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A SURVEY ON WATER QUALITY DETECTION

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Abstract: Water quality detection plays a crucial role in safeguarding human health, protecting ecosystems, and ensuring sustainable water management practices. This abstract provides an overview of recent advancements in water quality detection methodologies, highlighting the integration of innovative technologies, the challenges faced, and the emerging opportunities in this field.

Key technological advancements include the development of sensor technologies such as biosensors, nano material-based sensors, and IoT-enabled devices. These sensors offer real- time monitoring capabilities for various water quality parameters, including pH, dissolved oxygen, turbidity, and the presence of contaminants such as heavy metals and pathogens. Furthermore, advancements in data analytics, including machine learning algorithms and data fusion techniques, enable the integration of heterogeneous data sources to provide comprehensive insights into water quality dynamics.

Keywords: water conservation, urban settings, innovative strategies, water scarcity, comprehensive framework, sustainable water management practices

I. INTRODUCTION

The process of evaluating the chemical, physical, and biological properties of water to assess its suitability for various uses, including drinking, irrigation, industrial processes and aquatic habitats. Water plays acrucial role in various aspects of life, including drinking, agriculture, Industry and ecosystems. Ensuring the quality of water is essential for human health and the environment. Water quality refers to the chemical, physical, biological and radiological characteristics of water which determines its suitability for specific users.

Water quality detection includes PH, dissolved oxygen, temperature, concatenation. Various method and tool shave been developed for water quality detection, ranging from traditional laboratory– based technique to modern, portable sensors and monitoring systems.

There some of these tests can be used to determines if the water is safe for drinking, swimming, fishing, or other uses. They can also be used to identify and track changes in water quality over time.

IMPORTANCEOF WATERQUALITY DETECTION

- The presence of these factors makes water quality highly important for farmers. Therefore, farmers need to monitor water quality regularly.

- Monitoring water quality is all the efforts farmers do in observing, recording, and evaluating the quality of water as a guidance in taking appropriate measures in their pond. By regularly monitoring water quality, farmers can increase the chances of a successful cultivation.

- High-quality water will help shrimp survive and grow well, leading to the achievement of productivity targets. Without monitoring water quality, farmers cannot be aware of the conditions of their cultivation and, as a result, cannot anticipate problems such as shrimp diseases and more.

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II. LITERATURE REVIEW

S.NO	YEAR	TITLE	DESCRIPTON
1	2023	Intelligent aqua culture water quality detection scheme based on Turmass technology [1].	The Intelligent Aqua Culture Water Quality Detection Scheme utilizes Turmass technology for efficient monitoring. This innovative approach combines intelligent sensors with Turmass algorithms to assess key water quality parameters in aquaculture settings. By leveraging advanced analytics, the system provides real-time insights into factors like turbidity, temperature, and mass concentration, enabling proactive management and ensuring optimal conditions for aquatic organisms. This integrated solution enhances precision and responsiveness in aquaculture operations, contributing to sustainable and successful farming practices.
2	2022	Machine learning model for IOT edge devicebased water quality monitoring [2]	For water quality detection on IOT edge devices, a suitable machine learning model could be a binary classifier, such as a Logistic regression or a support vector machine. Input features may include sensor data like pH levels, turbidity, temperature train the model on labelled data indicating "good" or "bad" water quality. Optimize the model for resource efficiency and deploy it on the Edge devices for real –time monitoring. Regularly update the model to adapt to changing water condition.
3.	2021	Water quality monitoring system: A small city application with iot Innovation[3]	It involves following steps: Sensor Selection: Choose iot enables sensors for key water quality parameter like pH, turbidity, dissolved oxygen. Centralized Platform: Develop a cloud-based platform to aggregate and store real time data Alert System: Integrate an alert system to notify authorities in case of water quality deviations Scalability: Design the system to be scalable for potential expansion to cover more area Consider future iot advancements and compatibility Security Measures: Implement robust security protocols to safeguard sensitive water quality data Use encryption and secure communication channels

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4	2020	Design and implementation of a home intelligent water quality inspection Device[4]	It involves following steps: Understanding Turmass technology: gain a deep understanding of turmass technology and its capabilities on water quality detection Sensor Selection: Choose turmass sensors suitable for aquaculture applications, considering parameters like pH, dissolved oxygen, temperature System Architecture: Consider the placement of sensors within the aquaculture environment for optimal data collection User Interface: Design a user-friendly interface for aqua culturists to monitor and interpret water quality data. Power Efficiency: Implement power efficiency mechanisms for prolonged sensor operation Validation and Calibration: Conduct thorough validation and calibration of turmass sensors in the aquaculture environment. Ensure accurate readings and re ability overtime
5	2019	Research on Data Acquisition Method of Water Quality Detection Based on Revolving Door Algorithm[5]	This paper outlines the initial stages of a wireless sensor-based drinking water quality monitoring system. The system aims to detect and locate changes in water quality in real-time, assess their significance, understand consequences, and recommend appropriate actions. The process begins with determining optimal locations for quality control points in the drinking water distribution system. Subsequently, an anomalies detection algorithm is developed to identify contamination and malicious activities. Considering environmental parameters, a data aggregation method is proposed to minimize energy consumption at source nodes and reduce network load.
6	2018	A Study on Detection and Monitoring of Water Quality and Flow[6]	The paper addresses pressing issues related to water crises, including the scarcity of drinking water, unpredictable floods, and shifting water stream patterns, contributing to an increasing death rate worldwide. Researchers are actively working on leveraging computing techniques for detecting and monitoring water quality and flow, aiming to mitigate uncertainties in drinking water quality and provide early flood warnings. The paper provides an overview of existing literature, focusing on data sources and techniques employed for water quality and flow monitoring. It acknowledges the challenges in obtaining real-time and reliable data, highlighting limitations such as location dependency in predictions. The study serves as a guide for researchers, offering insights into potential data sources while considering tradeoffs in addressing these critical issues.

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7	2017	Towards water quality monitoring system based on wireless sensor networks[7]	Water quality monitoring system based on wireless sensors networks involves deploying sensors to collect data on various water parameter. This may include pH, turbidity, dissolved oxygen and more. The wireless sensor network facilitates real time data transmission, enabling continuous monitoring of water quality, such as system enhance environmental surveillance, allowing for prompt detection of pollution events or changes in water condition researches often explore wireless sensor network-based solution in this paper focusing on sensor deployment strategies, data transmission protocols, and efficient management of collected information for effective water quality monitoring.
8	2016	Detection of water quality multi parameter in sea water based on UV VIS spectrometer [8]	Detecting water quality in sea water using UVVIS (Ultraviolet-visible)spectrometer involves analyzing multiple parameter simultaneously this includes measuring absorption and transmission of light in UV and visible spectrum to determine characteristics such asnutrientconcentration,organicmatter,andpollutantlevelsutilizing UV VIS spectrometry allows for real time, multi parameter analysis, providing valuable insights into the overall quality of sea water and facilitating timely environmental monitoring and management.
9	2015	Application of water quality index for pollution at Luton Hoo Lake[9]	The application of water quality index for pollution assessment at Luton HooLake involves evaluating various water parameter. This paper cover topic like sensor technologies, data analysis methods and overall system design for efficient monitoring and assessment. The application could include using sensor network and advanced data analysis technique to asses and categorized water quality this aids in understanding the extent of pollution and picks "mcd await decision making for water resources management at Luton Hoo Lake.
10	2014	Water quality event detection based on Multivariate empirical mode decomposition[10]	This paper addresses the critical importance of water quality event Detection for national security and public health. It introduces a novel approach for enhancing the detection rate of accidental or intentional water contamination events. The proposed method utilizes multivariate empirical mode decomposition (MEMD), an advanced algorithm for analyzing nonlinear and non-stationary signals. Through MEMD, a sequence of n-dimensional intrinsic mode functions (IMFs) is generated. The Mahalanobis Distance is then employed for information fusion, and the normalized instantaneous energy (NIE) is used for anomaly detection. This approach aims to overcome limitation of standard Empirical Mode Decomposition (EMD) by considering multiple variations in water quality signals, thereby improving the overall effectiveness of water quality event detect

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11	2013	Web-based irrigation management for open canals using wireless sensor network[11]	The paper presents a Wireless Sensor Network (WSN) configuration designed for the management of crop irrigation in regions utilizing open canals and water pumps. The system integrates water level sensors along main irrigation canals and flow sensors on water pumps. Each sensor is linked to a solar- powered Zigbee module, forming a sensor node. These nodes communicate with a Zigbee gateway, which periodically collects sensor data and transmits it to a web server via GPS connection. The system's backend comprises a web server connected to a database, tracking irrigation water levels in main and auxiliary canals. Additionally, the system monitors water usage indifferent land areas, comparing it to optimal amounts based on crop type. The prototype has been successfully implemented, deployed, and tested in a typical village in the delta of Egypt, addressing challenges related to the equitable distribution of irrigation water.
12	2011	Detection and realization of lake water quality detection system based on wireless sensor networks [12]	Detection and implementation of a lake water quality monitoring system based on a wireless sensor within the lake to measure various parameters. This can include factors like pH, dissolved oxygen, temperature, and pollutant levels. The WSN facilitates real time data collection and transmission, enabling continuous monitoring. Key aspects of research or system design may include sensor selection, network architecture, communication protocols, and data analysis method

III. CONCLUSION

Detecting water quality is crucial for ensuring safe and clean drinking water. Here are some solutions for water quality monitoring:

Conventional Methods:
Traditional methods involve manual laboratory analysis, which is time-consuming and expensive. These methods are inefficient for real-time monitoring and detecting water contaminants.

Emerging Technologies:
Internet of Things (IoT): IoT-based systems offer smart and low-cost solutions for water quality monitoring.

Machine Learning: ML techniques can analyse water quality trends and detect anomalies, such as intentional water contamination.

Real-Time Monitoring: Implementing real-time monitoring using IoT devices can provide timely data on water quality.

UNICEF's Challenge:
UNICEF is seeking innovative solutions to rapidly and accurately identify faecal contamination in water. Current methods for quantifying E. coli contamination are cumbersome and limit on-site testing.

Stake holder Consultations:
UNICEF hosts forums to exchange knowledge and prototype innovations for water quality monitoring1.

These efforts aim to improve water quality, ensure safe drinking water, and enhance community-led water resource management.

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