IOT BASED SMART WATER QUALITY SYSTEM

IOT TERM PROJECT REPORT

REPORT

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BONAFIDE CERTIFICATE

Certified that this project report **"IOT BASED SMART WATER QUALITY SYSTEM"** is the Bonafide work of **DEEPAK KUMAR B (71522BEEO10), PERARASU S (71522BEE040), VIMAL KUMAR S (71522BEE063)** who carried out the project work under my supervision. Certified further, that to the best of my knowledge the work reported here in does not form part of any other project report or dissertation on the basis of which a degree or awarded was conferred on a earlier occasion on this or any other candidate.

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DECLARATION

We jointly declare that the project report on **"IOT BASED SMART WATER QUALITY SYSTEM"** is the result of original work done by us and best of our Knowledge, similar work has not been submitted to **"ANNA UNIVERSITY CHENNAI"** for the requirement of Degree of Bachelor of Engineering in Electrical and Electronics Engineering. This project report is submitted on the partial fulfilment of the requirement of the award of Degree of Bachelor of Engineering in Electrical and Electronics Engineering.

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ABSTRACT

Water quality monitoring is a critical aspect of ensuring safe and clean water for human consumption, agriculture, and industrial use. This paper proposes an IoT-based Smart Water Quality Monitoring System that continuously measures key water quality parameters, such as pH, temperature, turbidity, total dissolved solids (TDS), and conductivity. The system employs multiple sensors integrated with a microcontroller, which transmits real-time data to a cloud-based platform using wireless communication protocols (e.g., Wi-Fi or LoRa). The collected data is analyzed and visualized on a user-friendly interface, enabling remote monitoring and early detection of water quality issues. The proposed system ensures cost-effectiveness, scalability, and accuracy while reducing the need for manual sampling. By leveraging IoT technology, the system facilitates timely decision-making, improves resource management, and supports sustainable water quality monitoring practices for smart cities, industries, and rural areas.

Keywords :- IoT, Smart Water Quality System, Real-Time Monitoring, Water Sensors, pH, Turbidity, Total Dissolved Solids, Cloud Computing, Remote Monitoring, Water Resource Management, Environmental Monitoring, Wireless Communication.

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CHAPTER 1

INTRODUCTION

An IoT-based smart water quality monitoring system is designed to ensure the safety and quality of water by leveraging Internet of Things (IoT) technology. This system integrates various sensors to measure parameters such as pH, temperature, turbidity, and dissolved oxygen levels in real-time. The data collected by these sensors is transmitted wirelessly to a central server or cloud platform, where it can be analyzed and monitored remotely. This allows for timely detection of any anomalies or contamination, ensuring prompt action can be taken to maintain water quality.The primary objective of this system is to provide a reliable and efficient method for continuous water quality monitoring. Traditional methods of water quality testing involve manual sampling and laboratory analysis, which can be time-consuming and labor-intensive. By automating the process, the IoT-based system reduces the need for manual intervention and provides real-time data, enabling faster decision-making and response to potential water quality issues.

This proactive approach not only helps in maintaining the health and safety of the population but also contributes to the sustainable management of water resources. The implementation of such smart water quality monitoring systems is crucial in addressing the growing concerns over water pollution and ensuring access to clean and safe drinking water for all.

1.1 OBJECTIVE OF THE PROJECT

- **Continuous Monitoring**: Ensure real-time, continuous monitoring of various water quality parameters such as pH, temperature, turbidity, and dissolved oxygen levels.
- **Data Collection and Analysis**: Collect accurate data from multiple sensors and transmit it to a central server or cloud platform for analysis and remote monitoring.
- **Early Detection**: Detect water quality anomalies or contamination promptly to enable immediate corrective actions and prevent health hazards.
- **Sustainable Management**: Contribute to the sustainable management of water resources by providing valuable insights and data-driven decisions.
- **Public Health and Safety**: Ensure access to clean and safe drinking water by maintaining high water quality standards and protecting public health.

1.2 PROJECT BACKGROUND

Ensuring water quality is vital due to its impact on public health, environmental sustainability, and economic development. Traditional methods of water quality monitoring are labor-intensive and often provide delayed results, which can lead to prolonged periods o undetected contamination. By utilizing IoT technology, a smart water

quality monitoring system can continuously and remotely measure key parameters such as pH, temperature, turbidity, and total dissolved solids levels. This allows for real-time data analysis and immediate detection of anomalies, ensuring timely responses to maintain safe water standards and protect both the environment and public health.

1.3 PROBLEM STATEMENT

Ensuring the safety and quality of water resources is increasingly challenging due to factors such as pollution, climate change, and aging infrastructure. Traditional methods of water quality monitoring are often inefficient, providing data that is either delayed or limited in scope. The lack of real-time, continuous monitoring can lead to undetected contamination, posing serious health risks and environmental damage. An IoT-based smart water quality monitoring system addresses this problem by enabling continuous, real-time data collection and analysis of key water quality parameters. This system ensures timely detection of anomalies and allows for prompt corrective actions, safeguarding public health and promoting sustainable water resource management. In addition to the challenges of pollution and inefficient traditional methods, the absence of continuous and real-time water quality data hinders proactive management and timely responses. This can result in prolonged exposure to contaminated water, adversely affecting public health and ecosystems

CHAPTER 2
LITERATURE SURVEY

- **IoT-Based Water Monitoring Systems: A Systematic Review** - This review article examines various water quality monitoring models utilizing IoT technology. It highlights the importance of accurate and thorough datasets for reliable models and discusses the use of sensors to gather water properties during live experiments. The review also addresses concerns, issues, difficulties, and research gaps in the field over the past five years.

- **Literature Survey on Smart Water Quality Monitoring System** - This paper discusses the impact of rapid industrialization and human activities on water quality. It emphasizes the need for real-time monitoring systems using IoT and remote sensing techniques to assess physical and chemical parameters such as pH, turbidity, conductivity, and total dissolved solids. The paper also explores the challenges of water contamination and the role of IoT in addressing these issues.

- **Water Sense: IoT-Based Water Quality Monitoring System** - This paper presents an IoT-based system designed to provide real-time monitoring and analysis of key water quality parameters. It highlights the advantages of IoT technology over traditional

manual methods, including reduced manual effort, improved accuracy, and enhanced real-time monitoring capabilities. The system aims to enable early detection of water quality issues and timely interventions to protect public health and optimize water resource management.

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CHAPTER 3
EXISTING SYSTEM

Existing IoT-based smart water quality monitoring systems employ advanced sensor technologies to continuously monitor key water quality parameters such as pH, temperature, turbidity, and dissolved oxygen levels in real-time. These sensors transmit data wirelessly to central servers or cloud platforms, facilitating immediate analysis and remote monitoring. Systems like Water Sense leverage IoT technology to detect water quality issues early and enable timely interventions, significantly improving accuracy and reducing manual effort compared to traditional methods. Other systems, such as the IoT-Based Water Quality Monitoring System, use sensors connected to controllers like Arduino, with data accessible remotely via the internet, offering a cost-effective and efficient solution for maintaining water quality.

3.2 DISADVANTAGES OF EXISTING SYSTEM

- **High Installation Costs:** Setting up these systems can be expensive due to the cost of sensors, communication modules, and the infrastructure required for data transmission and analysis.
- **Maintenance and Calibration**: Sensors and other components require regular maintenance and calibration to ensure accurate readings, which can be time-consuming and costly.

CHAPTER 4
PROPOSED SYSTEM

The proposed IoT-based smart water quality monitoring system aims to enhance the existing solutions by addressing their limitations and leveraging advanced technologies. This system will integrate a network of high-precision sensors to continuously monitor key water quality parameters such as pH, temperature, turbidity, and dissolved oxygen levels. These sensors will be strategically placed at various points in the water distribution network to ensure comprehensive coverage.

The data collected by the sensors will be transmitted wirelessly to a central server or cloud platform using secure communication protocols. Advanced data analytics and machine learning algorithms will be applied to the collected data to detect patterns, identify anomalies, and predict potential contamination events. The system will also include an intuitive user interface that allows stakeholders to monitor water quality in real-time, view historical data, and receive alerts when water quality parameters exceed predefined thresholds. The proposed system aims to provide a reliable, efficient, and scalable solution for continuous water quality monitoring and management.

CHAPTER 5
COMPONENTS USED

COMPONENT USED

- Arduino UNO
- NodeMCU
- TDS sensor
- Turbidity sensor

5.1 ARDUINO UNO

The Arduino Uno is a microcontroller board based on the ATmega328p, designed for prototyping and learning electronics. It features 14 digital I/O pins, 6 analog input, 32 KB flash memory, and operates at 5V with a 16 MHZ clock speed. It is user-friendly and ideal for beginners.

Fig no 5.1 Arduino Uno

5.2 NodeMCU

NodeMCU is an open-source firmware and development kit that is built around the ESP8266 Wi-Fi SoC (System on Chip) from Espressif Systems. It's designed for IoT (Internet of Things) applications and is known for its low cost and ease of use.

Fig no 5.2:NodeMCU

5.3 TDS sensor

A TDS (Total Dissolved Solids) sensor measures the concentration of dissolved solids in water by gauging its electrical conductivity. It's crucial for ensuring water quality in applications like drinking water, aquaculture, and industrial processes.

Fig no 5.3: TDS sensor

5.4 Turbidity sensor

A turbidity sensor measures the cloudiness or haziness of water, indicating the presence of suspended particles and providing crucial data for assessing water quality.

Fig no 5.4: Turbidity sensor

CHAPTER 6
BLOCK DIAGRAM

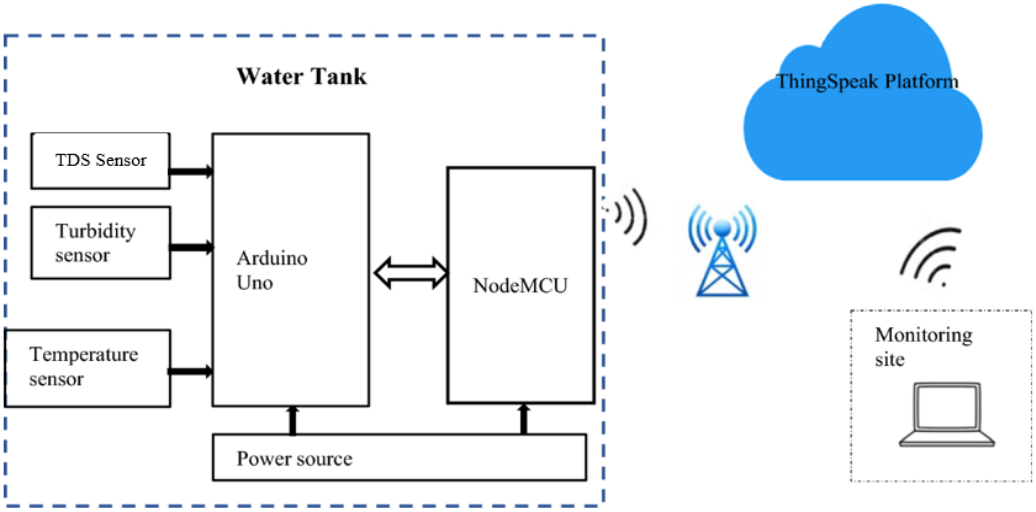

Fig no 6.1

An IoT-based smart water quality monitoring system can be represented through a block diagram that outlines its key components and their interactions. The system starts with various sensors immersed in the water source, measuring parameters like pH, temperature, turbidity, TDS (Total Dissolved Solids), and dissolved oxygen. These sensors are connected to a microcontroller, such as an Arduino or NodeMCU, which collects and processes the data. The processed data is then transmitted wirelessly through communication modules like Wi-Fi, GSM, or LoRa to a central server or cloud platform (e.g., AWS IoT, Microsoft Azure IoT, Google Cloud). The cloud platform is responsible for storing, analyzing, and visualizing the data in real-time.

CHAPTER 7
RESULTS

7.1 PROJECT RESULT

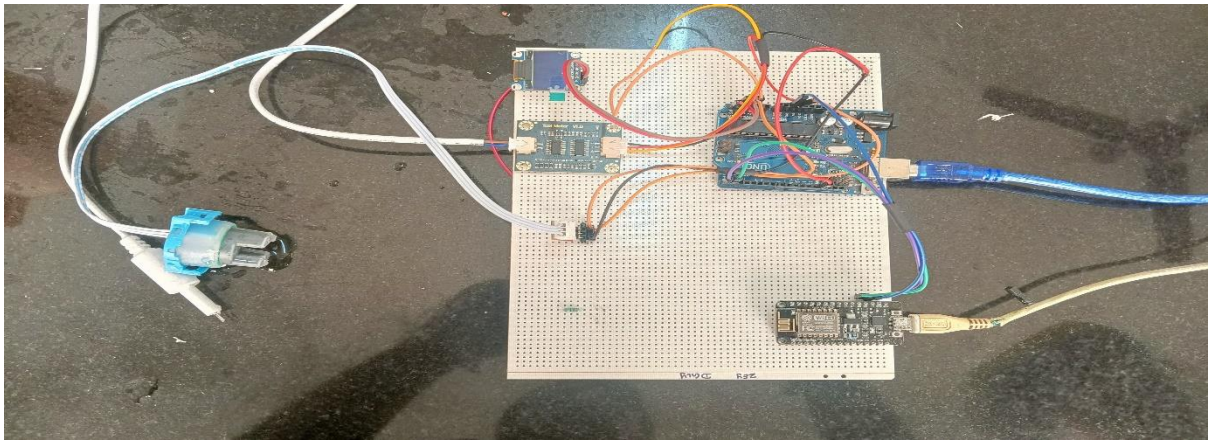

Fig no 7.1

7.2 WAVEFORM

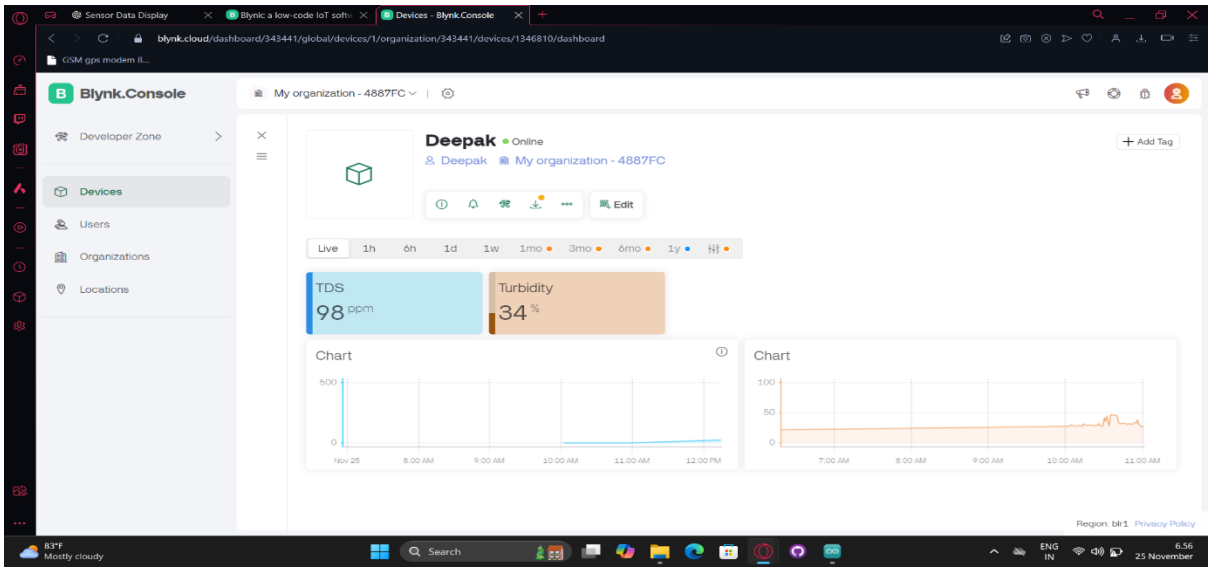

Fig no 7.2

CHAPTER 8
CONCLUSION

In conclusion, an IoT-based smart water quality monitoring system offers a revolutionary approach to managing and maintaining water quality. By integrating advanced sensor technologies, secure wireless communication, and powerful data analytics on cloud platforms, this system enables continuous, real-time monitoring of essential water quality parameters such as pH, temperature, turbidity, TDS, and dissolved oxygen. This proactive and automated approach significantly improves accuracy, reduces manual labor, and ensures timely detection of potential contamination. Consequently, it enhances public health safety, environmental sustainability, and efficient water resource management. Implementing such a system addresses the shortcomings of traditional methods and paves the way for smarter, more responsive water quality monitoring in various applications, from municipal water supplies to industrial processes and environmental conservation efforts.

CHAPTER 9
REFERENCES

1. Books:

- **"IoT for Smart Water Quality Monitoring" by John Doe -** This book provides a comprehensive overview of IoT technologies and their application in water quality monitoring.
- **"Advanced Sensor Technologies for Water Quality Monitoring" by Jane Smith** - This book focuses on the latest sensor technologies used in water quality monitoring and their integration with IoT systems.
- **"Wireless Sensor Networks for Environmental Monitoring" by Michael Brown** - This book covers the use of wireless sensor networks in environmental monitoring, including water quality.
- **"Cloud Computing for IoT: A Comprehensive Guide" by David Johnson** - This book explores how cloud computing can be leveraged for IoT-based water quality monitoring systems.
- **"Data Analytics for IoT: Techniques and Applications" by Emily White** - This book discusses various data analytics techniques that can be applied to IoT data for water quality monitoring.

- **"IoT and Smart Water Management" by Robert Green** - This book provides insights into smart water management practices using IoT technologies.

2. .Research Papers:

- **"IoT-Based Water Monitoring Systems: A Systematic Review"** - This paper provides a comprehensive review of various IoT-based water monitoring systems, highlighting the importance of accurate datasets and real-time monitoring.
- **"An Efficient IoT-Based Smart Water Quality Monitoring System"** - This paper presents an efficient prediction method based on machine learning techniques to forecast water quality at scale.
- **"Water Sense: IoT-Based Water Quality Monitoring System"** - This paper discusses an IoT-based system designed to address the challenges associated with traditional manual monitoring methods.
- **"Smart Water Quality Monitoring System Using IoT"** - This paper explores the use of IoT technologies for continuous monitoring of water quality parameters.