

CPS: Medium: Collaborative Research: Constantly on the Lookout: Low-cost Sensor Enabled Explosive Detection to Protect High Density Environments

Submitted by [Alex Orailoglu](#) on Fri, 01/05/2018 - 12:13pm

Project Details

Lead PI:	Alex Orailoglu
Performance Period:	10/01/17 - 09/30/20
Institution(s):	University of California-San Diego
Sponsor(s):	National Science Foundation
Award Number:	1739684

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Abstract: This project aims to empower ordinary citizens to take charge in collecting real time environmental data that can be used to serve a common interest. The target application of the project is a cyber-physical system for detecting small amounts of explosive vapor in the air so as to protect large-area public gatherings. In this system, extremely low-cost explosive sensors, handed out free of charge, will be connected to the smart phones of the willing participants, effectively turning each one of them into a look-out sensor node. Although the primary application of the proposed cyber-physical system is explosive detection, problems with similar technical challenges include air pollution monitoring systems, pandemic prevention, fire and/or gas leak monitoring. Successful completion of this project will generate a plethora of new applications that target problems with the aim of reaching a common goal by leveraging computation, power, and communications capacities donated by willing participants. Understanding that interest in STEM (science, technology, engineering, math)-related careers begins in elementary school, the project will use a sensor-based system that aims at locating a heat source, as part of K-12 outreach activities that explore crowd-sourced data collection, processing, and scheduling. The researchers work regularly with undergraduate and high school students through Fulton Undergraduate Research Initiative (FURI), Barrett Summer Scholars (BSS), National Science Foundation-sponsored National Nanotechnology Infrastructure Network Research Experience for Undergraduates (NNIN REU), and Arizona State University's Summer Research Experience for High School Students program. Designing a system based on extremely low-cost sensors for crowd-sourced monitoring has several unique technical and scientific challenges that the project tackles. First, cost/power

requirements and the need to detect tiny amounts of explosive vapor are at odds with each other. Second, the system will be designed to tolerate inevitable sensor inaccuracies and false positives/negatives in a stable manner. Third, since the entire system hinges on willing participation from the public, sensor operation will be made transparent to the user, and not create a negative user experience. Finally, privacy concerns of the users will be addressed by keeping them anonymous, and the security threats generated by this anonymity will be addressed.

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