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Identification of water quality for irrigation and drinking purposes

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Abstract: Water is a fundamental requirement for human, animal, and plant survival. Despite its importance, quality water is not always fit for drinking, domestic and/or industrial use. Numerous factors such as industrialization, mining, pollution, and natural occurrences impact the quality of water, as they introduce or alter various parameters present therein, thus, affecting its suitability for human consumption or general use. The Water Quality Index (WQI) and Irrigation WQI (IWQI) are metrics used to express the level of these parameters to determine the overall water quality. Collecting water samples from different sources, measuring the various parameters present, and bench-marking these measurements against pre-set standards, while adhering to various guidelines during transportation and measurement can be extremely daunting. To this end this study proposes a network architecture to collect data on water parameters in real-time and use Machine Learning (ML) tools to automatically determine suitability of water samples for drinking and irrigation purposes.

Key words: Irrigation water, Drinking water, WQI, IWQI, Water parameters.

1. INTRODUCTION:

Water quality is a critical factor to consider when it comes to irrigation and drinking purposes. Poor water quality can have a negative impact on crops, livestock, and human health. Therefore, it isimportant to accurately detect and monitor the water quality to ensure its safety for consumption and usage.

In this project, we will develop an ML-based water quality detection system for irrigation and drinking purposes. The system will be designed to take input data from water parameters collected from various sources. The ML models will then analyze the data to predict various water quality parameters, such as pH, temperature, turbidity, and dissolved oxygen. These models can analyze large volumes of data and detect patterns that are difficult for humans to identify. The ML models can also be trained to predict the water quality based on the input data.

Some popular machine learning algorithms used in quality analysis of water include Support Vector Machines (SVM), Naive Bayes, Logistic Regression, SGD Classifier, K-Nearest Neighbors (KNN) Decision Tree algorithms. This project aims to and develop an ML-based water quality detection system that can accurately and efficiently detect water quality parameters for irrigation and drinking purposes.

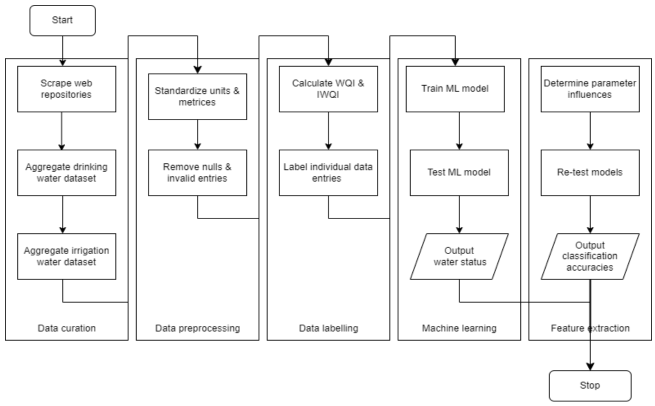

Fig – 1: System Architecture

2. IDENTIFY, RESEARCH AND COLLECT IDEA:

In [1], a network for measuring and monitoring water parameters in a metal producing city in Brazil was developed. Twelve water monitoring stations were setup to measure several physio-chemical water parameters, including pH, dissolved solids, Zinc, Lead etc. Finally, obtained results were analyzed using principal component analysis.

In a similar manner, [2] developed a system to monitor water quality in Limpopo River Basin in Mozambique and set up 23 monitoring stations to measure physio-chemical and microbiological parameters, and ultimately assess the quality of waterin the river basin. To address the challenges of optimal placement of gauges and sampling frequencies, which are often faced when developing water monitoring systems, the authors in [3] developed an economically viable model that combined genetic algorithm with 1-D water quality simulation. Though the work was only simulated by using genetic algorithm, the authors were able to solve the NP hard problem of optimally placing monitoring stations.

Monitoring water parameters often entails periodically sampling a body of water to capture relevant metrics. These metrics might include physio- chemical and microbiological measurements, such as potential of hydrogen (pH), temperature, sodium levels etc. In a water monitoring network, measured parameters need to be transferred to a base station where relevant decision(s) would be taken. Due to the sparse nature of transmitted data, light weight communication protocols capable of transmitting relatively small data over long distance are required for water monitoring networks.

3. PROPOSED APPROACH:

The water network proposed in this work is to be deployed with the intention of monitoring water parameters in water storage dams and/or water treatment plants across the region. Data gathered by the network which are previously collected are then passed through Machine Learning (ML) models to determine their suitability for consumption or irrigation purposes. Curate sample sized datasets on drinking and irrigation water that can be used to train and test machine learning models to automatically determine the "fitness for use" of a sample of water for drinking and/or irrigation purposes. Build models that determine the most critical parameters that influence the accuracy of machine learning models in analyzing water for drinking or irrigation.

- Data curation phase: Collecting datasets from the websites which are best suitable for our project.
- Data preprocessing: Data cleaning should be done here by removing null and invalid entries in the dataset and prioritize units and metrics.
- Data labelling: Data should be labelled based on calculated WQI and IWQI values.
- Training phase: The labelled data is passed through ML models to train and test the data.
- Feature extraction: Determine the most significant features used for the classification and retrain the data for improving the accuracy.

4. FUTURE WORK:

The proposed work in this paper discusses about the Detection of water quality by using machine learning algorithms such as Naïve Bayes, Decision tree classifier, SVM, SGD classifier, KNN, Random Forest, Logistic Regression. In this, we worked on limited amount of datasets, but in we will work on real time water monitoring network.

5. CONCLUSION:

We developed an ML-based water quality detection system that can accurately and efficiently detect water quality parameters for irrigation and drinking purposes. Data gathered from the monitoring network would ideally be aggregated on a Cloud server, where ML models can then be applied to assess the water's fitness of use for drinking or irrigation purposes. Results of the test showed that Naïve Bayes and LR performed best and gave the highest classification accuracy and lowest false positive and negative values. The system will help farmers and water supply authorities to monitor water quality, reduce wastage, and ensure the safety of crops, livestock, and human health.

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