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IoT-Based Real-Time Monitoring System for Water Bodies in Delhi

- **Problem Statement ID – SIH1619**
- **Problem Statement Title- Online real-time survey and monitoring of water bodies in Delhi**
- **Theme- Miscellaneous**
- **PS Category- Software**
- **Team ID-**
- **Team Name – Team Hydra**

Team Hydra

IoT-Based Real-Time Monitoring System for Water Bodies in Delhi

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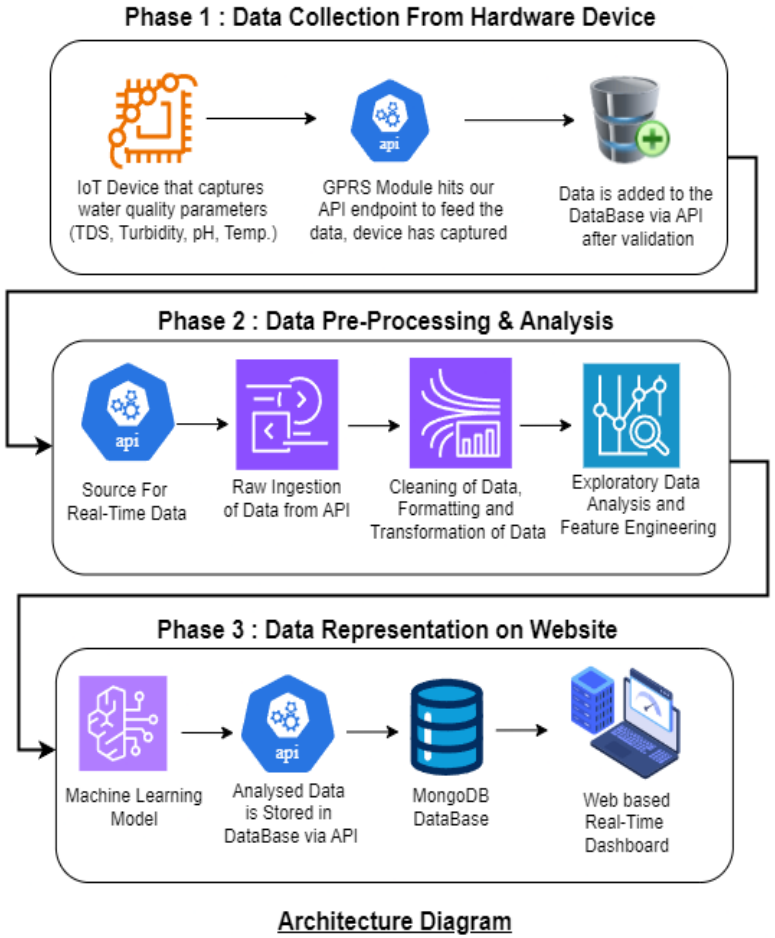
❖ Proposed Solution

We have developed an **IoT-Based water quality monitoring system** that provides **Real-Time Water Quality Parameters Data** for the **water bodies** in Delhi. This **end-to-end solution** allows authorities and stakeholders to **monitor water quality remotely** and **in real-time** through an intuitive **web-based platform**. Here's how our system functions :-

- **Our Approach** involves **integrating IoT hardware** (NodeMCU ESP8266 and GPRS Module and sensors like turbidity, TDS, pH and temperature) with a **full-stack web solution via APIs**, enabling **seamless collection**, **processing**, and **visualization** of water quality data in **real-time**.
- **Real-Time Updates**: The platform delivers **real-time updates** through **custom APIs**, with a dashboard serving as a central hub for monitoring, featuring **interactive analytics** and an **overview section** for quick assessment of **average WQI** values across Delhi's water bodies
- **Safety First** : The platform sends **SOS alerts** when **water quality parameters** like pH, turbidity, or TDS **exceed safe limits**. These alerts allow for **immediate intervention** to protect the health of water bodies and surrounding communities.
- **Interactive Visualization for Clear Insights**: Effortlessly Visualize water quality parameters with **heat maps**, **line charts, bar charts** and **area charts**. Our platform ensures **dynamic updates**, making it easy to **compare data** across **different regions** and **timeframes**.
- **Stay Informed and Act Quickly**: Our comprehensive system offers **real-time monitoring** and **alerts**, enabling authorities to make **data-driven decisions** and responding effectively to water quality issues in a timely manner.
- **Multi-Layered Data Strategy:** Leveraging **historical data,** our system provides **comprehensive insights** into **water** and air quality.



Architecture Diagram

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TECHNICAL APPROACH

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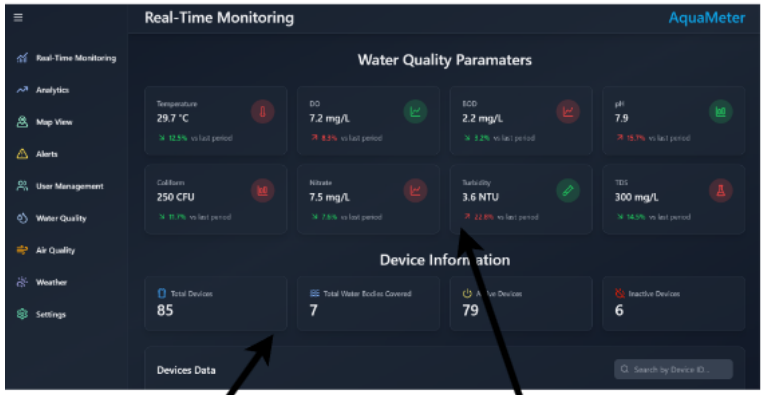
Technologies to be used

- **Languages & Frameworks**: C/C++, JavaScript, Python, ReactJS, ExpressJS, NodeJS
- **Libraries & Tools**: Recharts, Mongoose, TailwindCSS, pandas, Scikit-learn, seaborn, matplotlib, HTTPClient.h, analogRead(), SoftwareSerial.h, TinyGsmClient.h, PubSubClient.h, EEPROM.h
- **Database**: MongoDB
- **Cloud Services**: AWS
- **Hardware**: NodeMCU ESP8266, GPRS Module, Turbidity Sensor, TDS Sensor, Temperature Sensor

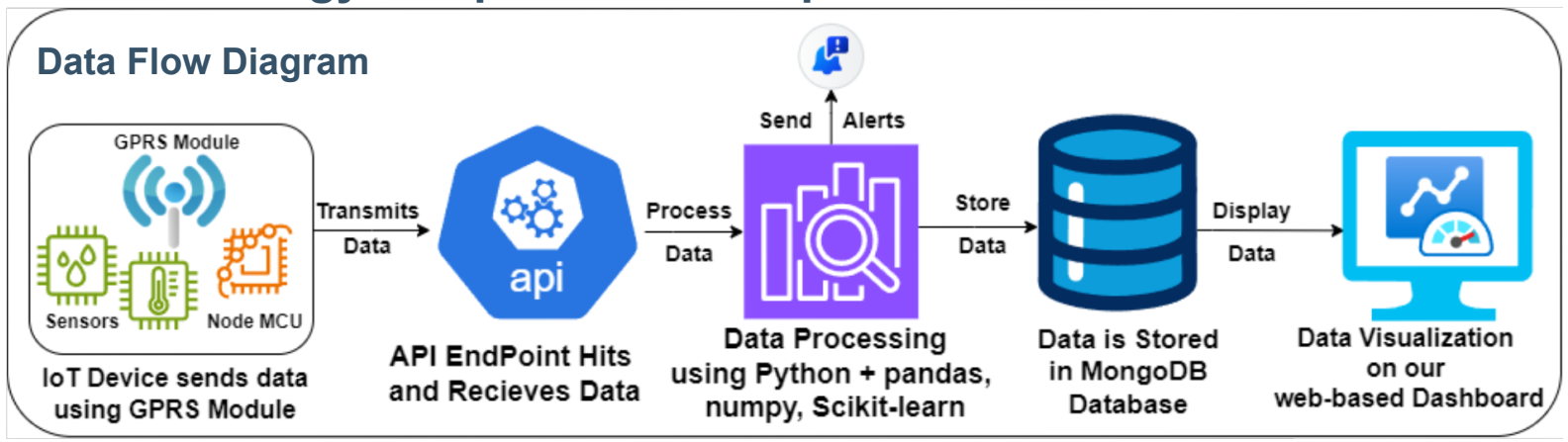


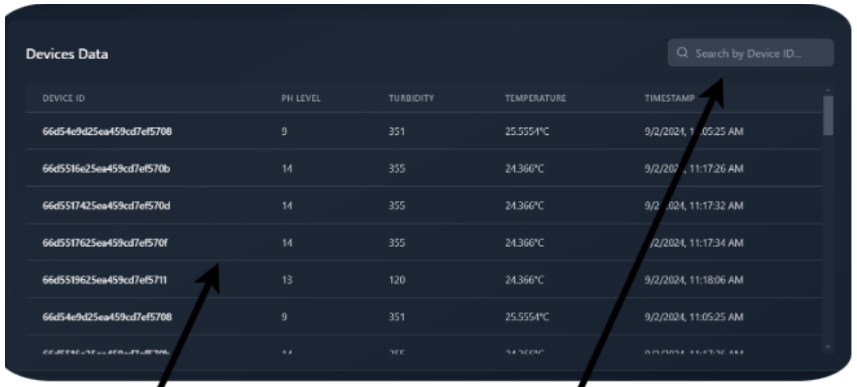
Easy to use UI

Real-Time Updates

Comparison of Data Using Graphs

Methodology and process for implementation





All devices data at one place

Search for Devices

Map Representation	Real-Time Dashboard	Comparison of data using graphs	SOS Alerts	WQI	AQI	Custom API	ML Prediction
✓	✓	✓	✓	✓	✓	✓	✓

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FEASIBILITY AND VIABILITY

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❖ Feasibility Analysis:

- **Technical Feasibility**:- Uses proven technologies (NodeMCU, React, Express) and well-established sensors (TDS, Turbidity, pH). Seamless integration of hardware and software through APIs enables real-time data flow.
- **Operational Feasibility**:- Authorities can monitor water quality remotely through a user-friendly web platform, ensuring real-time updates and alerts for immediate action.
- **Financial Feasbility**:- Affordable hardware like NodeMCU and sensors. Government partnerships can help fund and sustain the project.

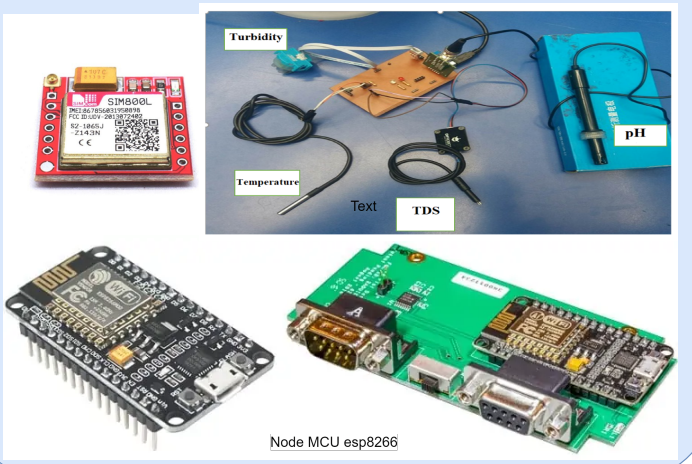
❖ Potential Challenges and Risks:

- **Sensor Calibration & Accuracy**:- Sensor readings might vary due to environmental factors, leading to inaccurate data.
- **Data Latency & Connectivity issues**:- Real-time data transmission may face delays or interruptions in areas with poor network coverage.
- **Scalability & Data Handling**:- Expanding the system across multiple regions may lead to storage and processing challenges due to big data volume.

❖ Strategies for Overcoming Challenges:

- **Regular Sensor Calibration**:- Ensure accuracy with routine calibration and validation of anomalous data.
- **Improved Connectivity & Durability**:- Use data caching techniques and durable enclosures for IoT hadware to handle network and environmental issues.
- **Cloud Solutions for Scalability**:- Leverage cloud storage and processing (e.g. AWS) to manage large datasets and scale the system efficiently.

Hardware Kit



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IMPACT AND BENEFITS

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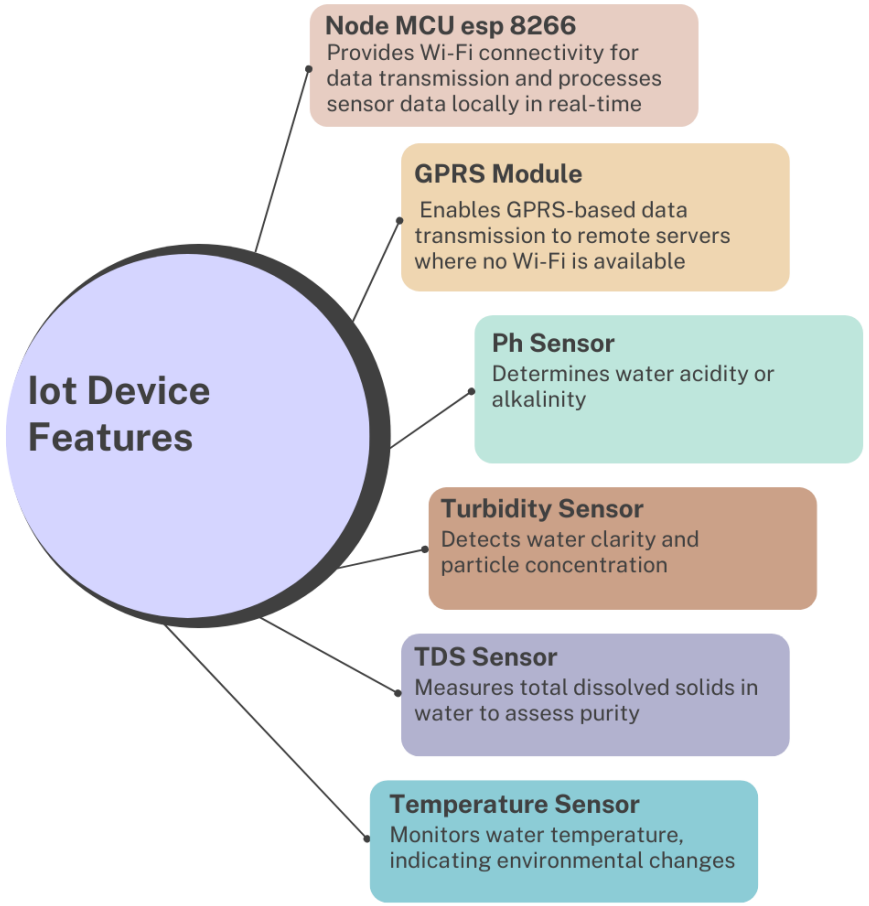
❖ Potential Impact and Benefits of Solution:

- **Public Health** :- Real-time water quality data helps authorities and citizens protect public health by enabling informed decisions, especially for vulnerable groups like children and the elderly.
- **Environmental Awareness**:- Promotes awareness of water pollution and its impact on ecosystems, helping communities understand need for water conservation and pollution control.
- **Data-Driven Policy Making**:- Government agencies and organizations can use the system for policy changes and environmental action enhancing resource management.
- **Economic and Social Benefits**:- Prevents costly environmental damage, generates potential revenue through partnerships, and promotes healthier communities by enhancing water monitoring.

❖ Business Model Opportunities:

- **Government Partnerships**:- Collaborate with government agencies to provide data and anlysis tools, aiding in environmental monitoring and policy making.
- **Consulting Services**:- Provide consulting and implementation services for other organizations or municipalities looking to set up similar water quality monitoring systems.
- **Data Licensing**:- License water quality data to research institutions, environmental organizations, or private companies for further analysis and use in studies or commercial applications.



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RESEARCH AND REFERENCES

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