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Introduction

1. Overview

Water sanitation is one of the major issues faced by the country. A large amount of population is drinking water which looks “clean” but is ridden with harmful impurities such as arsenic or is overly saline and thus rendered undrinkable by health standards. This problem is particularly more intense in rural India where people cannot afford to purify water at such a large scale or install high end water purifiers in their homes. The impact of this is not only on the health, but also on the economic and social development of areas.

An analysis of the impurities present in the water in different regions across the country tells us about the magnitude of the issue and just hoe many habitations are affected by the problem. Understanding the problem well, we can derive effective solutions to combat the problem which are region specific and help supply water fit for drinking to people in the heart of the country.

2. Purpose

According to the survey, about 42.9% of the households in the rural areas used hand pump as the principal source of drinking water and about 40.9% of the households in the urban areas used piped water into dwelling as the principal source of drinking water. This water, coming straight from the ground, is often saline and contains mineral impurities such as arsenic, iron, fluoride and nitrate based salts.

An analysis of this data in an area wise manner would allow the government to determine and take proper actions for making the drinking water safer for the community residing in the area. It would also enable them to roll out guidelines for the primary treatment of water obtained by the people, which can help make water safer to a certain degree.

A nationwide analysis allows one to know what states need immediate attention from the authorities and where the greatest number of people are affected. Analyzing the people affected per mineral gives information on what mineral impurity needs to be removed at the earliest.

Literature Survey

1. **Existing problem**

   India has roughly 1000 m^3 of usable water per person per year

- Around 37.7 million Indians are affected by waterborne diseases annually o 1.5 million children are estimated to die of diarrhea alone o 73 million working days are lost due to water borne disease each year.

- The resulting economic burden is estimated at $600 million a year.
- The National Sample Survey's (NSS) remote sensing data suggest that as much as 75 to 80 per cent of the country's irrigated area is served by groundwater wells. This has lowered the groundwater table in many areas.

Over the years, many surveys have been done by organizations around the world to monitor the health of the data and thus find ways to better the situation of drinking water in habitats across the country. Efforts have been made to improve the conditions but the problem still persists, especially in the desert state of Rajasthan where the major source of water is groundwater and brings with high number of impurities.

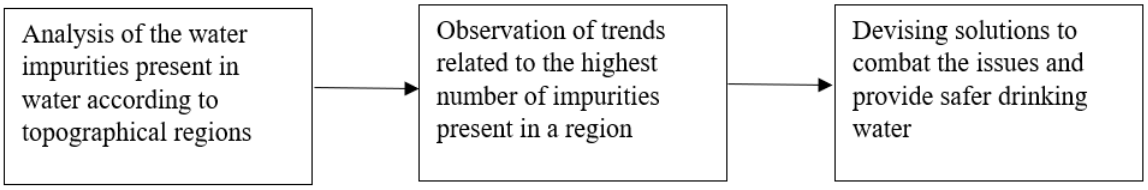
2. Proposed solution

Dividing the country into 4 major regions – Northern India, north east India, Southern and central India in accordance to the geographical features of these areas and their topological conditions allows one to see the trends on impurities.

Dealing with the impurities on a regional level makes the problem much easier to visualize and handle. For instance, analysis of the North eastern states reveals that the water there is majorly affected by iron impurities. Iron itself is not harmful, but the bacteria present with it is and causes health issues. The water can be thus treated to ensure these impurities are removed from water.

Theoretical Analysis

1. Block diagram



2. Hardware / Software designing

Software requirements: Tableau Desktop

Hardware requirements: Laptop/Desktop that supports tableau software

Experimental Investigations

1. **Pan India Analysis**

   A Pan India Analysis revealed what states are the most affected by water impurities. Plotted on a political map of India, the visual shows states of central India to be highly affected due to water impurities. This allows one to determine the regions where action needs to be taken at the earliest.

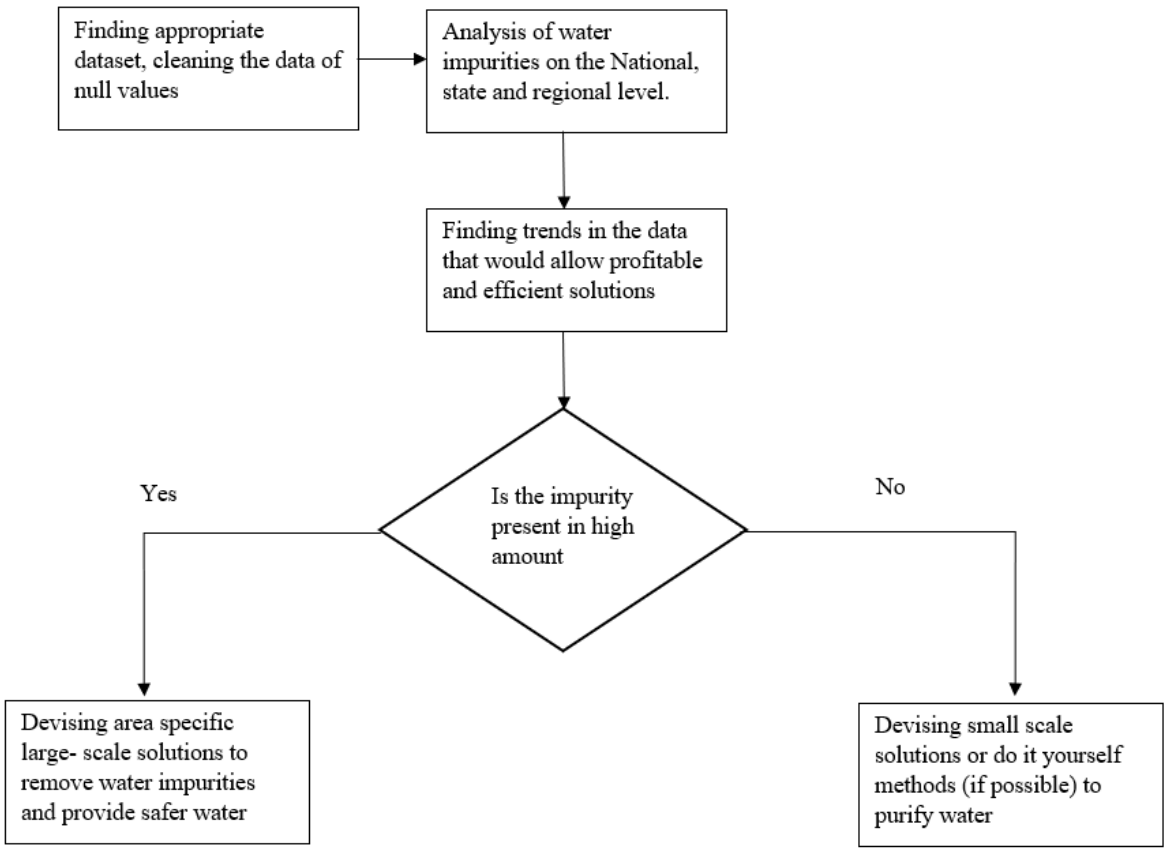
2. **State wise analysis**

   A closer look at the states indicates the following: What are the impurities that affect the habitations in a state the most? And, How many impurities does the water in the state contain? This allows for goal specific action and saves the cost of having to perform procedures to remove all impurities generally available in water

3. **Region wise analysis**

   The region wise analysis is perhaps the single most important analysis in the project, for it is based on the topography of the region and provides a large area where similar impurities are present, paving the way for large scale solutions. For instance, in North-eastern states of India, almost every state has a high amount of iron present in the water. Hence, setting up a water purification Centre in that region which emphasizes on removal of iron from the water would be effective and efficient.

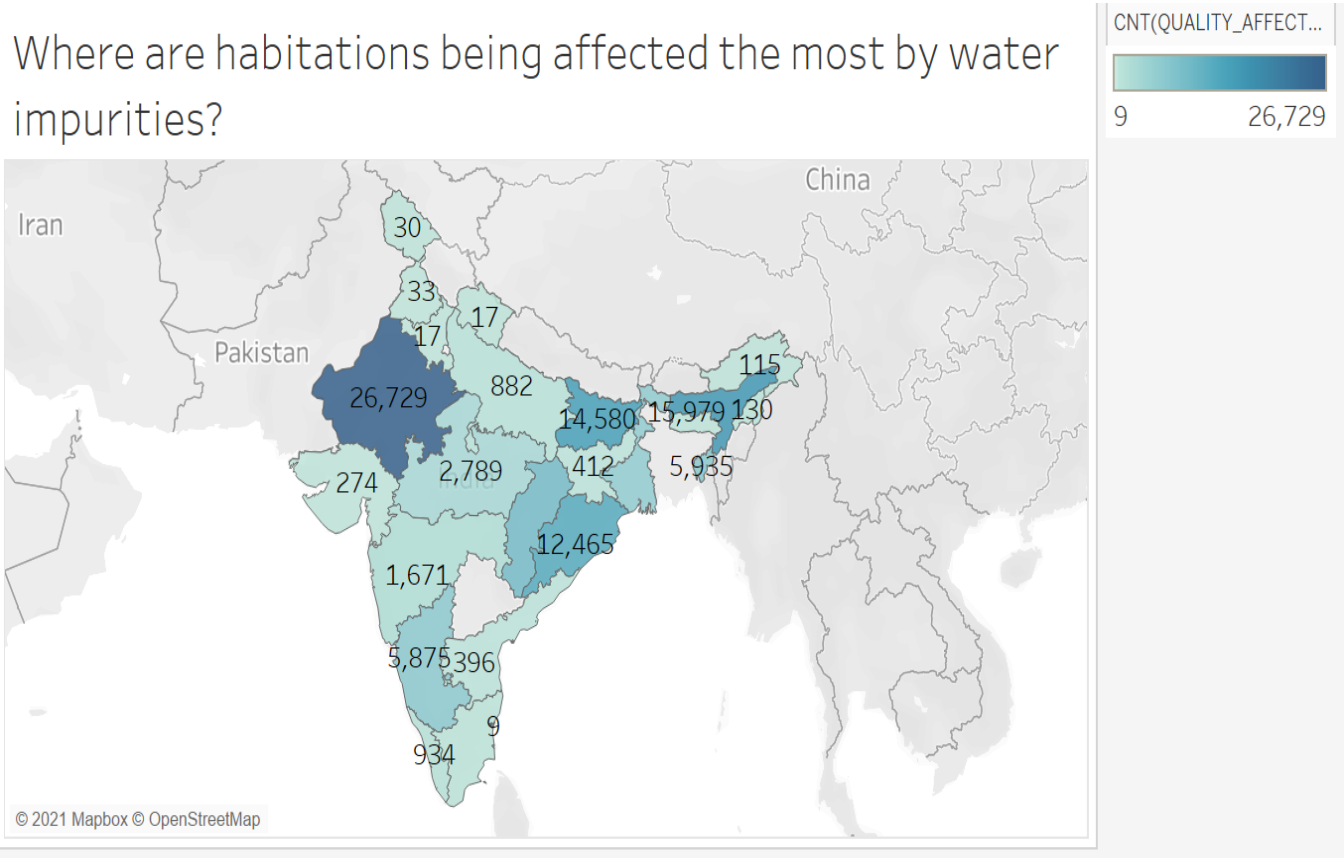
Flowchart


Finding appropriate dataset, cleaning the data of null values
Analysis of water impurities on the National, state and regional level.
Finding trends in the data that would allow profitable and efficient solutions
Is the impurity present in high amount
Yes
No
Devising area specific large- scale solutions to remove water impurities and provide safer water
Devising small scale solutions or do it yourself methods (if possible) to purify water

Result

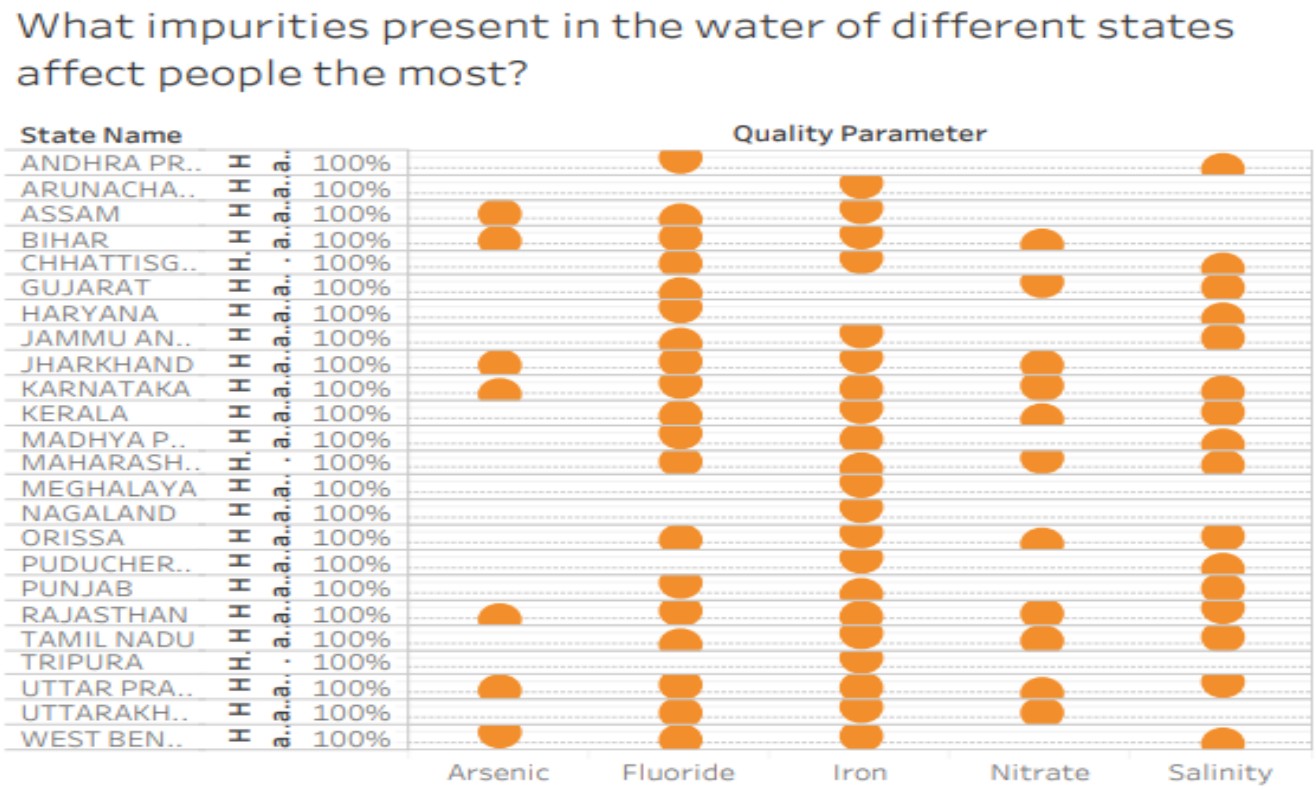
1. Pan India Analysis

Analysis of data on the national level revealed that states in the central part on India have the highest number of habitations affected by water impurities.



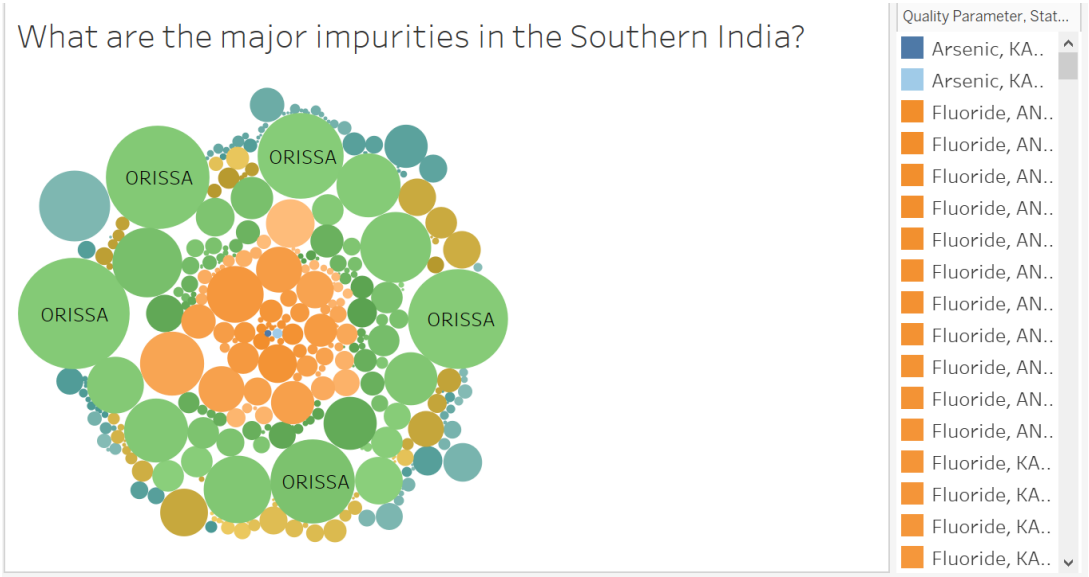
2. State Level Analysis

This helped answer the questions: What are the impurities that affect the habitations in a state the most? And, How many impurities does the water in the state contain?

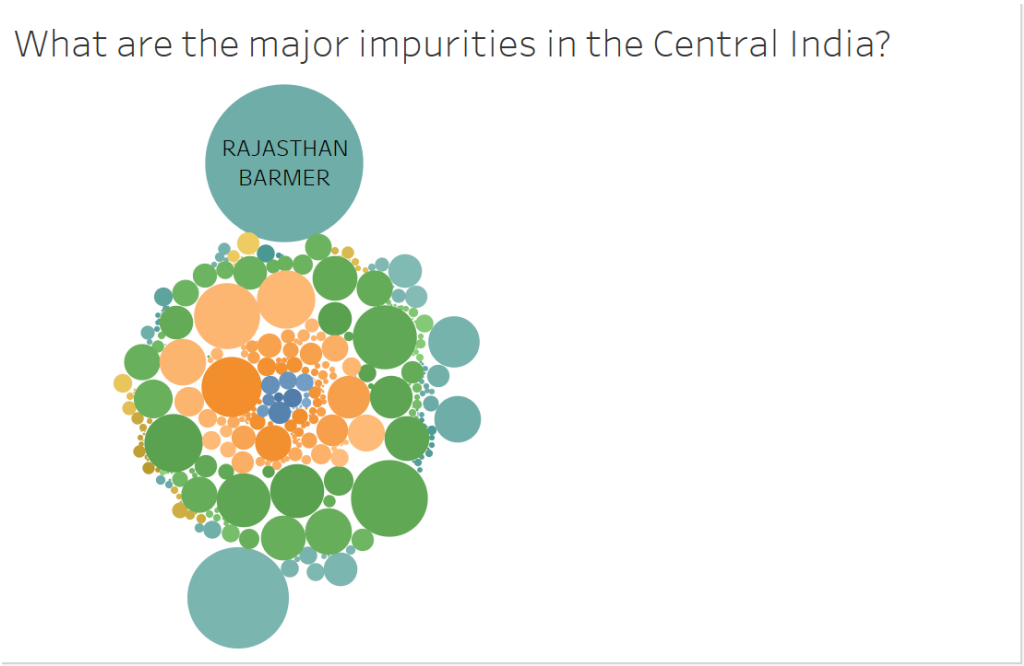


3. Region wise analysis

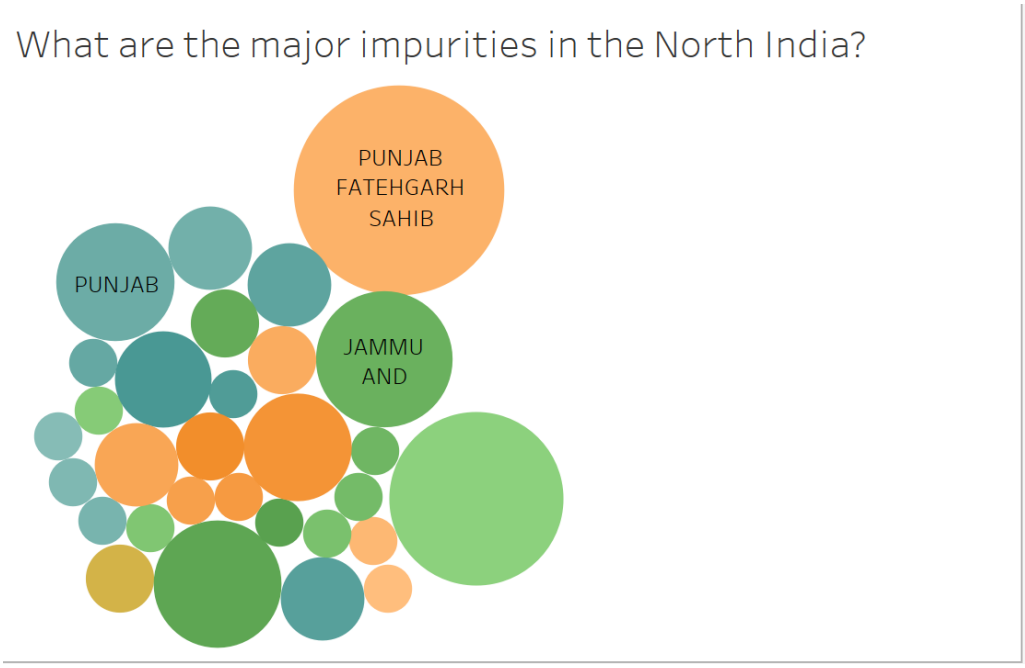
The region wise analysis shows the trends of impurities in different regions. The topography of central India majorly consists of plateau and desert, giving rise to salinity in water. Similarly, north eastern regions are characterized by mountains, hence leading to the high amount of iron impurities. The plains and northern India is known for the farming and contains of the plains. The run off of fertilizers leads to nitrate and fluoride impurities and so on.

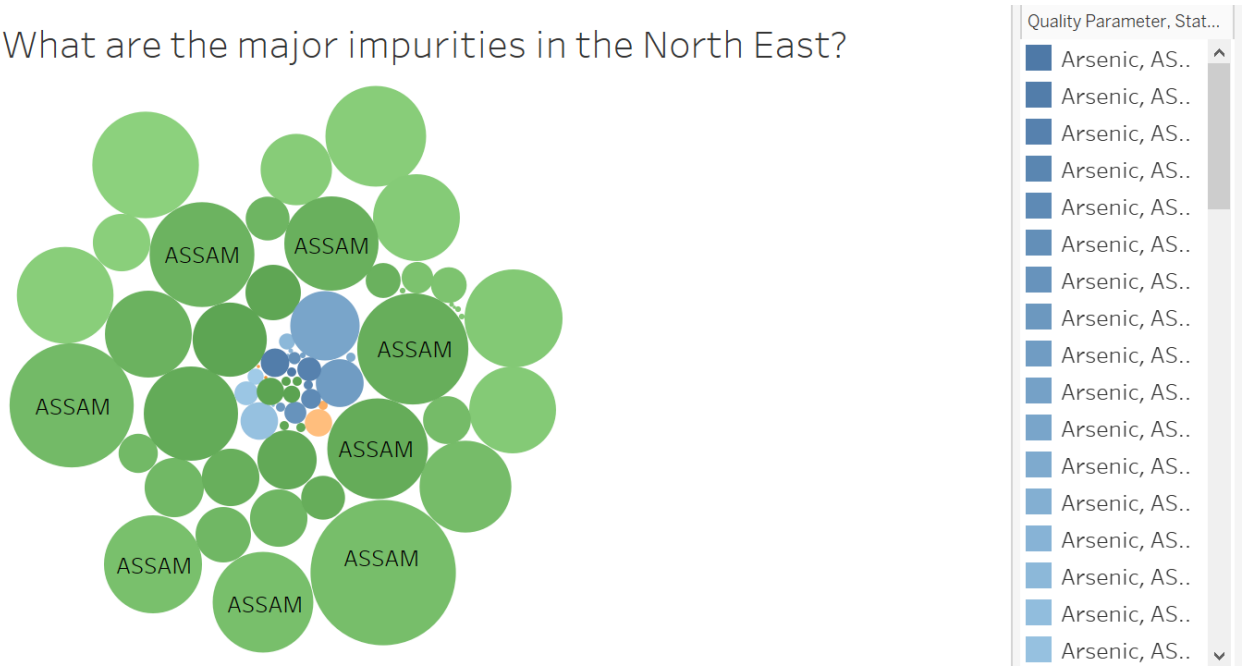


What are the major impurities in the Central India?



What are the major impurities in the North India?





Advantages and Disadvantages

1. Advantages

Helps devise strategies according to area so that they are effective and efficient. The scale of the solutions required can also be seen in accordance to the amount of impurities in the water and the area of people affected by those particular impurities.

The level of life people live can also be improved drastically, as better water means better crop produce, healthier and disease free people.

2. Disadvantages

The solutions for impurities in a minority will not be cost effective. Small scale solutions may or may not be applicable if an impurity is present in small amounts with another one in large amounts.

The do-it-yourself solutions advised to people may not result in the total removal of the impurities present in the water, thus continuing to cause diseases.

Applications

The solutions offered by the project are based on real databases collected by the government of India and are very much applicable in the rural scenario of India. The analysis can be used to address the issue of unavailability of drinking water in the rural regions of India and solve their problems to provide them with drinkable water.

Conclusion

Local patterns of access to safe drinking water and sanitation facilities of the year 2012 were visually demonstrated with the help of interactive visualization tool- Tableau. These can be used to bring productive changes in the water quality and thus improve the living standards of scores of Indians.

Future Scope

We will move on to compare the changes in access to safe drinking water and sanitation facilities over the years at multiple spatial scales and asses the level of changes that can be seen in the level of impurities and the number of people affected by them.

Bibliography

[1] Hueso, Andrés & Bell, Brian. (2013). An untold story of policy failure: The Total Sanitation Campaign in India. Water Policy. 15. 1001. 10.2166/wp.2013.032.

[2] https://thp.org/what-we-do/issues/water-and-sanitation/

[3] http://www.swaniti.com/wp-content/uploads/2014/05/NRDWP_edited_formatted.pdf

Appendix A

GitHub Repo: https://github.com/smartinternz02/SPS-10580-Water-Sanitization

Tableau Public link:
https://prod-apnortheast-a.online.tableau.com/#/site/anushkadixit0088/projects/106441?:origin=card_share_link

Dataset Link:
https://data.gov.in/catalogsv2?format=json&offset=0&limit=9&filters%5Bogpl_module_domain_name%5D=data.gov.in&filters%5Bfield_sector%3Aname%5D=Drinking+Water&sort%5Bogpl_module_domain_name%5D=asc&sort%5Bcreated%5D=desc

Dashboard Source Code:

https://github.com/smartinternz02/SPS-10580-Water-Sanitization/blob/main/Water%20Sanitation%20in%20India%20-%20Dashboard.twb