SENSOR ADVANCEMENTS

Wildfires across the U.S. and around the world are becoming more frequent, costly, and dangerous. Risk factors include urban sprawl into previously undeveloped lands prone to wildfires and climate change hazards, necessitating technical innovations to assist firefighters on the front lines and keep our communities safe and resilient.

The Department of Homeland Security (DHS) Science and Technology Directorate (S&T) is working with the U.S. Fire Administrator, N5 Sensors Inc., TechNexus, and the Virginia Innovation Partnership Corporation to develop and test early wildfire detection technology to assist the Federal Emergency Management Agency and state and local emergency management partners.

The sensor technology under development detects elements found in wildfire conditions, including particulate matter, chemicals, and gases. Artificial Intelligence (AI) algorithms are used to compare ambient background conditions against wildfire elements to provide warnings and alerts if wildfire conditions are detected. Internal batteries are recharged through solar panel energy harvesting with LTE cellular network communications. A web portal, graphical user interface, app, and API's allow stakeholders to review sensor performance, download data, and receive text and email notifications for the warnings and alerts.

LAB TESTING FIRE SENSING TECHNOLOGY

Beginning in 2020, extensive modeling was performed to define and understand the level of smoke composition and particulate matter at varying distances, environmental conditions, and wind speeds. Industry performers made enhancements to their sensor technology designs based upon initial testing—laboratory-controlled burns were performed in repeatable and adjustable environments to evaluate different characteristics (e.g., ignition, flaming, smoldering, humidity, wind speeds, smoke concentrations, particulates, etc.) and combinations of the factors.

FIELD TEST AND EVALUATION

From 2021 to 2022, sensor arrays were prototyped and tested in various real-world scenarios. Based upon those tests, a second phase of research deployed 200 Alpha sensors throughout the U.S. and Canada in 2023, where the sensors were used to provide fire alerts and warnings as well as air quality warnings. Notable examples of wildfire detections include a flare up from accumulated brush pile, an unauthorized bonfire near a utility pole in Colorado, and lightning tree strikes in California and Canada.

N5 Sensor detects unusual concentrations or spikes in levels of particulates or carbon monoxide to detect wildfire ignition.

2024 DEPLOYMENTS

Beta Phase 1 launches in 2024 with significant enhancements to AI algorithms based upon 2023 data collected, integration of local wind sensors and updates to user interface, installation, and operation. The current plan is to deploy approximately 200 beta N5 wildfire sensors in 2024 for operational testing and evaluation with stakeholders across the U.S. and Canada.

COLLABORATORS

FEMA   U.S. Fire Administration

Learn more about how S&T is fighting fire with technology at https://www.dhs.gov/science-and-technology/wildfires.