REAL-TIME DATA FUSION SYSTEM FOR CLASSIFYING WATER USAGE

PROJECT PROPOSAL - STUDENT PROJECTS FOR INTERNAL FUNDING

Department of Information Technology

SSN College of Engineering, Kalavakkam - 603 110

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DEPARTMENT OF INFORMATION TECHNOLOGY

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SUMMARY

The primary objective of this project is to build a 'robust' Real-time Water Quality Detection System for domestic needs that can dynamically detect and certify the quality of water accordingly. Sophisticated systems for detection have already been developed, however they are neither affordable by a common man, nor suited for Indian circumstances. A combination of Data Analytics, Data Fusion and Machine Learning techniques, is designed to innovate a system that provides a cheaper yet effective solution to detect the quality of water. Real-Time Data from water and air, are processed to alert the user whenever the water is detected non-potable. This idea could be used to incorporate an effective device for every Indian household and in the near future, for industrial purposes also.

KEYWORDS

Water Usage - Data Mining - Data Fusion - Machine Learning - Clustering - Bayesian - Decision Trees - Sources - Resources - Parameters - Alert

ORIGIN OF PROPOSAL

Despite the existence of various systems to check the state of water, not many small organizations or in fact, a regular person can afford such sophisticated devices. Only preliminary research is being done in this field, and water, a depleting resource, needs to be utilized to its fullest. Thus building cost-efficient systems is essential. There arises a need to classify water for various activities such as domestic or industrial purposes, rather waste it unnecessarily. This thought kindled us to take an initiative as engineers to save water resources.

OBJECTIVE

- To gather data of various parameters of water, soil and surrounding air using sensors in real-time
- To fuse data from all parameters of the sources
- To fuse and process the local decisions into one final decision at the central node
- To alert the user with a prompt when the water is detected not usable

IMPORTANCE OF THE PROJECT

There is a high correlation between the water quality and human health. The concentrations of the several organic and inorganic substances dissolved in water beyond acceptable ranges may cause an adverse effect on human health. Water borne diseases are the most common cause of deaths in developing countries such as India. The paucity of clean water for domestic use has led to the increase in the number of deaths in both the urban and the rural parts of India. Deaths due to water related diseases in India are nearly 76.7 percent. Minimum of 18 lakh people worldwide are affected annually, especially children. Diarrhoea, Cholera, Malaria, Japanese Encephalitis, Filariasis, Hepatitis, Typhoid are the major water borne diseases. Improper discharge of Industrial wastes, domestic sewage, city garbage, etc. have led to serious problems such as the Nagpur, Amravati District in Maharashtra, Ratnagiri, Ahmednagar, Thane and Pune.

Though everyone is well aware of the statistics and the current situation, there is only preliminary research being done in the related fields. We felt that application and knowledge of Data Analytics can be put to better use as a contribution to the environment. We felt the need to change this by beginning with every home.

DETAILED METHODOLOGY

- The project proposes a system to alert an user if the water being consumed becomes non potable. This is a domestic system to start with, which can be used in every home.
- The system can be planted in a water tank or in any other water source. Water sensors need to be planted inside the water and air sensors, immediately above the water. Optionally, soil sensors can be included too in case of bore wells or underground water.
- These sensors are implemented in different parts of the tank, or different individual homes of the same community, to detect whether the water, in the community as a whole, is usable or not.
- Parameter Readings from these different resources are taken individually at first, such as the pH, alkalinity, temperature. For example, the water parameters from all the sensors flood in at the same moment. The readings are taken after every thirty minutes. False negative values are removed by Clustering and the mean readings of every parameter are compared with the Indian Government Standards for reasonable usage of water, soil and air around it, with Deviation Methods.
- Local Fusion Modules are implemented to fuse and process the filtered mean readings of every resource separately, ie., for example, all water readings of all parameters from all houses are acquired, filtered and fused at the local water fusion module. Similarly, two more modules for soil and air, are taken.

- Once local fusion is done, decisions are given at their ends whether the readings are okay or pose a danger, using Decision Trees. The respective safety categories are labeled.
- These individual decision labels are taken to a central fusion module. The labels are fused and synthesised by Bayesian Classification Methods to provide a final decision whether the water in that community is safe to be used or not. These decisions provoke an alert to the user. This system checks the waters every thirty minutes.

ESTIMATED BUDGET :

S.No	PARTICULARS	PRICE/UNIT (INR)	UNITS	AMOUNT (INR)
1	Temperature, Humidity and Pressure Sensor	1,447.20	1	1,447.20
2	Water Conductivity Sensor	2,387.88	1	2,387.88
3	Water pH Sensor	1,230.12	1	1,230.12
4	Soil Moisture Probe	615.06	1	615.06
5	ORP Sensor	3,256.20	1	3,256.20
6	Raspberry Pi	6,222.96	1	6,222.96
	TOTAL			**15,159.42**

SCOPE

From developing a small equipment for one household, this idea can be used to benefit a greater audience with a community-wide or even a state-wide deployable system such as a rain water harvesting system. Apart from decision at the domestic level, it can be leveraged for industrial purposes or to conserve greater water bodies such as lakes and rivers. With the fast growing technical advances, the pollution and contamination of water is also growing at large and this can be immediately mitigated by scaling up this project. Incorporation of Data Fusion ideas in water monitoring is a fresh concept which is expected to grow greater heights in the future.

We also are looking forward to publish an International Journal for the Call For Paper in Information Fusion in Elsevier. It has future scope in the Big Data Initiatives taken by the Government such as those taken by Department of Science and Technology, India.

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