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Ai Powered Water Quality Detection And Purification Recommendation System Using Refactor Index

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TARGETS OF THE MAIN PROJECT WORK

ACTIVITIES	STATUS	ACTIVITIES	STATUS
Domain & problem identified	Yes	Development of product	No
Literature Review	Yes	Testing	No
Objectives formulated	Yes	Obtained Result	No
Methodology / Design	Yes	Documentation	No
Created work plan and task allocation	Yes	Report submission	No

INTRODUCTION

- Water quality is essential for safe drinking water, environmental protection, and sustainable agricultural and industrial use.
- The proposed system integrates Artificial Intelligence (AI) with Internet of Things (IoT) sensors to evaluate water quality in real time.
- The AI module calculates the Refactor Index (RI), a single score ranging from 0–100, to classify water quality as Good, Moderate, Poor, or Unsafe.

INTRODUCTION

- Based on the computed RI, the AI model provides intelligent purification recommendations such as boiling, filtration, or UV treatment.
- The results are displayed on an OLED screen and simultaneously transmitted to a mobile application via Wi-Fi or Bluetooth for user access.
- This AI-driven approach ensures accurate, automated, and sustainable monitoring, reducing human error and improving water safety.

PROBLEM STATEMENT

Traditional water quality testing relies on manual sampling and lab analysis, which are slow, costly, and unsuitable for real-time monitoring. This delay prevents early detection of contamination, increasing health and environmental risks. Hence, there is a need for an AI-powered IoT system that can monitor water quality continuously and provide instant purification recommendations.

OBJECTIVES

- Develop an AI-powered system to monitor and assess water quality using IoT-enabled sensors in real time.
- Calculate a unified Refactor Index (RI) value that classifies water quality as Good, Moderate, Poor, or Unsafe.
- Provide intelligent purification recommendations such as boiling, filtration, or UV treatment based on RI score.
- Enable wireless data transmission and visualization through a mobile application for user convenience.
- Promote low-cost, portable, and sustainable water quality monitoring suitable for rural and urban environments.

EXISTING SYSTEM

- Traditional water quality assessment methods rely on manual laboratory testing of samples.
- These methods are time-consuming, costly, and not suitable for real-time monitoring or field applications.
- Many existing IoT-based systems only measure single parameters such as pH or turbidity without combined analysis.
- Some models use threshold-based alerts but lack AI-driven evaluation or purification recommendations.
- Dependence on manual interpretation and absence of automated decision-making lead to delayed contamination detection.

LITERATURE REVIEW

No	Name of the Paper	Outcome	Authors, Publication, Year
1	IoT-Based Smart Water Quality Monitoring System	Designed a low-cost setup using pH, turbidity, and temperature sensors; provided real-time monitoring but lacked AI analysis or purification features.	Prasad, Gokhale, Patil, IEEE, 2022

LITERATURE REVIEW

No	Name of the Paper	Outcome	Authors, Publication, Year
2	Water Quality Index (WQI) Calculation Using IoT Sensors	Used sensor data to compute a single WQI value; effective for reporting quality levels but lacked adaptability and AI-based decision-making.	Kaur, Sharma, Elsevier, 2023

LITERATURE REVIEW

No	Name of the Paper	Outcome	Authors, Publication, Year
3	AI-Based Water Quality Prediction Using Machine Learning	Applied Random Forest and SVM models to predict contamination; achieved good accuracy but required offline data, lacking real-time IoT support.	Singh et al., Springer, 2023

LITERATURE REVIEW

No	Name of the Paper	Outcome	Authors, Publication, Year
4	AI-Enabled Decision Support System for Water Treatment	Integrated AI with water chemistry rules to recommend purification methods; effective for industries but lacked IoT sensor integration.	Zhang, Li, Huang, IEEE, 2024

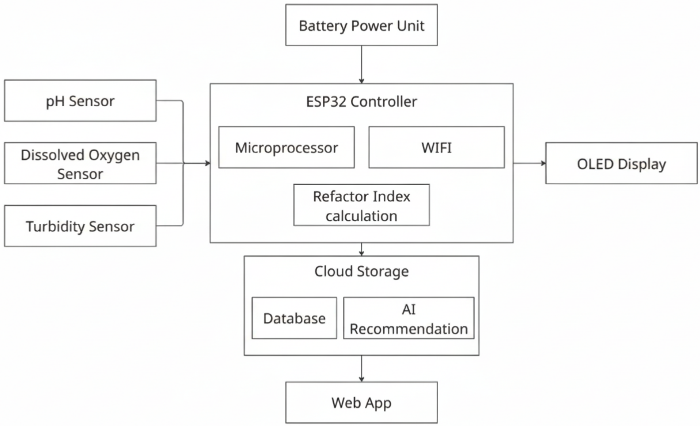
LITERATURE REVIEW

No	Name of the Paper	Outcome	Authors, Publication, Year
5	DOxy: A Dissolved Oxygen Monitoring System	Proposed a smart DO monitoring framework; accurate and reliable but focused only on a single parameter without purification insights.	Shaghaghi, MDPI, 2024

PROPOSED SYSTEM

- **AI-Based Detection:** Uses pH, turbidity, temperature, and DO sensors for real-time water analysis.
- **ESP32 Processing:** Computes the Refactor Index (RI) and sends results via Wi-Fi/Bluetooth.
- **Smart Recommendations:** Suggests purification methods like boiling, filtration, or UV treatment.
- **Mobile Integration:** Displays RI score and status through a user-friendly app.
- **Future Extensions:** Add more sensors, cloud analytics, and automated purification features.

METHODOLOGY



METHODOLOGY

- **Data Acquisition:** pH, Dissolved Oxygen, and Turbidity sensors continuously collect real-time water parameters.
- **ESP32 Controller:** Acts as the core processing unit, integrating the microprocessor and Wi-Fi module for data handling and transmission.
- **Power Supply:** Operated using a rechargeable battery and solar-powered unit, ensuring portability and energy efficiency.
- **Refactor Index (RI) Calculation:** The ESP32 processes sensor data and computes a composite RI score indicating water quality.

METHODOLOGY

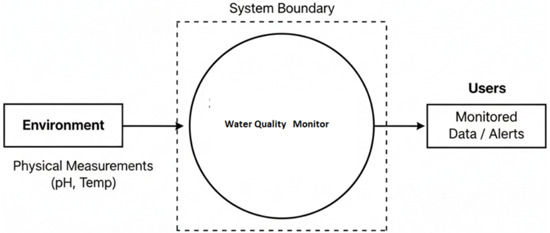
- **Cloud Storage:** Processed data is transmitted to a cloud database for secure storage and further processing.
- **AI Recommendation Module:**
  - Analyzes RI values and patterns.
  - Provides purification suggestions such as boiling, filtration, or UV treatment.
- **Display Unit:** Results, including RI values and water quality status, are displayed on the OLED screen.

METHODOLOGY

- **Web Application:** Allows users to remotely access live water quality data and recommendations via an intuitive interface.
- **Data Management:** Cloud database maintains historical readings for trend analysis and long-term monitoring.
- **End Output:** The system delivers real-time water quality detection, purification guidance, and data accessibility through both OLED and web app interfaces.

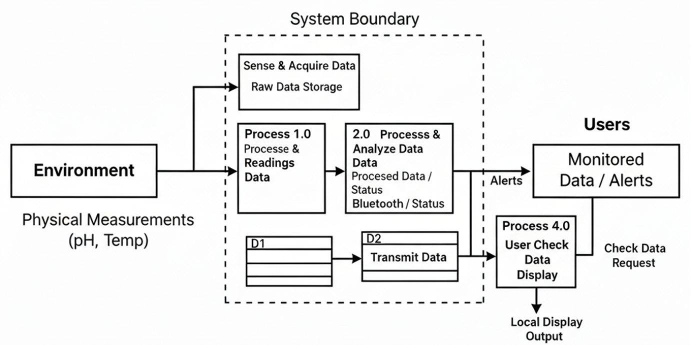
SYSTEM LEVEL DESIGN

Level 0



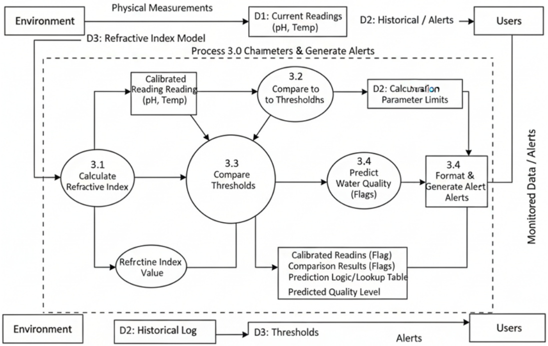
SYSTEM LEVEL DESIGN

Level 1



SYSTEM LEVEL DESIGN

Level 2



TOOLS / MATERIALS / RESOURCES USED

Hardware Specifications:

- Microcontroller: ESP32-WROOM-32 with built-in Wi-Fi and Bluetooth
- Sensors: pH, Turbidity, Temperature, and Dissolved Oxygen (DO)
- Display: 0.96-inch OLED Display Module
- Power Supply: Solar panel with rechargeable battery

Software Specifications:

- Programming Languages: Python, C/C++, Java
- Platforms: Arduino IDE, Android Studio
- Libraries/Frameworks: TensorFlow / Scikit-learn for AI analysis
- Cloud Integration: ThingSpeak / Firebase for data storage and visualization

ADVANTAGES

- **Real-Time Monitoring:** Instantly checks key water parameters using IoT sensors.
- **AI Analysis:** Calculates Refactor Index (RI) for accurate water quality classification.
- **Smart Suggestions:** Recommends suitable purification methods automatically.
- **Low-Cost & Portable:** Affordable, solar-powered, and easy to deploy anywhere.
- **Eco-Friendly:** Promotes sustainable and energy-efficient water management.

WORK PLAN

ABIN SANTHOSH	Monitoring and Reporting, Quality Assurance
ADHITH SUNIL	Designing and Coding
ANITTA RAPHI E	Documentation, Resource Allocation
ADHAWITH TT	Testing and Validation

FEASIBILITY ANALYSIS

1. Economic Feasibility

- Low-cost sensors and ESP32 make the system affordable.
- Solar-powered design reduces long-term operating costs.
- Minimal maintenance; ideal for rural and small-scale use.

2. Operational Feasibility

- Easy setup with OLED display and mobile app interface.
- Provides instant Refactor Index (RI) and purification suggestions.
- Reliable operation in both rural and urban environments.

FEASIBILITY ANALYSIS

3. Technical Feasibility

- Uses IoT sensors and ESP32 microcontroller for real-time data.
- AI algorithms ensure accurate RI calculation and classification.
- Supports wireless connectivity via Wi-Fi and Bluetooth.

4. Legal & Ethical Feasibility

- Complies with environmental and safety standards.
- Encourages safe data handling and transparent reporting.
- Promotes eco-friendly and sustainable technology use.

FEASIBILITY ANALYSIS

5. Scalability & Future Feasibility

- Easily expandable for community, industrial, or municipal water systems.
- Future upgrades: integration with cloud storage and predictive AI.
- Potential to evolve into a global smart water monitoring platform.

SCOPE OF PROJECT

- Monitors key water parameters such as pH, turbidity, temperature, and dissolved oxygen in real time.
- Calculates the Refactor Index (RI) to provide an easy-to-understand measure of overall water quality.
- Suggests suitable purification methods like boiling, filtration, or UV treatment based on RI values.
- Helps households, industries, and rural communities maintain safe and sustainable water usage.
- Can be expanded with additional sensors, cloud storage, and predictive AI for large-scale water management.

CONCLUSION

The proposed system uses AI and IoT to check water quality in real time. It calculates the Refactor Index (RI) to show if the water is good, moderate, poor, or unsafe. The system also suggests simple purification methods, making it a low-cost, portable, and eco-friendly solution for safe and sustainable water use.

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Thank You