Survey On: "Real Time Water Quality Monitoring System Using IoT And Machine Learning"

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Abstract

There is need for effective monitoring, evaluation and control of water quality in different areas. Ensuring safe water supply of drinking water is big challenge for today's generation. The excessive use of fertilizers in farms and also in other sectors such as mining and construction have contributed in overall reduction of water quality. To ensure the safe supply of the drinking water the quality needs to be monitor. So we can give a design and development of a low cost system for real time monitoring of the water quality using IoT(Internet of Things) and machine learning. The system include of different sensors is used for measuring physical and chemical parameters of the water.

Keywords : *IoT , Arduino model, Wi-Fi model, Temperature sensor, Odour sensor, turbidity sensor, pH sensor, Water level sensor, Cloud.*

1. Introduction

Nowadays, water quality monitoring faces challenges because of global warming limited water resources, growing population, industrial improvements etc[1]. So there is need to develop a best methodologies to monitor the water quality parameters in real time. Water quality is generally affected due to both point and non-point sources of pollution. Hazardous of various category have got mixed with the drinking water which is produced through the industrialization, globalization, urbanization, agriculture etc. Basically Poor water quality spreads diseases causes death[1]. Upto 5 million people die due to waterborne diseases in the world. Basic definition of Water quality monitoring is the collection of information at set locations and at regular intervals in order to provide data which may be used to define current trends. There is need of controlling pollution and the measures for the effectiveness of pollution control in water is finished by monitoring Water quality. Our proposed System consists of various sensors which compute the standard values of water in real-time for effective action and is accurate and only less manpower required[4].

The water quality parameters like pH, it generally measures the concentration of hydrogen ions. It shows whether the current water condition is acidic or alkaline. Pure water has 7 pH value, less than 7 pH has acidic and more than 7 pH has alkaline. The range of pH is 0-14 pH. For drinking purpose it should be 6.5-8.5 pH[1]. The another quality attribute Turbidity measures the large number of suspended particles in water that are invisible. If the turbidity is higher then there is higher risk of diarrhea, collera[1]. On the other hand if turbidity is lower then the water is clean. Temperature sensor measures whether water is hot or cold. The traditional methods of water quality monitoring involves the manual collection of water samples from different locations. As we will get the solutions of water samples then we can measure the different quality attributes of water and compare them with the given threshold values or standard values, if the values generated from the sensors are exceeded then alert is sent to the user of system and necessary actions will be taken by user.

2. Literature Survey

As real time water quality monitoring are emerging all over the world. From drinking water to industrial waste water. In this general water quality parameters are total Organic carbon, Residual Chlorine, Conductivity, pH, Turbidity. Total three subsystems are used:

- Data Collection Subsystem.
- Data Transmission Subsystem.
- Data Management Subsystem [2].

Various types of parameters are measured with sensors by placing them into different solutions of water. Data generated is compared with standard values in cloud and if exceeds then message sent from cloud to the users mobile. The given paper presents a detailed information of recent works carried out in smart water quality monitoring. Also, a power efficient, simpler solution for in pipe water quality monitoring based on Internet of Things technology is presented. The system developed in this paper is generally used for testing water samples and the data uploaded over the Internet are analyzed. The paper presents a detailed survey on the different techniques implemented in existing smart water quality monitoring systems. Also, a low cost, less complex water quality monitoring system is proposed.[1]

In this paper we got the idea about how previously water quality is monitored. As 1. Autonomous water quality monitoring using GSM. 2. Using Image Processing technology for water quality monitoring system. 3. Using Zigbee protocol. The proposed system of this paper describes conditions of water quality through various sensors like pH, Water level, Turbidity, Conductivity using WSN through microcontroller and Wi-Fi[5].

From this paper we got the details of each sensor pH, Temperature, Turbidity, Conductivity, Water level etc. How these sensors are working and How they will get interfaced with Arduino controller. how the data generated by sensors will get transferred to the cloud in our proposed system[6].

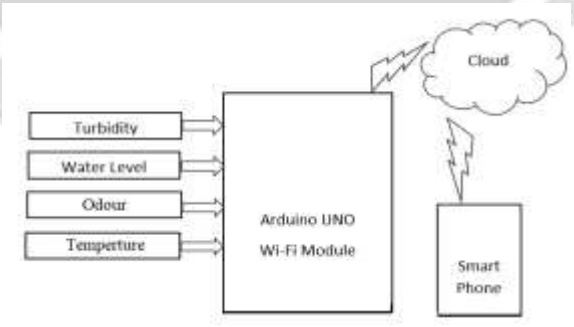
We studied that the high use of fertilizers and other chemical sectors such as mining and construction have reduced overall quality of water. This paper gives study about Fiji islands water quality which requires frequent data collecting network for water quality monitoring using IoT and RS(Remote Sensing).the comparative study is provided for different parameters such as pH, Turbidity, Conductivity, Temperature etc[7].

In this paper, methodologies results are as, when the sensor board is switched on, the sensors are stumble on individual water parameter information. Here represented and we studied about statistics of water stage pH, Turbidity, Temperature etc are displayed on the dashboard of system.[9]

This paper also proposes a sensor based water quality monitoring system measuring physical and chemical parameters of water. This paper is beneficial for the development of water quality measuring devices, for measuring and analysis of water used for various living things ex. Human beings, animals as well as marine fishes and plants. It focuses on checking odour, Water level, Turbidity and temperature and verified on a daily basis. Here also Data transmission subsystem include wireless communication device with built in security features that transmits data from controller to data storage. Data Collection subsystem consist of multi-parameter sensors[10].

2.1. Methodologies of Problem solving

- System Architecture:



• Decision Tree (Algorithm):

Decision Trees are considered for representing classifiers. A decision tree is a classifier expressed as a recursive partition of the instance space. The decision tree consists of set nodes that form a rooted tree, it is a directed tree with a node

called root that has no incoming edges. All other nodes have only one incoming edge. A node with outgoing edges is called an internal or test node. Decision tree generates the rule for the classification of the generated data set. The decision tree generally represents the flow chart like a tree structure that classifies instances by sorting them based on the feature (attribute) value[12].

C4.5 Algorithm

1. Take data as a input
2. If the dataset has more features and condition then apply it on data parameters.
3. The data generated from the sensors are evaluated depending upon WHO values.
4. Classify and splitting the data.
5. Analysis of data.
6. Find the accuracy of the model.
7. Compare the value store on cloud.

3. Advantages

1. Due to automation it will reduce the time to check the parameters.
2. This is economically affordable for comman people:
3. Provides the prevention from diseases caused by water
4. Accuracy in measurement
5. SMS alert is sent to the user

4. Limitations

1. **System hardware need to be handled with care:**

As we are using different sensors and arduino controller it is mandatory to handled them with care.

2. **Only limited users are added to handle the system:**

Only the persons who are authorized to system able to access it.

5. Application

1. **This system is used in commercial and domestic use**:

The water for commercial uses come from the surface and under ground sources. The extend to which community uses a surface or underground source depends on which source is more abundunt in the particular area.

2. **Water supply agencies**:

water supply is the provision of water by public utilities, commercial organisations, community endeavors or by individuals usually via system of pipes.

3. **Useful for health departments to identify the reason of water diseases:**

Waterborne illness have two causes of pollution eg. dangerous levels of nitrates or heavy material in the water supply due to industrial pollution or the over use of agriculture chemicals. Dirt and contamination, viruses causes different kinds of diseases.

4. **Residential Areas**:

This system will be more useful in residential areas like small village or town.

5. **In different organizations**:

So the system of monitoring the water quality will be very much useful in organizational area like any industry, construction sites, Hostels, Schools, colleges etc.

Conclusion

This presents a detailed survey on the tools and techniques employed in existing smart water quality monitoring systems. Also, a low cost, less complex water quality monitoring system is proposed. The implementation enables sensor to provide online data to consumers. The proposed setup can be improved by incorporating algorithms for anomaly detection in water quality. So this proposed system will surely helpful to the society for safe supply of water.

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