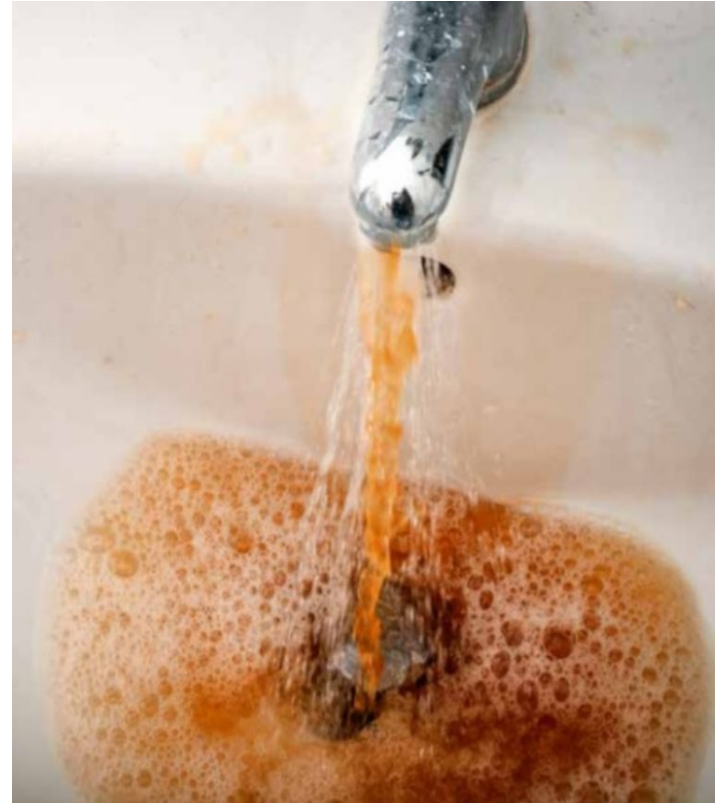# Water Quality Project

Sensing lead in residential pipelines

Agenda

-   Motivation - The problem we are trying to solve

-   Proposed Idea - Our approach to the problem

-   Tech arquitecture

-   Next steps

Motivation - Why this matters?

- Lead can enter drinking water when plumbing materials that contain lead corrode. The most common sources of lead in drinking water are lead pipes, faucets, and fixtures in buildings built before 1985.
- There is no acceptable level of lead in drinking water, according to the Centers for Disease Control and the U.S. Environmental Protection Agency. Boiling water actually makes it worse.
- In the US alone, the Centre for Disease Control estimates that 2.5 percent of small children have elevated levels. [1]
- Lead affects children development as it prevents calcium absorption
- Lead contamination is a slow moving disaster

Where's the lead?

There are an estimated 6.1 million lead services lines—pipes that connect a water main to a building's plumbing—still in use across America

Lead service lines in state
- 10k
- 50k
- 250k
- 500k
- 700k
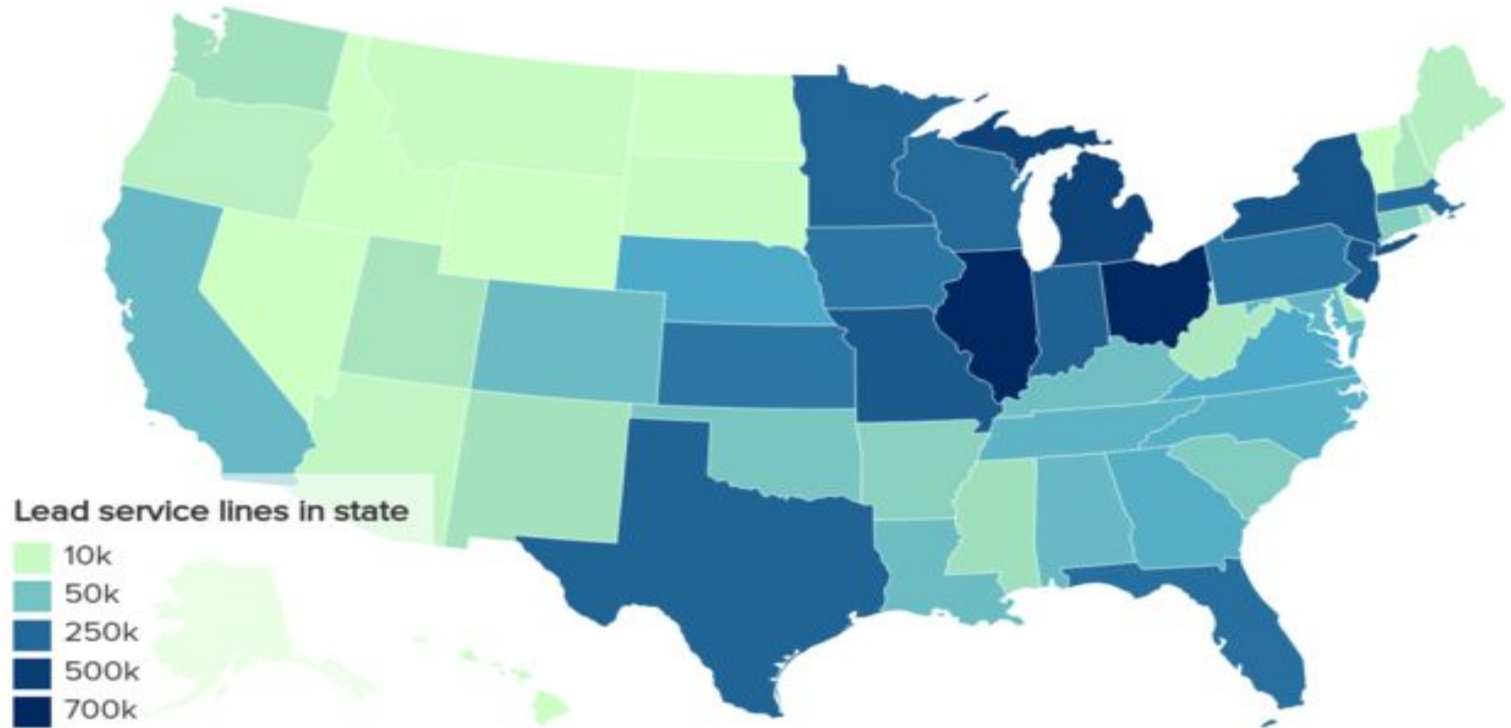
Our Approach

Monitor for lead content in water sources at the point of use. By placing a sensor in a toilet tank, the sensor will have a fresh tank of water to sample with every flush.
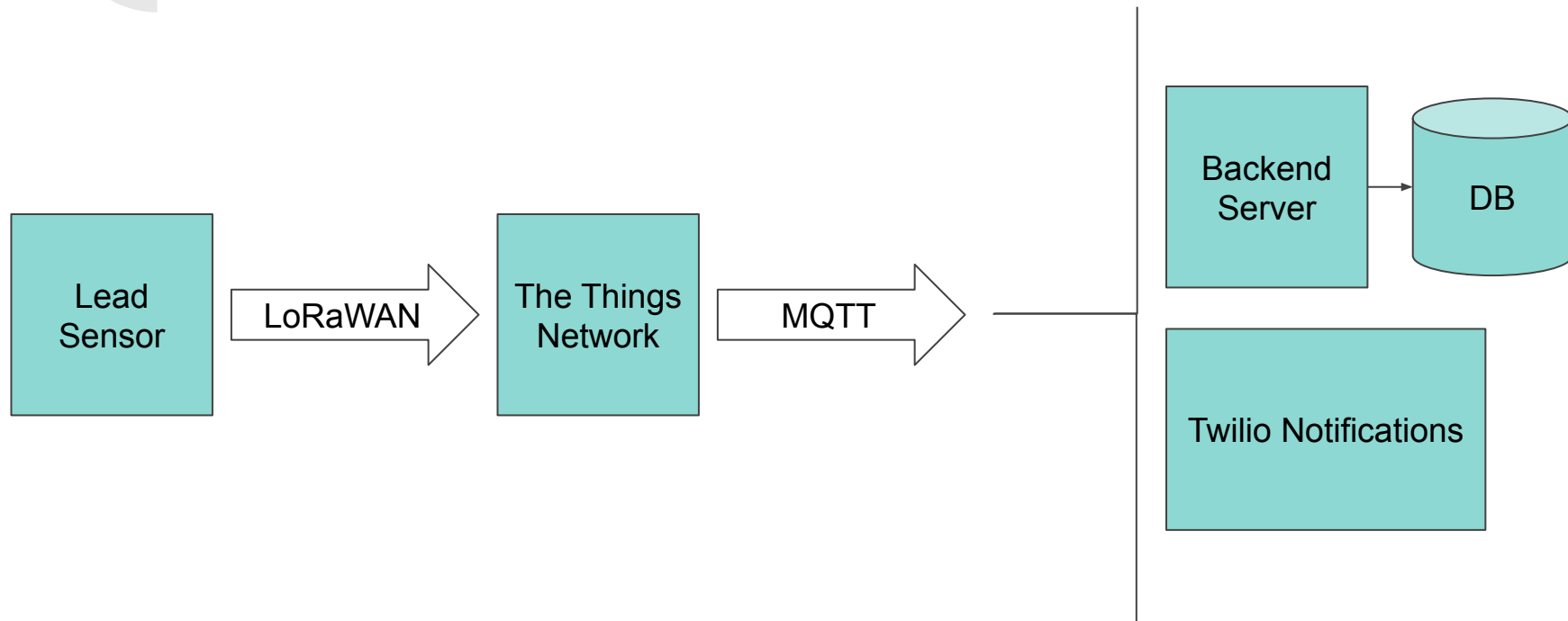
Our proposal is superior to existing solutions because:

> It minimises the human intervention

> It uploads the information automatically to a centralized database,
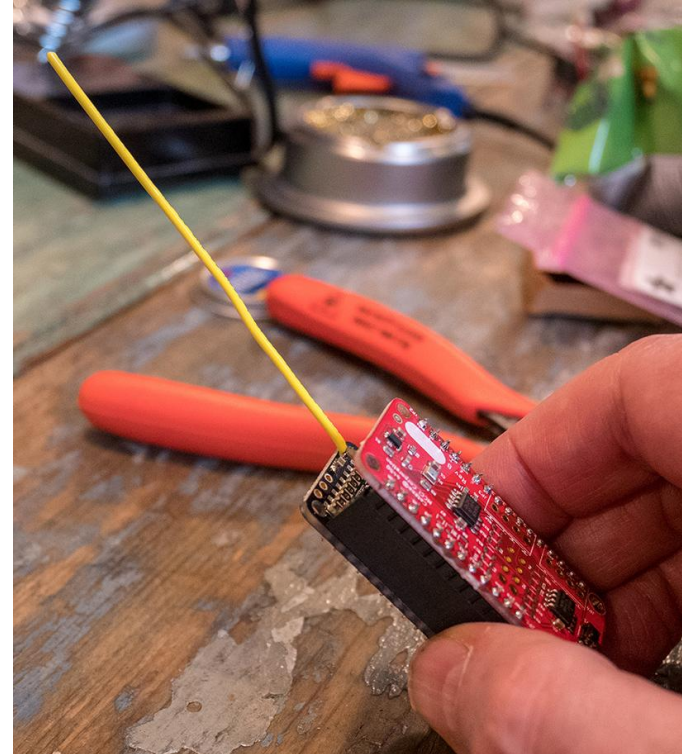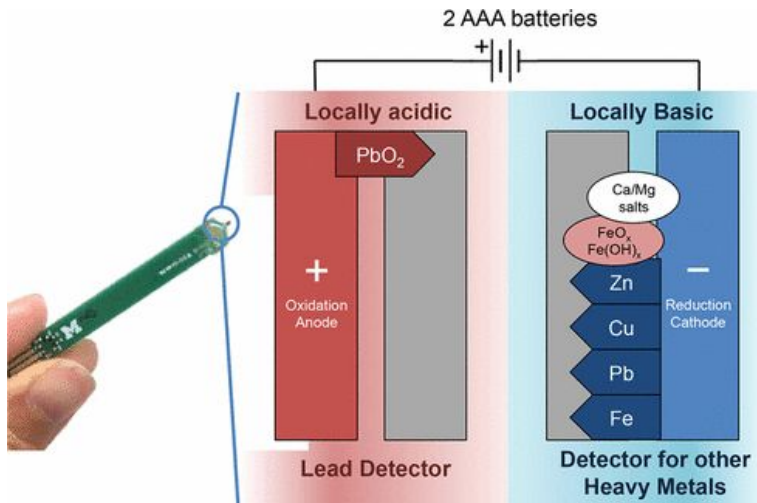
therefore it can be used to advocate for residents.

Tech Architecture

Tech Stack - Lead Sensor

- LoRaWAN radio
- [UMich lead sensor](#)
- Microcontroller
- Battery

2 AAA batteries

Locally acidic

PbO₂

+

Oxidation Anode

Locally Basic

Ca/Mg salts

FeOₓ Fe(OH)ₓ

Zn

Cu

Pb

Fe

−

Reduction Cathode

Lead Detector

Detector for other Heavy Metals

Tech Stack - The Things Network

Aggregate data through The Things Network and emit formatted data via MQTT.

Multiple applications can subscribe to live MQTT data to store, notify, and or analyze the data.

APPLICATION DATA   ‖ pause   🗑 clear

Filters	uplink	downlink	activation	ack	error

	time	counter	port			
▲	14:08:32	×	×	*historical*	payload: 14 7D 47 0E 12 1B 90 60 CF 8E 04 5D 00 24 00 2B 00 00 00 00	boot: 18 error: "none" lux: 1117
▲	14:02:28	×	×	*historical*	payload: 14 7D 47 0E 12 1B 86 60 CF 90 03 CE 00 24 00 2B 00 00 00 00	boot: 18 error: "none" lux: 974
▲	13:56:24	×	×	*historical*	payload: 14 7D 46 F4 12 1B 86 60 D0 91 04 16 00 24 00 2B 00 00 00 00	boot: 18 error: "none" lux: 1046
▲	13:50:20	×	×	*historical*	payload: 14 7D 47 0E 12 1B 8D 60 D1 91 04 7C 00 24 00 2B 00 00 00 00	boot: 18 error: "none" lux: 1148

Data storage and visualization

Node-RED, Grafana, and InfluxDB via this [Docker config](#)

Next Steps

1. Research suitable and inexpensive sensors

2. Outreach grant writing

3. Reach out for potential partnerships for funding and human resources

4. Build a working prototype

5. Contribute to coding into our GitHub Repo [2]

References

[1]
https://www.scientificamerican.com/article/thousands-of-u-s-areas-afflicted-with-lead-poisoning-beyond-flints/

[2] Github Repo:

https://github.com/mimiflynn/water-quality-sensing/

Additional Information:

https://news.umich.edu/affordable-lead-sensor-for-home-city-water-lines/