PROJECT PROPOSAL FORMAT

Project Title: Water Quality Monitoring System Team ID: 11

INTRODUCTION:

The project aims to address the critical need for effective water quality monitoring systems. With increasing industrialization, urbanization, and agricultural activities, water bodies are facing contamination from various pollutants, including chemicals, heavy metals, and pathogens. Contaminated water causes significant risks to human health, aquatic ecosystems, and overall environment. The present Traditional monitoring methods often lack real-time data collection, accuracy, and efficiency, leading to challenges in timely detection and response to water quality issues which is dangerous for environment. Therefore, there is a need for a comprehensive water quality monitoring system that can provide reliable, real-time data to ensure the safety of the human and animal health by ensuring the safety of water resources.

Project's objectives:

The project's primary objectives are to develop and implement an advanced water quality monitoring system capable of:

1. Real-time Monitoring of water quality: Designing(or)Selecting sensors and data collection mechanisms to continuously monitor key parameters such as pH, turbidity, temperature, and total dissolved solids.
2. Data Analysis and Interpretation: Developing algorithms and analytical tools to process the collected data, identify patterns, and detect anomalies indicative of water quality issues.
3. Remote Accessibility: Creating a user-friendly interface accessible via web or mobile platforms, allowing authorities and researchers to remotely access real-time water quality data and analysis.
4. Early Warning System: Implementing automated alert mechanisms to notify relevant authorities and agencies in case of deviations from

established water quality standards or the presence of hazardous contaminants.

5. Integration with Existing Infrastructure: Ensuring compatibility and seamless integration of the monitoring system with existing water management infrastructure and networks to facilitate data sharing and decision-making.

Deliverables of the project include:

1. web applications for data collection, analysis, and visualization.
2. Documentation and guidelines for system deployment, operation, and maintenance.

HARDWARE REQUIREMENTS:

SENSORS:

*1.*Temperature sensor (waterproof)

Quantity required: 2

Series: DS18B20

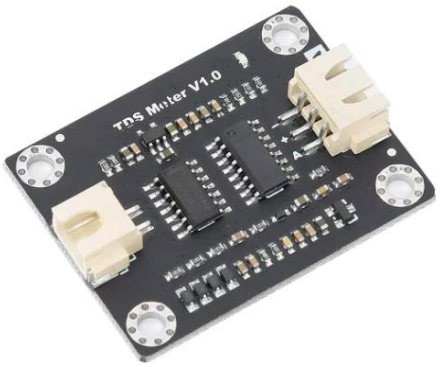
Reference link:

https://www.electronicscomp.com/ds18b20-water-proof-temperature-sensor-probe-india?gad_source=1&gclid=Cj0KCQjwzZmwBhD8ARIsAH4v1gXFZXirRAg9VjM3Zh2wLuka0C69xXAxp9SuOustCjE_xk_HpNhU_fEaApGOEALw_wcB

1.This sensor's primary purpose is temperature measurement which allows for precise temperature measurement between -55°C and +125°C (-67°F and +257°F).

2.Analog TDS Sensor Water Conductivity Sensor Module Board Kit which includes:

1. TDS signal adapter board



The TDS signal adapter board makes it possible to integrate with control systems or data logging platforms by digitally transforming the TDS sensor output.

2. Waterproof TDS probe

It can precisely detect the concentration of dissolved solids in water while withstanding exposure to dampness and water. It is the main sensing part .

3.Analog sensor line

It is just a wire that helps in connecting the adapter board to esp32.

Quantity required:1

Reference link:

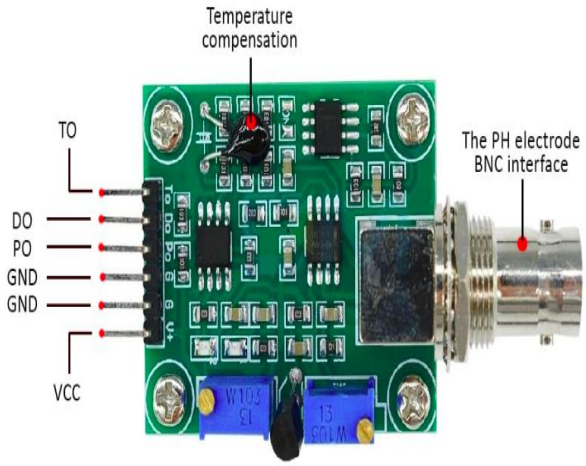
https://www.indiamart.com/proddetail/analog-tds-sensor-water-conductivity-meter-liquid-detection-tester-diy-water-quality-monitoring-2851522086462.html

3. PH Sensor Kit for Water with Buffer Solutions which includes:

1. Industry pH electrode

It is main sensing part of the pH sensor.

2.pH sensor circuit board



This circuit board provides a BNC interface for the receiving electrodes raw output and make necessary conversions and then sends it to micro controller.

Quantity required:1

Reference link:

https://www.electronicscomp.com/analog-ph-sensor-kit-for-arduino?gad_source=1&gclid=Cj0KCQjwzZmwBhD8ARIsAH4v1gWI4DDJ5rv77fuyuXfNW2_ZovfkTTVMoxaGrEIW1SuIglmNYlNoKaYaAkNZEALw_wcB

4.Turbidity sensor's kit:

1.turbidity sensor with module

This is the main sensing part for measuring water turbidity level.

2.connecting cable

Helps in connecting sensing part to the esp32

Quantity:2

Reference link:

https://www.electronicscomp.com/turbidity-sensor-with-module?gad_source=1&gclid=Cj0KCQjwzZmwBhD8ARIsAH4v1gUxO-XfvnCltyPqTSZN0nVKLiLQP7vIqusjpqw1qZ4OtvWRwkuVe_waAiIxEALw_wcB

Controllers:

1. ESP32

   Quantity :1

   This in an microcontroller which receives the sensor's data and modifies it to readable format if necessary and makes calculations for alerts as per the delay which was set in the code and send the data to the respective channel in the OM2M.

Other features:

1. Power Supply: Depending on the deployment location, options might include battery power or mains power. We ensure that the power supply is reliable and capable of sustaining continuous operation for extended periods.
2. Calibration Equipment: standard pH buffer solutions with known pH values for pH sensor calibration, Reference standards like formazin turbidity standards for turbidity sensor, Standard TDS calibration solutions containing known concentrations of dissolved salts (e.g., potassium chloride) are used to calibrate TDS sensors etc.

DATA COLLECTION PLAN:

1.Sensor Data Acquisition:

We will write code on the ESP32 to read data from each sensor periodically. we will use appropriate libraries and functions to interface with each sensor and obtain accurate readings.

2. Data Transmission:

Once sensor data is obtained, it needs to be formatted properly for transmission. In this case, since we're using HTTP requests for OM2M, we'll format the data into a JSON payload. This JSON payload will contain the readings from each sensor.

After formatting the data, the ESP32 will utilize its Wi-Fi connectivity to establish a connection with the internet. This involves connecting to an available Wi-Fi network using the ESP32's Wi-Fi module and obtaining an IP address through DHCP. Once connected to the internet, the ESP32 will then implement the HTTP protocol for data transmission. Specifically, it will make POST requests to the appropriate OM2M RESTful API endpoints, including the formatted sensor data in the request body. To ensure organized data handling, specific channels or topics can be designated for each type of sensor data within the HTTP request payload. This way, OM2M can parse the incoming data and route it accordingly for storage and further processing.

3. Frequency of Data Fetching:

We will fetch the frequency of data depending on the application requirements and the dynamic nature of the water.

Example: For flowing rivers, we try to fetch data frequently (e.g., every few minutes) to capture changes in real-time.

4.Data visualisation on OM2M:

We use plotting libraries or visualization tools to create graphs and charts based on the retrieved sensor data.

* Below are the alert messages or outcomes possible to send/notify based on the data obtained:

pH Sensor:

Problem 1 (Exceeding Limit): pH level is higher than the safe limit, indicating alkaline water, which can lead to pipe corrosion and skin irritation.

Solution: Implement pH adjustment systems using neutralizing agents like citric acid or vinegar to lower the pH level within the safe range.

Problem 2 (Below Limit): pH level is lower than the safe limit, indicating acidic water, which can corrode pipes and fixtures and cause metallic tastes.

Solution: Install alkaline injection systems to raise the pH level within the safe range, ensuring proper corrosion control and preventing taste issues.

Temperature Sensor:

Problem 1 (Exceeding Limit): Water temperature exceeds the safe limit, promoting bacterial growth and posing scalding hazards.

Solution: Install temperature control devices such as thermostatic mixing valves to regulate water temperature within the safe range and prevent bacterial proliferation and scalding.

Problem 2 (Below Limit): Water temperature falls below the safe limit, leading to reduced efficacy of disinfection processes and potential for bacterial contamination.

Solution: Implement insulation measures for pipes and storage tanks to prevent heat loss and maintain water temperature within the safe range, ensuring effective disinfection and minimizing microbial risks.

Turbidity Sensor:

Problem 1 (Exceeding Limit): Turbidity levels exceed the safe limit, indicating high levels of suspended particles, which can impair disinfection processes and reduce water clarity.

Solution: Install filtration systems such as sediment filters or coagulation-flocculation units to remove suspended particles and reduce turbidity to safe levels.

Problem 2 (Below Limit): Turbidity levels are below the safe limit, suggesting insufficient filtration or sedimentation, which can lead to inadequate removal of pathogens and contaminants.

Solution: Optimize filtration processes by adjusting flow rates, coagulant dosages, or filter media to ensure effective removal of particles and maintain turbidity within the safe range.

TDS Sensor:

Problem 1 (Exceeding Limit): Total Dissolved Solids (TDS) levels exceed the safe limit, indicating high mineral content, which can cause scale buildup, unpleasant taste, and health concerns.

Solution: Install reverse osmosis or ion exchange systems to reduce TDS levels and remove excess minerals, ensuring water quality within acceptable limits.

Problem 2 (Below Limit): TDS levels are below the safe limit, suggesting insufficient mineral content, which can lead to taste issues and inadequate nutrient intake.

Solution: Add mineralization systems or remineralization cartridges to increase TDS levels and improve water taste and nutritional quality.

CONCLUSION:

Overall, our project aims to design a water quality monitoring system which measures the parameters like pH, turbidity, TDS, temperature of water through appropriate sensors which are triggered by a microcontroller like

esp32 at regular intervals to optimize the battery performance and thereby achieve continuous real-time data collection, accuracy, and efficiency. By doing this, challenges in timely detection and response to water quality issues can be addressed to ensure the safety of public health. This project also focuses on remote accessibility by creating user friendly web applications. We also analyse data periodically and send alerts (if any) to the respective authorities to manage water treatment. Apart from these we ensure that our model integrates seamlessly with existing infrastructure and technologies. We use wireless communication and network protocols for data transmission, separate channels for each sensor in the OM2M to publish the data frequently, appropriate data visualization techniques like plots, data analysis techniques based on time stamps to identify any patterns for predicting anomalies.