A SURVEY ON PERFORMANCE ANALYSIS OF IMPURITY DETECTION METHODS TO SUPERVISE THE AQUA QUALITY

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Abstract: Water is essential for all living things. We cannot life without water. However, water pollution is a major issue these days. Therefore, finding a remedy to water contamination is very vital. Water should be monitored to guarantee a safe supply of drinkable water and water that is suitable for many uses, for example commercial and agricultural processes. The layout of a low-cost mechanism for instantaneous IOT (internet of things) water purity as well, quantity monitoring can be seen within the current article. A pH, turbidity, and temperature sensor, among other sensors, are portion in the context that measures the physical characteristics in the water. The controller has the potential for process the measured values obtained from the sensors. Working as the Arduino model is worked as the controller of the system. Next-gen approaches for overseeing and regulating lucrative natural assets involving sustainable solutions through the internet of things. The research on the oversite of water using IoT systems spans diverse sectors such as agriculture, industry, residential areas, and fossil fuels exploration. This reflects the versatility and importance of IoT solutions in optimizing water usage and monitoring across different domains. In light of this, in contrast to other surveys accessible among the scholarly works, these work involves conducting an extensive analysis of 43 papers published between 2014 and 2022, focusing on systems proposed for comprehensive water management. If you have specific questions or need assistance with aspects of this analysis, keep a close eye on water in four different sectors: agricultural, industrial, residential, and oilfield sectors. During this piece of writing, moreover, we offer a novel optical system for managing water so as to fill a vacuum along the written word, especially for oil zone procedures requires need a great deal of moisture to boost oil output. This suggested system senses and transmits gathered data using a sophisticated optical method. When things are considered, the work offers a groundbreaking manual for further studies aimed at incorporating IoT under the domain of water monitoring and management.

Keywords: Internet of things, Arduino IDE, Water Pollution, Sensors, Controller, electric vehicles.

1. INTRODUCTION

Water is very essential part of life without water no one can survive. About 71% of the Earth's surface is covered with water. 96.5% of water is saline water present in sea. Less than 3% of water is fresh or non-saline. However, as the population grows, so does the contamination of the water nowadays. All living things now highly value drinking water. The majority of people on the planet use tainted water that contains varying levels of various pollutants for drinking and cooking, often due to vector diseases. Finding resolution regarding the water monitoring and control system is therefore crucial. Internet of things can be a fix. The network is the Internet Of things of interconnected gadgets that cooperate to efficiently support human tasks. The network of electronic gadgets that sends each other replies with the assistance of a controller is known as the "Internet of Things." These gadgets may take the shape of data analysis microchips, embedded systems, appliances, or sensors. This study offers an inexpensive water monitoring system. To ensure that addressing the problem with water quality and purity, this study offers a low-cost water monitoring system. For that system, sensors and microcontrollers are employed. Similar to pH, temperature, and turbidity sensors, water level is measured using sensors. Where the pH sensors are employed in determining the acidic or alkaline of water. The turbidity sensor are accustomed to measure the content of particle present inside the water. Where water contamination refers to presence of harmful substances or pollutants in water sources compromising their quality and making them unsuitable of consumption or use. This pervasive problems originate from a variety of causes, such as industrial discharge, agricultural runoff, improve waste disposal and natural processes. Contaminates may un-compose chemicals, heavy metals, pathogens and nutrients posing significant threats to both human well-being and ecosystem. Addressing water contamination is crucial for safe-guarding public health, sustaining bio-diversity and ensuring access to clean water for future generations. Another tool we have is the flow sensor, which measures the water flow. The Wi-Fi module (ESP 8266) allows the Microcontrollers to process the computed data from the sensors and upload them to the web. The used microcontroller is called Arduino.

Communication technology that is utilized for connecting the general components of the framework such as ZigBee, LOWPAN, Bluetooth, and WIFI. IoT cloud for processing, storing and analysis of data using emerging technologies such as Big Data, Edge Computing, Machine Learning (ML), an Artificial intelligence (AI) Power stuff such as chargeable/rechargeable batteries that could be equipped with energy harvesting components.

Plenty of skills are currently put into practices for water resource management and monitoring to serve different sectors. A section for the suggested scheme aimed at reducing the amount of waste water, improving the efficiency of the water distribution systems, and predicting as well as alerting the community of any serious environmental issues related to water, which is a portion of the road-map for creating future sustainable IoT solutions. This impetus is driven by many reasons, perhaps them is the estimated amount of water lost each year, when considering the urban supply systems in the developing world which could reach 32 billion cubic feet. Clearly this water waste contributes to energy waste, and, in turn, to global warming. This motivated transforming urban planning in 45 percent of cities and communities around the world to adopt new IoT-enabled water resource monitoring and management solutions by 2024 as it is stated by the International Data Corporation (IDC).

The contents in this work is structured as follows: section II categorizes recent work published in this field into agricultural, industrial, and residential applications. section III discusses open issues by reviewing the literature presented in section II. Part IV concludes the paper.

II. IWMS CLASSIFICATION

In this section, the IWMS Classification methods as been projected.

A. Agricultural (Irrigation)

As per the United Nations Food and Agriculture Organization, almost 60% of the freshwater utilized in framing worldwide are lost or squandered [1]. The rise in IoT technologies has stimulated interest among researchers, who have proposed using advanced IWMS instead of manually operated systems to achieve better water resource utilization. This advancement was discussed in, which provided a comprehensive examination of the published IWMS solutions between 2014 and 2019. The systems were categorized according to the first author's origin, water distribution method, sensor utilization, and water amount estimation. The work in [2] revealed that India has the highest interest in developing IWMS. This country's interest in developing a low-cost and efficient IWMS has significantly increased over the past few years. For instance, in, a cheap price system was proposed to monitor irrigation for Indian farmers. In [3], the authors presented a simple precision agriculture system for greenhouse monitoring connected through a web-based application. They also proposed a remote automated irrigation system, which provides notifications via mobile SMS using fog and IoT cloud technologies. A mathematical model to predict water amounts needed for irrigation was proposed, in addition to, a real-time monitoring of agricultural parameters including water.

B. Residential (Domestic)

For home IWMS applications, real-time adoption of IoT-based advanced approaches has been implemented to monitor residential water consumption and water quality. Because it makes it possible to create sustainable and managed home water systems, measuring the water level in water tanks has drawn a lot of attention from researchers. By turning a motor on or off in reaction to the water level, the system's creators they presented manage the flow into the tank. The information kept in the cloud and is accessible by homeowners via an Android application. The work in reported another tank sensor system installed and tested on a university campus to generate data reports, resulting in later accessing by end-users via the web or sent by SMS or email alerts. A system that operates on a larger scale, such as for a village or urban area, was proposed in this system.

In [4], Another important area of current research attention is the rise to prominence of clever tracking of the condition of water tools that will replace the necessity and expense of laboratory water analysis. A pilot project that installs a intelligent fluid grid-like control system in a community close to the Bay of Bengal was covered by the writers in. To keep an eye on the water's quality, the team put a range of sensors at carefully selected places, producing real-time data. Following that, a microcontroller in a long-range (LoRa) module that connects towards the cloud for storage via a LoRa gateway was linked to these sensors. If the system detects a drop in the dire case of the water below allowable limits, the end-user can access an email, SMS, and web interface that alerts the authorities.

C. *Industrial*

Industrial facilities count among those primary water pollution sources; however, monitoring and regulating the excellence pertaining to the fluid with IWMS for large-scale applications is a challenging task. These applications require complex IoT systems with many different sensor types and the vast amounts of collected data require efficient monitoring and managing algorithms [5]. The authors in targeted large-scale industrial wastewater monitoring by proposing a WSN that interconnects various sensors, such as turbidity, density, temperature, and pH, by using IoT for long-term real-time monitoring and water level reporting. A prototype created to minimize water contamination due to industrial activities was proposed in .The system involves pH, conductivity, temperature, and turbidity sensors that are interconnected using Zigbee and WiFi modules controlled through the IoT.

To enable water quality predictions for large-scale applications, an enhanced method of machine learning was presented in as a subsequent step in an internet of things-based intelligent water's condition monitoring system that comprises of four sensors: pH, temperature, conductivity, and turbidity. WDSs need to optimize water supply and use in addition to lowering water pollution. This was addressed in the work that was submitted in, which sought to create a thorough water management system at the municipal level.

III. OPEN ISSUES AND FUTURE RESEARCH DIRECTION

A. Proposed System Infrastructure

1) Advanced Optical Sensors

Physical, chemical, optical, and biosensors are the four groups that these sensors is dividing. The only practical method that enables real-time measurements without the requirement for chemical reagents is the application of optical sensors. These sensors generate outcomes that are typically within 3–5% of laboratory data, demonstrating their excellent level of accuracy. Measurements of markers of water effectiveness, such as dissolved oxygen are made with optical sensors, pH, turbidity, bacteria, hydrocarbons, and nitrates; however, the only optical sensor type, which decompose the spectral absorption properties of the sensed material such that the traits of interest can be estimated, are the optical nitrate and multispectral sensors.

Sensors based on multispectral photos haven't been investigated across the regulation of IWMSs for oilfield applications, to the best of this authors' knowledge . Multispectral imaging research, where Various visuals are utilised to capture material data within individual spectral bands, acted as a significant focus of academic and industrial interest since 1970 because of this concept of 'spectral fingerprint' of each material. The gathered information is examined to determine particular chemical properties. Multispectral imaging is a useful non-invasive method for determining the composition of materials, although its utility had constrainted by the size and expense of the multispectral cameras.

2) Data Transmission Techniques

The need to acquire data from underground wells, the elevated pressures and temperatures, and the corrosive media in the downhole pipes makes data collection and transformation using wireless communications techniques, [6] such as Bluetooth WiFi LoRa/LoWPAN GSM and GPRS . Implying that the only feasible solution for data transmission that can withstand the heat, pressure, moisture, corrosion, and vibration expected is optical communication technology: either wireless or wired techniques such as wired optical fiber or directed laser light. Wireless laser-based photonic Proposals are overlooked for oilfield applications, although free-space visible laser light communication (VLLC) technology is promising for compact and high-speed wireless communication links.

3) Architectural Design

The entire system; i.e, the sensors and the transceiver, all packed into the ruggedized carrier, can be preassembled at a factory before in-well installation. Another possible alternative would be to install the carrier during drilling operations since the remote sensing parts, including the transceivers and the sensors, can be installed by utilizing an underground in-pipe robot. The robot would need to be lightweight, mobile, suitable for the diameter of the in-line pipeline, suitable for a long-distance pipeline, and high temperature and pressure resistant. Robots are useful and often utilised in many similar applications.

Optical windows should be integrated within the ruggedized carrier so that the light signal can penetrate the carrier to the desired sensed liquid. The optical window should also have high optical performance to avoid affecting the utilized multispectral camera. The optical sensor should be protected from harsh conditions, such as high pressure, high temperature, corrosivity, and vibration, so it can operate without damaging the sensing elements that must be protected with a robust sensor capsule. It is noteworthy also to mention that suitable capsules have been designed using 316L Stainless Steel because of it's resistance to oxidation and qualities that prevent corrosion, was being able to withstand high pressure up to 15,000 psi and temperatures up to 150∘ C

IV. MONITORING WATER QUALITY'S DIFFICULTIES AND CONTAMINATION DETECTION

Monitoring the condition of water and identifying contaminants are critical for ensuring safe and sustainable water resources. However, these tasks come with several issues demanding attention for effective and reliable monitoring. These include a few of the main obstacles:

- Implement a network of IoT sensors to collect real-time data on key water quality parameters.

- Artificial intelligence is used by employees to analyze real-time data on water quality and spot trends, abnormalities, and patterns.
- To measure Technologies used to detect and monitor water leakages and pilferage.
- Utilize machine learning models to predict potential water quality issues based on historical data environmental factors and seasonal variations.
- To examine methods for detecting and keeping an eye on water quality.
- To create an internet of things model to keep to an eye on leaks and water quality.

V. CONCLUSION

With the aid of an Arduino board and A handful of sensors, the TDS, temperature, turbidity, and Water's pH values are measured in this suggested system. In the future, factors such as conductivity, hardness, chloride, ammonia, iron, and fluoride will also be considered while calculating the water quality. These values accustomed to verify the water's purity for an assortment of uses, including drinking water and everyday necessities. With the aid of this suggested technique, we are capable of acquiring clean and useable water. By utilizing AI algorithms, analytical capabilities are improved and abnormalities and patterns that could be missed by traditional approaches are now able to be detected.

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