Web Interface to Monitor Water Quality

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Introduction:

Consider how life would be different if clean water was not readily available! It's unfathomable. Activities that we take for granted such as washing our bodies and having clean water in our homes, using indoor plumbing, and drinking clean water, would not be possible — ever. We've seen so many examples around us that have made us realize that safe water is essential to life. Let's consider the case of a village of Southern Ethiopia back in 2017. When a prolonged drought killed all its animals, villagers faced severe economic crisis and the lack of safe drinking water became greater threat to their lives. People in her village began drinking whatever water they could find, became ill (most likely from cholera), and died. Hence, not only do individuals require clean water, but entire communities do as well, and they require more than just water for cooking, washing, and sanitation. Safe water, according to the United States Geological Society (USGS), is "water that will not harm you if you come into contact with it."

What defines safe water? Safe water represents water that will not harm people if they come into contract with it. Though the most common application of this term is drinking water, it could also refer to the water we use for our other daily activities. In a word, water is safe if it contains only a trace amounts of harmful contaminants. These contaminants could be any physical, chemical, biological, or radiological substance or matter in water.

Drinking water contaminated with heavy metals such as arsenic, cadmium, nickel, mercury, zinc, lead etc. is becoming a major public and health care concern. Heavy metals are known to cause occupational exposure due to their use in various industrial processes and/or contents such as color pigments and alloys. However, the most common source of measurable human exposure to heavy metals is drinking contaminated water, and the resulting health issues may include cardiovascular disorders, neuronal damage, renal injuries, and an increased risk of cancer and diabetes. The general mechanism involved in heavy metal-induced toxicity is recognized as the generation of reactive oxygen species, which results in oxidative damage and adverse health effects. That's why it is important for us to know about water health.

For this project, we have developed a web interface that will monitor the water quality of an area based on the presence of heavy metals in the water. This web interface will help the users

to get to know their area's water health just by clicking their locations on the map. Based on the percentage of heavy metals, consumers can decide whether their tap water is safe to drink or not.

Methodology and Implementation:

Firstly, we use HTML and CSS to design the web interface for our project. The web interface shows a mapping window of ArcGIS online. The mapping window can show water contamination information collected in a CSV file. The user of the web interface can find the information of water contamination from the map window.

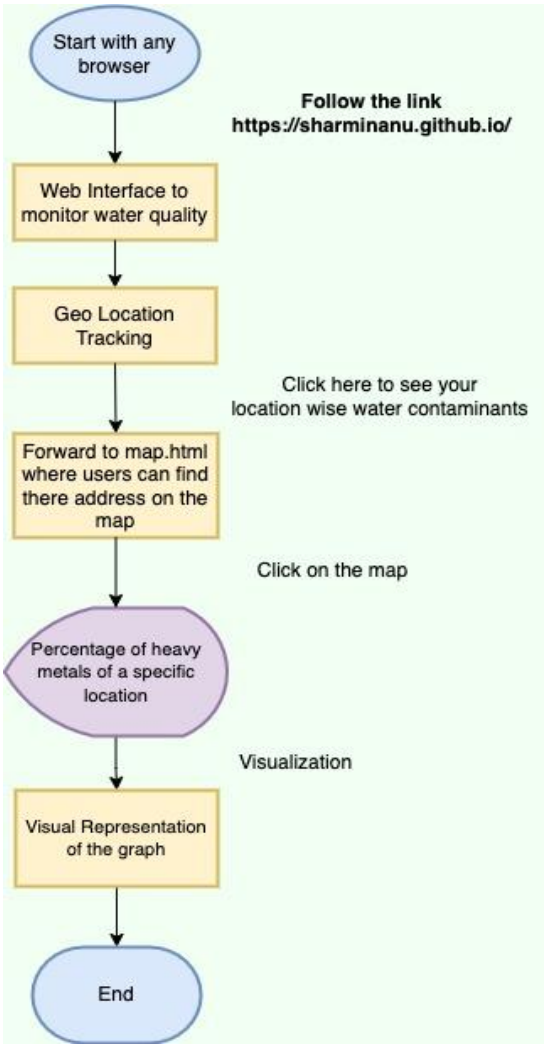

Fig.1: Outline of the website

Step by step demonstration:

1. The home page starts with the heading and a relevant image. The html code is as follows and fig 2 shows the corresponding representation on the web interface. We have added a suitable background color as well.

```
<center> <h1>Water Quality Monitoring Web Interface</h1></center>
<center><a href="https://ibb.co/2vQt5g4"><img src="https://i.ibb.co/HtszXn8/1.jpg" alt="1" border="0"></a><br /></center>
```

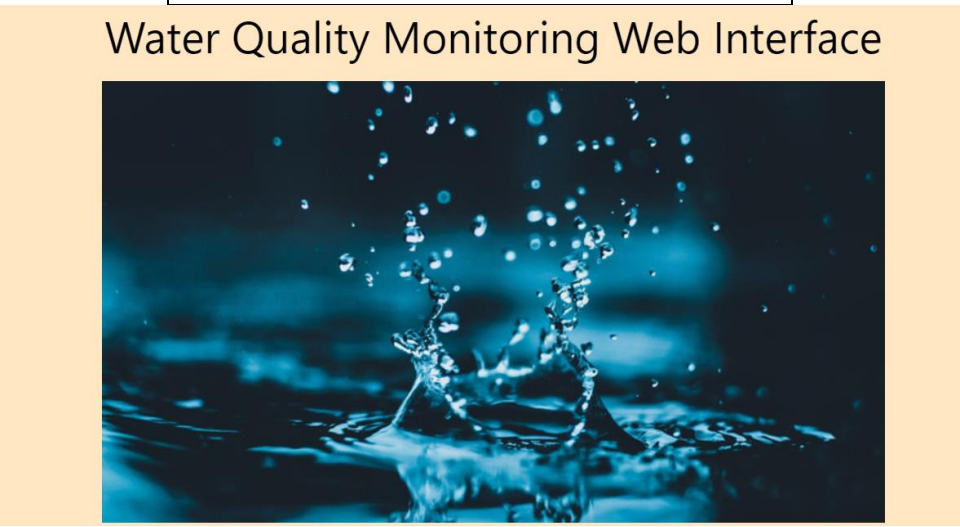

Fig 2: Heading of the web interface

2. After that, a paragraph (Fig 3) has been added with a brief note describing what our website is all about. Here we have described the importance of safe drinking water and the need to be aware of the water contamination in each user's neighborhood.

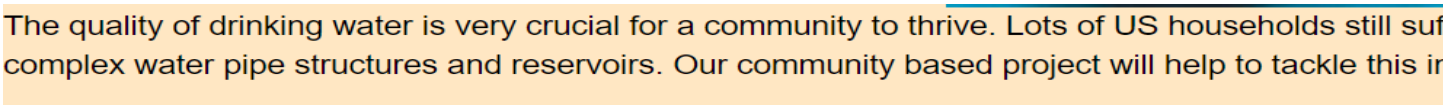

Fig 3: Introduction Paragraph

3. In a separate paragraph, we have explained shortly about the geo location (Fig 4). Here users must put the cursor in their desired location, and it will automatically display the percentage of heavy metal on that area. At the end of the paragraph, there is a link that will take users to the ArcGis map.

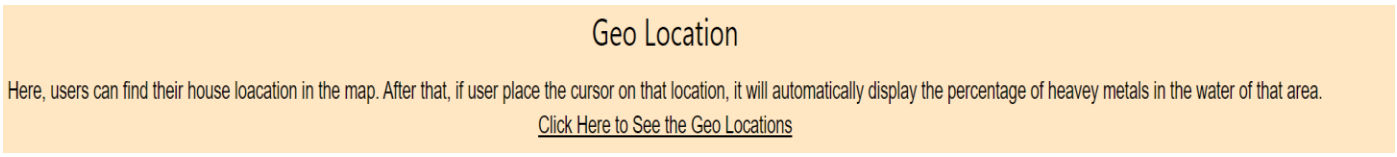

Fig 4: Geo Location Paragraph.

4. After clicking on the Geo Location link, the ArcGis map will open. Fig 5 shows the corresponding html code and map view.


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<style>.embed-container {position: relative; padding-bottom: 80%; height: 0; max-width: 100%;} .embed-container iframe, .embed-container object, .embed-container iframe{position: absolute; top: 0; left: 0; width: 100%; height: 100%;} small{position: absolute; z-index: 40; bottom: 0; margin-bottom: -15px;}</style><div class="embed-container"><iframe width="500" height="400" frameborder="0" scrolling="no" marginheight="0" marginwidth="0" title="first_basic_map" src="https://arcgis.com/apps/Embed/index.html?webmap=b9082e2407e845a39346af898292d0d0&extent=-71.3671,42.624,-71.2445,42.6625&zoom=true&previewImage=false&scale=true&disable_scroll=true&theme=light"></iframe></div>
```

Fig 5: Geo location map with small dot representing locations.

There are several addresses pinpointed with a small dot. We saved the latitude and longitude of some dummy addresses in a csv file that is integrated with the ArcGis map dynamically(Fig 6a). When the cursor is on a certain dot, a display will pop up showing the percentage of heavy metal in the drinking water of that address (Fig 6b).

lowell_water_data_dummy

Address	Latitude	Longitude	Lead (ppb)	Arsenic ug/L
34 white st	42.652347	-71.330798	5	10
54 gates st	42.635987	-71.319821	10	0.01
23 lincoln st	42.631454	-71.319461	16	1
61 CLARE ST	42.64462	-71.32822	0.62	0.24
501 PAWTUCKET ST	42.6463	71.33306	1	3

Fig 6a : CSV file containing the location data.

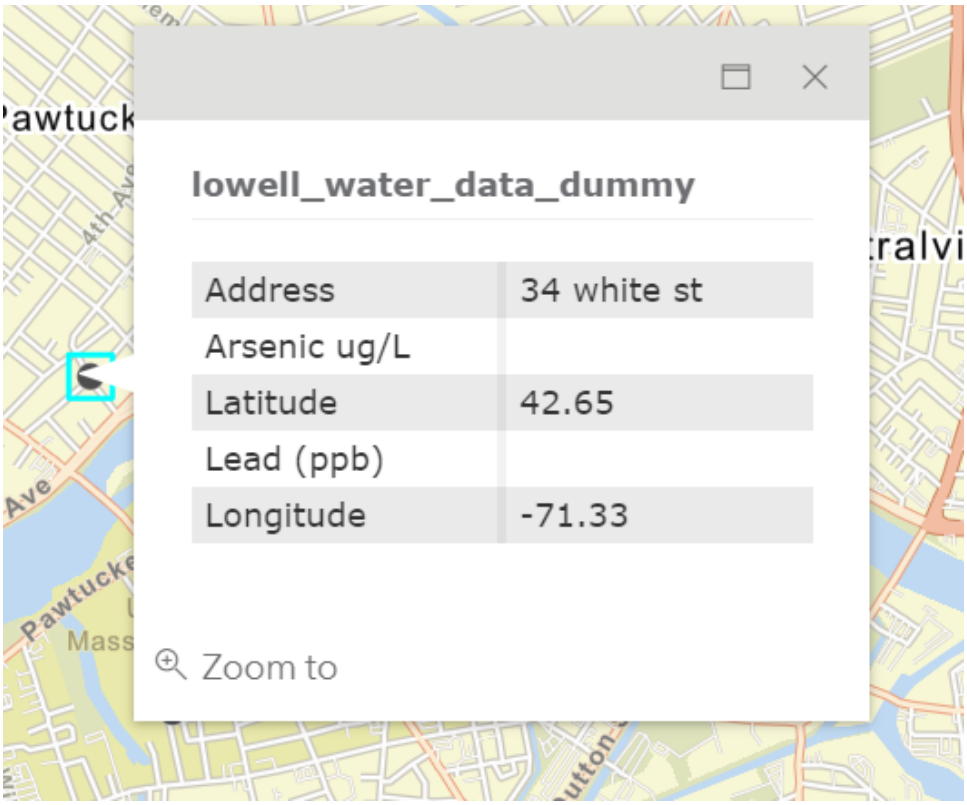

Fig 6b : Percentage of heavy metal in water in a random location.

5. At the end of the Geo location page there is a link that will take the users to another page where the statistics of the heavy metal in a locality will be shown using a graph (Fig 7)

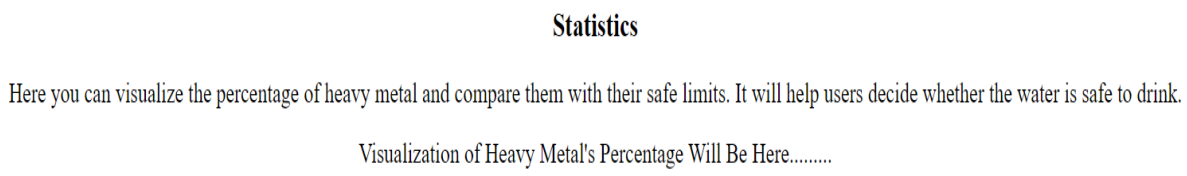

Fig 7: Statistics page

Conclusion:

As water quality is important for any community, this work can serve a significant role in creating awareness among the community members about the water quality situation. People can visualize the current water contamination situation interactively with the ease of their fingertips. Although there are multiple ways to measure the quality of drinking water available, common people are not aware of any water contamination because of the lack of proper communications at the community level. Additionally, it is difficult to assess the extent of the contamination problem due to the lack of collaborative data collection. Our project can also help in getting the bigger picture of water contamination situation with the help of crowdsourced data collection.

Contributions of Team Members in Report Writing:

Atqiya Munawara Mahi: Step by step demonstration

Md Mahmudur Rahman: Description of the Methodology and Conclusion.

Sharmin Sultana: Introduction and the Flowchart of the Methodology Section.