NSF Convergence Accelerator

NSF Convergence Accelerator's 2023 Cohort Phase 1 Award

Project Title
An Optoelectronic Nose for Toxic Gas Detection by First Responders

Awardee
Iridescent Sensors Inc.

Award/Contract
24C0016

Award Contract Type
R&D

Award Date
January 15, 2024

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NSF Funded Program
NSF Convergence Accelerator

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PROJECT ABSTRACT

There are >22,000 reported chemical spills and related incidents annually in the U.S., resulting in 2,800 injuries or deaths and $6.8 billion in economic loss. Police and firefighters, the first responders to such events, have extremely limited capabilities for rapid, mobile, and inexpensive detection of toxic gases.

To address this problem, Iridescent Sensors Inc. (ISI) is developing a new class of chemical sensors: the optoelectronic nose, developed at the University of Illinois (UIUC) by Professor Suslick (ISI's CEO). A convergence research effort between ISI, UIUC, Texas A&M University, and six consulting experts is developing a handheld analyzer using colorimetric sensor arrays as a field device to identify and protect against chemical spills by first responders. A disposable array of chemically responsive dyes is digitally imaged; the array's color changes are a unique molecular fingerprint of the odorants and requires no calibration. The technology is able to identify and quantitate the unique fingerprints of high-hazard toxic industrial chemicals, rapidly with low error rates for concentrations from well above hazardous levels to well below permissible exposures.

Phase 1 will develop a new inkjet printer capable of producing arrays with up to 60 chemically responsive inks in a scalable technology capable of >1 million arrays/year and an inexpensive state-of-the-art handheld optical reader. These arrays are then packed into disposable injection-molded cartridges, scanned by the reader, and finally analyzed with machine-learning pattern recognition software ("AI") of the sort developed for facial recognition. Progress in Phases 1 and 2 will push the technology to a commercial device, including field-testing with first responders. This device will have substantial impact on society at a national scale and improve the safety of the nearly two million first responders in the US.