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A REVIEW ON WATER PURITY MONITORING SYSTEM USING IOT

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Abstract
Depletion of available water supplies and deterioration of water quality are the results of growing demands for water from agriculture, industry, and domestic use. Chemicals utilized in a variety of industries, including manufacturing and agriculture, also worsen the quality of the water. Conventional techniques for evaluating the quality of water entail the labor-intensive and time-consuming manual collection of water samples, followed by laboratory examination. A water quality monitoring system that measures important parameters including temperature, pH, and turbidity using several sensors has been created to address these issues. The system compares the sensor data with the application- or industry-specific threshold values for these parameters to ascertain whether the water sample satisfies the necessary requirements for a given use. When compared to conventional approaches, this approach provides a quicker and more accurate way to evaluate the quality of the water. This monitoring system's fundamental controller, the Internet of Things (IoT) concept, enables real-time data collecting and processing. Additionally, stakeholders have instant access to vital information concerning water quality thanks to the sensor data's remote internet accessibility via a Wi-Fi system. The incorporation of technology not only facilitates the monitoring procedure but also allows for anticipatory decision-making to guarantee the security and appropriateness of water for diverse uses.

Keywords: IOT, Turbidity, pH, Wi-Fi.

I. Introduction

In India, water pollution is a significant issue, with over 70% of surface water resources polluted due to untreated wastewater discharge. The consequences are severe, with waterborne diseases affecting millions annually, and industries contributing significantly to water pollution. Sectors like textiles, chemicals, and manufacturing are major consumers of water, exacerbating the problem. For example, the textile industry alone is responsible for a substantial portion of water usage and releases millions of tons of wastewater into water bodies each year.
[1] states that although India's overall water demand is predicted to exceed 1,500 bcm (by 2030) (2030 Water Resources Group, 2009), the country is still under water stress and is moving closer to the category of water scarce (CWC, 2019). The industrial water demand in India has been rising in line with the rate of industrial development and accounts for roughly 8% of total water extraction. By 2050, it is predicted to have multiplied from 56 BCM in 2010 to 151 BCM (CWC, 2014). The expansion of several water-intensive industries, including as steel, pulp and paper, textile, and coal-based thermal power plants, has put additional strain on the demand for industrial water.

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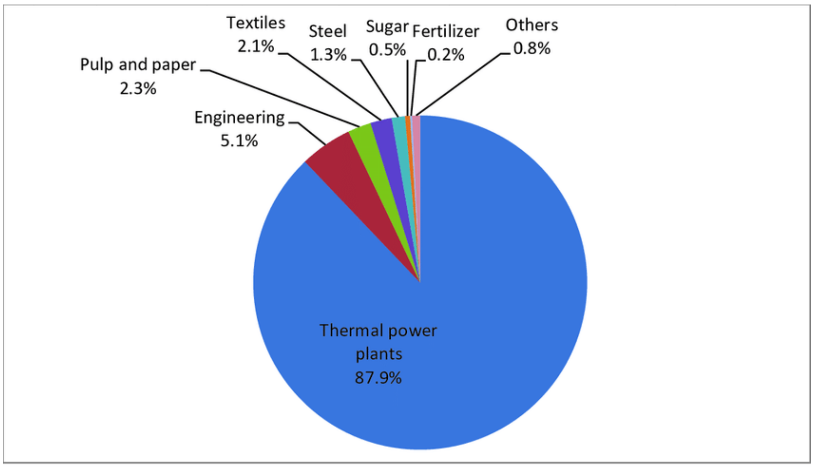

Figure 1: Water Demand in Industries

The ramifications of water pollution extend beyond public health concerns; they also affect agriculture and industry. Contaminated water sources pose health risks and lead to reduced crop yields and soil degradation in agriculture. Moreover, industries face regulatory pressures to treat wastewater before discharge, resulting in increased operational costs and impacting profitability. Addressing these challenges requires a comprehensive approach, involving policy interventions, infrastructure development, and public awareness campaigns.

Efforts to combat water pollution must prioritize sustainability and inclusivity, ensuring that clean water access is available to all sectors of society. By implementing sustainable water management practices and investing in pollution control measures, India can mitigate the adverse effects of water pollution. Collaboration between government, industries, and civil society is crucial to safeguarding water resources and securing a healthier future for all. This collaborative effort should emphasize the importance of balancing economic development with environmental conservation to achieve long-term sustainability.

Water management is increasingly vital in a world where the population is rapidly expanding, particularly in sectors such as industry and agriculture. Access to clean drinking water remains a global challenge, with millions suffering from diseases caused by contaminated water each year. To tackle this issue, innovative solutions are needed, including the integration of intelligent water quality monitoring systems into IoT platforms. These systems have the capability to monitor various physical properties of potable water in real-time, reducing reliance on traditional, often slower human processes.

In the bigger picture, tackling water pollution and demand calls for coordinated efforts to put sustainable water management techniques into place. This entails cutting down on water waste, tightening laws governing the use of chemicals, and making investments in infrastructure for the filtration and treatment of water. Stakeholders can better understand and manage water resources by utilizing technology, such as the water quality monitoring system mentioned, eventually protecting future generations' health and the environment.

II. Literature

[2] tells us about the parameters that are to be assessed for water quality. For a given purpose, the "goodness" of water is determined by its quality. Tests on the water quality will reveal details on the condition of the stream. Water quality can be observed to alter over time by conducting periodic tests. Testable parameters include salinity, turbidity, temperature, pH, nitrates, and phosphates. An evaluation of the aquatic macroinvertebrates might also reveal information about the quality of the water.

[3] discusses about the categories of water based on its quality. Nearly every day since the late eighteenth century, when the industrial revolution began, new causes of pollution have been found

worldwide. Therefore, pollution of the air and water is a possibility everywhere. Changes in the rates of pollution are not well understood. An accurate indicator of the level of environmental contamination is the rise in illnesses linked to water. The ecological criteria of water quality—both for people and other living things—are compiled in this chapter. Water can be divided into four categories based on its quality. A thorough analysis of the significant characteristics that these four types of water quality have in common, such as physical, chemical, and biological parameters, is used to discuss them. The meaning, origins, implications, consequences, and methods of measurement of these water quality metrics are discussed.

[4] explains the most significant factor in forming the terrain and controlling the climate is water. It is among the most significant substances that has a significant impact on life. Water quality is typically defined in terms of its physical, chemical, and biological properties. Water quality is declining and aquatic biota is being lost as a result of significant and diversified contamination in the aquatic environment brought on by rapid industrialization and the careless use of chemical pesticides and fertilizers in agriculture. Water-borne diseases affect the human population as a result of drinking contaminated water. Checking the water quality at regular intervals is therefore essential. Temperature, pH, turbidity, salinity, nitrates, and phosphates are among the parameters that can be measured.

[5] Mukta, Surajit Das, Samia, Ahmed, M Saddam entitled “IoT based Smart Water Quality Monitoring System”. This paper describes a smart water quality monitoring (SWQM) system that is based on the Internet of Things (IoT) that helps measure water quality continuously using four physical parameters: temperature, pH, electric conductivity, and turbidity. To monitor the properties of the water, four discretely connected sensors are coupled to an Arduino Uno. The sensors' extracted data is sent to a desktop application built on the.NET platform, where it is compared to WHO (World Health Organization) standard values. The suggested SWQM system may effectively use a rapid forest binary classifier to assess the water parameters and determine whether or not the test water sample is drinkable based on the measured results. The SWQM system's ability to accurately detect water quality based on physical factors has demonstrated its significance. In the near future, this system can be used as a real-time water monitoring solution thanks to advances in IoT technologies that detect chemical characteristics in water.

[6] Dr. Nageswara Rao Ch. Mukesh Dr. P. Vidya Sagar entitled “Water Quality Monitoring System Using IOT”. This internet-of-things-based water quality monitoring system's goal is to determine the water's quality, or how its pH content fluctuates, and to notify the appropriate authorities of its findings. This project will be implemented at drinking water reservoirs and municipal water tanks. To do that, we're utilizing a GSM module for the communication technique and an Arduino board to measure the pH. We monitor water conditions continuously using an LED display. The pH value of the water is finally displayed to the user. We are expanding this research even further by transmitting sensor data to the cloud to monitor water quality globally.

[7] Sathish Pasika and Sai Teja Gandla proposed a monitoring system which consists of a number of sensors used to measure several quality parameters like turbidity, pH value, water level in the tank, dampness of the adjoining environment and temperature of the water. The Microcontroller Unit (MCU) interfaces with the sensors, and the Personal Computer (PC) does additional processing. The Internet of Things (IoT)-based ThinkSpeak application will use the collected data to send the data to the cloud in order to monitor the water quality under test.

[8] Konde and Deosarkar proposed a method for developing a Smart Water Quality Monitoring (SWQM) system with reconfigurable sensor interface device using IoT environment. Six different water quality parameters like turbidity, pH, humidity, water level, water temperature and carbon dioxide (CO_2) on the surface of water were considered in real-time. The proposed method will provide assistance in guarding the safer and balanced environment of water bodies.

[9] Prasad developed a method for smart water quality monitoring system in Fiji, by employing remote sensing and IoT technology. The quality parameters used to analyze water are Oxidation and Reduction potential (ORP) and Potential Hydrogen (pH). With efficacious implementation of this approach of monitoring, an early warning system for water pollution will be developed with a completely implemented system using numerous monitoring stations.

[10] Jayti Bhatt, Jignesh Patoliya created a model to guarantee a safe supply of drinking water; in order to achieve this, a new method called IOT-based water quality monitoring should be used to check the quality in real time. This system is made up of a few sensors that detect many aspects of water quality, including temperature, turbidity, conductivity, pH, and dissolved oxygen. The microcontroller processes the measured values from the sensors, and then sends the processed values to the core controller via remote communication. Finally, cloud computing allows sensors data to be viewed on web browser applications.

[11] Vaishnavi V. Daigavane and Dr. M. A Gaikwad offered a low-cost system's design and development for IOT (internet of things) real-time water quality monitoring. The system, which consists of multiple sensors, measures the water's chemical and physical characteristics. It is possible to measure the water's parameters, including temperature, PH, turbidity, and flow sensor. The core controller has the ability to process the measured values obtained from the sensors. One possible usage for the Arduino model is as a core controller. Lastly, a WI-FI system can be used to see the sensor data online.

[12] Nikhil Kumar Koditala, Dr. Purnendu Shekar Pandey this study suggests a low-cost water quality monitoring system that can replace current methods of quality monitoring by utilizing cutting-edge technologies like cloud computing, machine learning, and the Internet of Things. This protects residents of rural locations from a number of harmful illnesses, including fluorosis and bone abnormalities. The suggested model can also regulate the water's temperature and adapt it to the surrounding air temperature.

[13] Shabinar Abdul Hamid, Solahuddin Yusuf Fadhlullah, Samihah Abdullah, Zuraida Muhammad, Nor Adni Mat Leh discussed the proposed Smart Water Quality Monitoring System (SWQMS) design, and the evaluation of factors influencing pH value and temperature of swimming pool using DOE and ANOVA statistical tools. The experimental findings reveal that time of day, pool volume and their interaction factors do not influence the pH value however time of day does have an effect on the water temperature of the swimming pool.

III. Existing Methodology

Smart Water Quality Monitoring System based on Internet of Things that helps measure water quality continuously using physical factors such as temperature, pH, electric conductivity, and turbidity. Sensors are attached to an Arduino Uno board; data taken from the board is then sent to an application written on the.NET platform, where it is compared to WHO standard values. The suggested SWQM system may effectively use a rapid forest binary classifier to assess the water parameters and determine whether or not the test water sample is drinkable based on the measured results.

The Water Quality Monitoring System's goal by measuring variations in pH content, IOT can determine the quality of the water and notify the appropriate authorities. This was put into practice at drinking water reservoirs and municipal water tanks. To find the pH value, an Arduino board is utilized, together with a GSM module for message delivery and an LED display for ongoing monitoring of water parameters. The pH value of the water is finally displayed to the user.

IV. Proposed Methodology

Water is a vital resource for all forms of life, and ensuring its quality is crucial for the well-being of both human and environmental health. Water pollution can adversely affect aquatic ecosystems and the water quality available for consumption.

To address this issue, many systems that monitor the quality of water are proposed but they are all an application centric system i.e., systems focus on only one application like if water can be used for drinking, or for aqua culture etc.

But the proposed system provides for more than one application like drinking water, pharmaceutical applications, industrial applications where each application has their corresponding values for parameters.

Hence using this system one can know if the tested sample is useful for their purpose or not.

V. Conclusion

Water quality monitoring systems available today usually serve specific uses, including drinking water or medical applications. Nonetheless, there remains unrealized potential to broaden the range and adaptability of these systems to include several applications at once, hence augmenting their usefulness and influence. A single monitoring system could benefit various industries and sectors, such as public health, environmental conservation, and agriculture, by expanding its scope beyond specific uses.

Furthermore, there's a chance to improve the predictive power of water quality monitoring systems by utilizing cutting-edge technology like machine learning. Through machine learning algorithms, predictive models are created so that these systems can evaluate large datasets in real time, spot trends, and anticipate possible problems with water quality before they become more serious. Proactive monitoring and management can lead to far faster response times and more effective resource allocation for conservation and water treatment projects.

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