

Community Based Approach to Address Heavy Metal Contamination in Drinking Water using Cloud-Connected Smart Electrochemical Sensors

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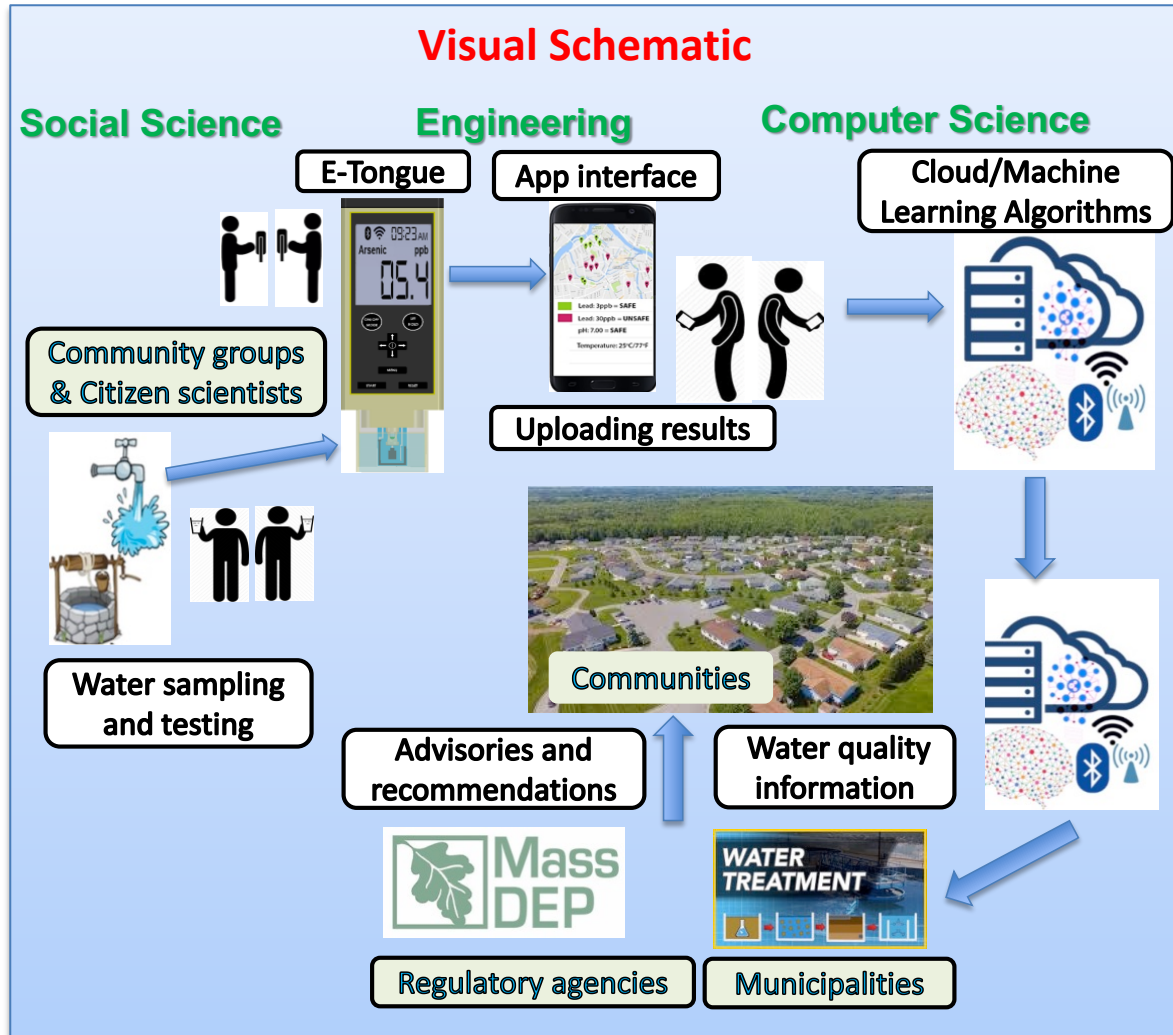
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Community Partners (Name, Institution)

- Massachusetts Department of Environmental Protection
- Merrimack River Watershed Council
- Municipalities (water utilities, wastewater treatment plants)
- Schools
- Neighborhood organizations
- Nonprofits

Project Overview



Project Vision

- ❑ A multidisciplinary team of social scientists, engineers, and computer scientists will work closely with community stakeholders to pilot smart Electronic Tongue devices for evaluating toxic metals (lead, arsenic, chromium etc.) in drinking water.
- ❑ Cloud-based machine learning algorithms will acquire responses from individual E-Tongue devices and make predictions about the extent and source of the detected contaminants.
- ❑ Results and water advisories will be communicated to different community stakeholder in a prioritized and timely manner. As a result, water utilities can take remedial actions, and communities can advocate for improved conditions.

Project Overview

Use-Inspired Research

- ❑ This project addresses the unmet need for a smart user-friendly technology for citizens to test and determine the quality of their drinking water, and the remedial actions to take if contaminants are detected.
- ❑ Water utility managers will benefit from real-time water quality data, that will enable them to adjust water treatment processes, and make infrastructure upgrades as and when required.
- ❑ Communities: Lowell, Lawrence, Dracut, Chelmsford, Westford, and Lexington in Massachusetts.
- ❑ Community Partners: Massachusetts Department of Environmental Protection, Merrimack River Watershed Council, Municipalities, Water treatment plants, Schools, Neighborhood organizations, Nonprofits.

PG Activities

- ❑ Project team building
- ❑ Community engagement workshops
 - University Community Outreach Workshop
 - Educational Planning Workshop with Community Stakeholders
 - Experimental Workshop (refine research concepts based on feedback)
- ❑ Prototype apps & web interface (small scale study to refine pilot concepts)

Project Update

- ❑ Ongoing Team building: New researchers from Social Science, Computer Science, and Environmental Engineering added; New community: Lexington, MA.
- ❑ Community outreach workshops and meetings (ongoing):
 - ❑ Identifying key stakeholders/partners, building relationships, and piloting education and outreach efforts
 - ❑ Enhancing awareness through social media, infographics, short videos, education and outreach efforts with schools, museum of science, community organizations, informal social groups and individuals
 - ❑ Improving the user-friendliness of the technology for socio-technically diverse communities.
- ❑ Planning Meetings with MassDEP and Town Engineers informed us about the new revisions to the “Lead and Copper Rule” and how our project could focus on rapid screening for Lead and Copper in drinking water.
- ❑ Handheld E-Tongue: Tested with real-world groundwater, river water, and tap water samples.



Groundwater



River water



Tap water



Testing with the E-Tongue

Project Evolution

- We found that water utility engineers were concerned the early warning system could cause panic in the community and suggested implementing the system in a phased approach, with validation testing from certified labs, and recommendations from government regulators.**
- We found that residents may have concerns sharing their water quality information, due to uncertainty about who is responsible for addressing the problem, and what short-term measures to take.**
- At the community outreach workshop, we found that there is a need to educate communities about:**
 - the health risks posed by toxic metals in drinking water**
 - the participation of citizens to test their water using smart technologies**
 - the steps to take such as using filtered or bottled water if contamination is detected**