Monitoring of Arsenic in Groundwater Sources using an Innovative IoT Sensor

Chadha, Annika

The EPA's Safe Drinking Water Act, governs the legal threshold of contaminants allowable in public water systems. The Maximum Contaminant Level (MCL) for arsenic, the #1 ranked toxin, was reduced from 50 ppb to 10 ppb, validating the severe health risks like cancers, blood toxicity, and keratosis, posed by arsenic exposure. Over 50 million people in the United States and over 1.8 billion people worldwide obtain water from ground-water and well-water sources. Unfortunately, the MCL goal does not govern these water sources, and humans are exposed to arsenic levels higher than 10 ppb on a regular basis. The engineering goal is to build an automated, portable, IoT-based sensor for arsenic using an original design. Although technologies for arsenic detection exist, they are expensive, time-consuming, or onerous to operate by a layperson. That is why a cost-effective sensor that digitally records the amount of arsenic in water sources over time and across locations and stores this data in the cloud is invaluable. The sensor prototype with >98.5% accuracy, programmed in Python and C, utilizes a colorimetric technique for arsenic detection where the input is a mercury bromide test strip, which is read inside a white box using LEDs. The sensor converts color values into arsenic concentrations in ppb. The data is collected and stored in the cloud for easy access as well as for ongoing comparative study of the arsenic levels. The components used include a Particle Electron cellular transmitter, an Intel Edison Arduino board, a camera, and LEDs, among others.

Awards Won:

Fourth Award of $500