Major Project Presentation

National Institute of Technology Goa

Water Quality Monitoring System

21ECE1024: Paras Kore
21ECE1013: Kalyan Sharma
21ECE1005: Ayush Raj

Under the supervision of:
Dr. T. Veerakumar

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Why we chose this project?

Water quality monitoring is vital for public health and environmental sustainability. The recent cholera outbreak at **Cutbona jetty, Goa**, shows the severe effects of poor water sanitation. By using IoT and machine learning, we can build advanced systems to prevent such crises in the future

01 **Public Health:**
Real-time monitoring detects contaminants early, reducing risk

02 **Tehnology**
IoT and data analytics offer modern, efficient water management

03 **Water Scarcity**
Optimised monitoring minimises waste

04 **Cost Saving**
Automation cuts long-term manual testing costs

05 **Climate Change**
Growing need for smart tech makes this project timely and valuable

What we aim to achieve?

1. **Real-Time Monitoring**: Continuously track water quality using IoT sensors for up-to-date information.
2. **Predictive Insights**: Use machine learning to forecast contamination risks and enable early action.
3. **Remote Access**: Utilise cloud computing for real-time data availability from any location.
4. **Early Warning Systems:** Implement timely alerts to prevent waterborne diseases and safeguard public health.
5. **Data Analytics:** Analyse trends to predict issues and support better decision-making.
6. **Cost Efficiency**: Automate monitoring to reduce long-term operational costs.

Previous work in water quality monitoring

- **Cost:** Existing systems rely on expensive proprietary cloud services. Our solution reduces costs by using open-source technologies without sacrificing functionality.

- **Parameter Detection:** Traditional systems monitor a few parameters. Our system tracks a broader range, providing a more comprehensive water quality analysis.

- **Delayed Data Reporting:** Traditional systems often provide data with delays. Our approach enables instant monitoring, improving system efficiency and decision-making.

Four phases of our project

Phase 1:
Machine Learning Model Development

Phase 2:
Hardware Preparation and Manual Data Input

Phase 3:
Testing and Validation

Phase 4:
Cloud Computing Integration

Phase 1 – Machine Learning Model Development

Dataset

A readily available water quality dataset will be used for initial model training.

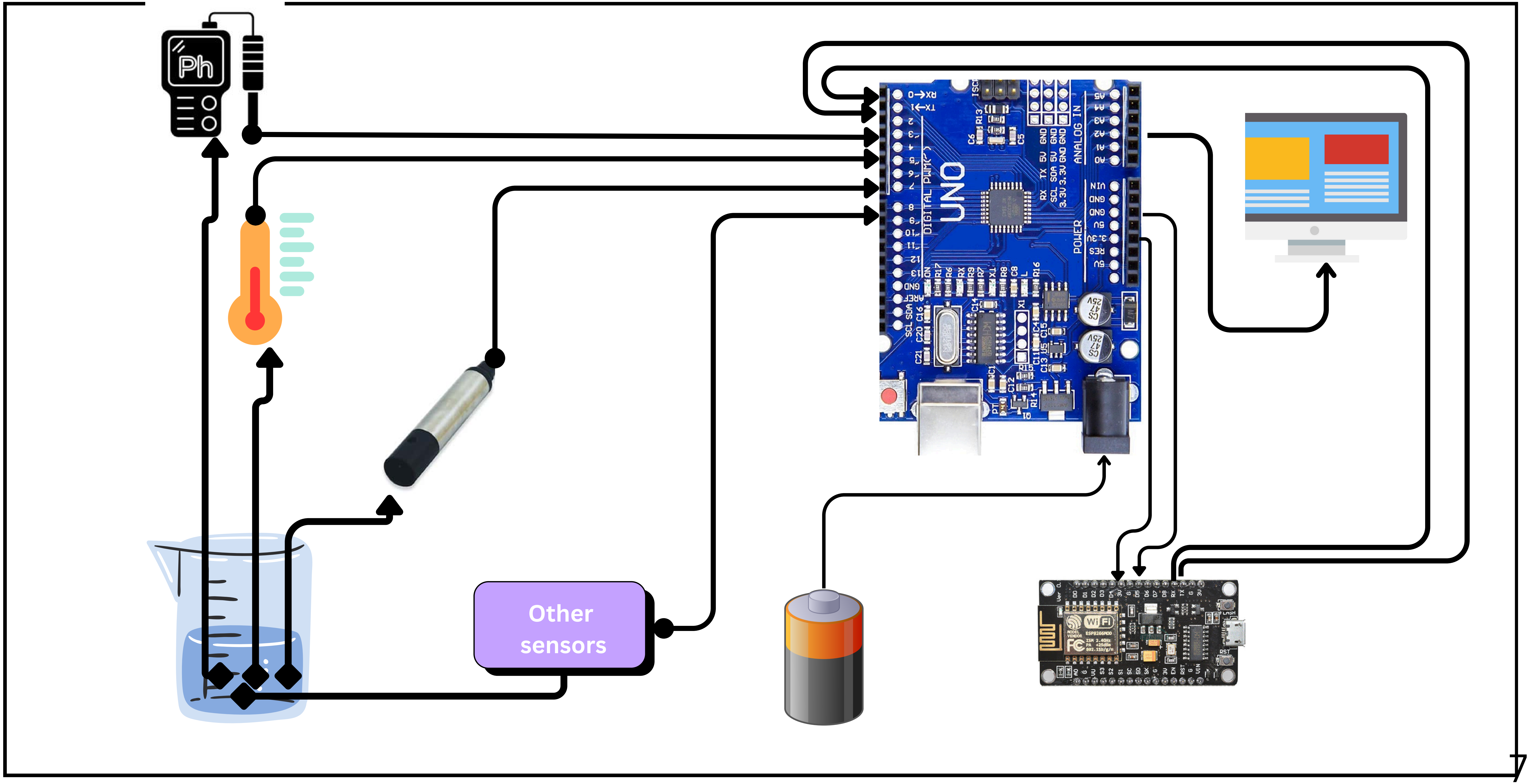
Model

A machine learning model will be built to predict water quality from different parameters.

Goal

To have a reliable predictive model before starting hardware and real-time integration.

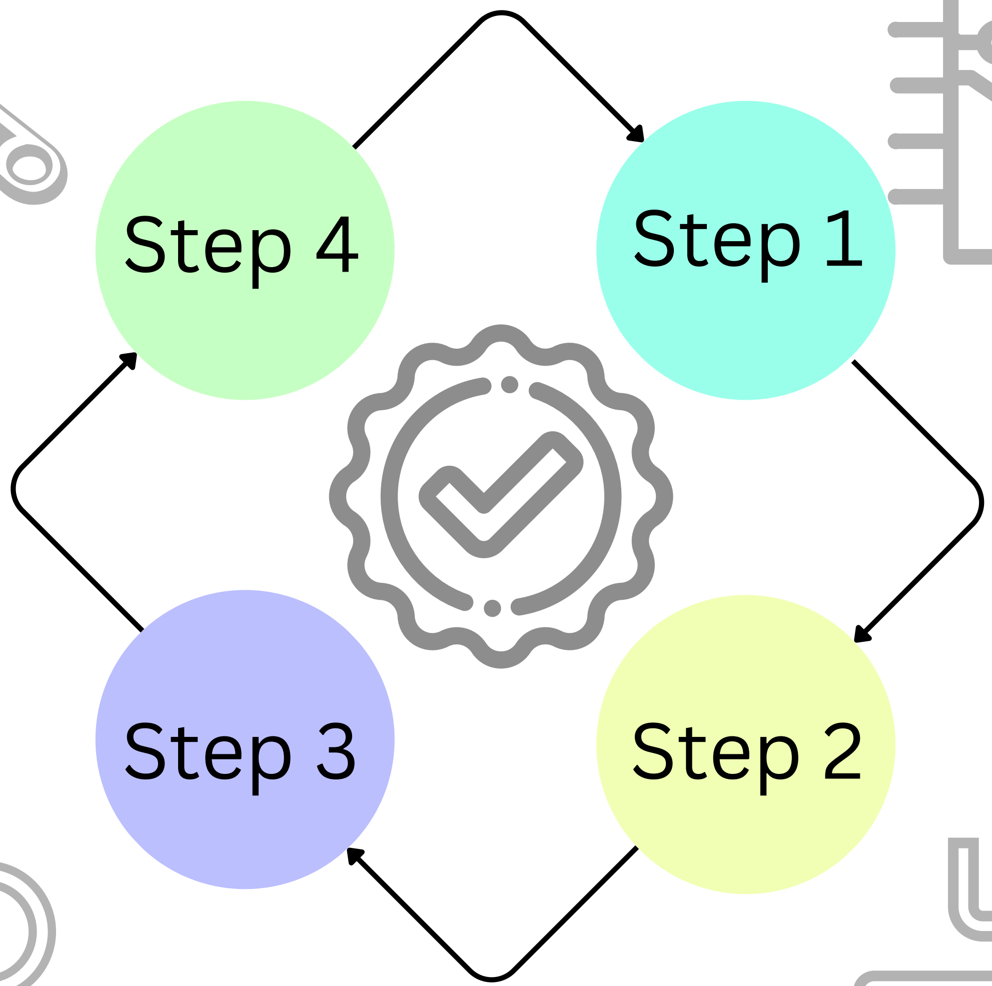
Phase 2 – Hardware Preparation



Phase 3 – Testing and Validation

Fine-tuning

Refine the system based on test outcomes.



Test Hardware

Ensure sensor are working and giving proper output.

Model Accuracy Testing

Confirm model predictions match expected results.

Manual Data Entry Testing

Verify model accuracy with manual data input.

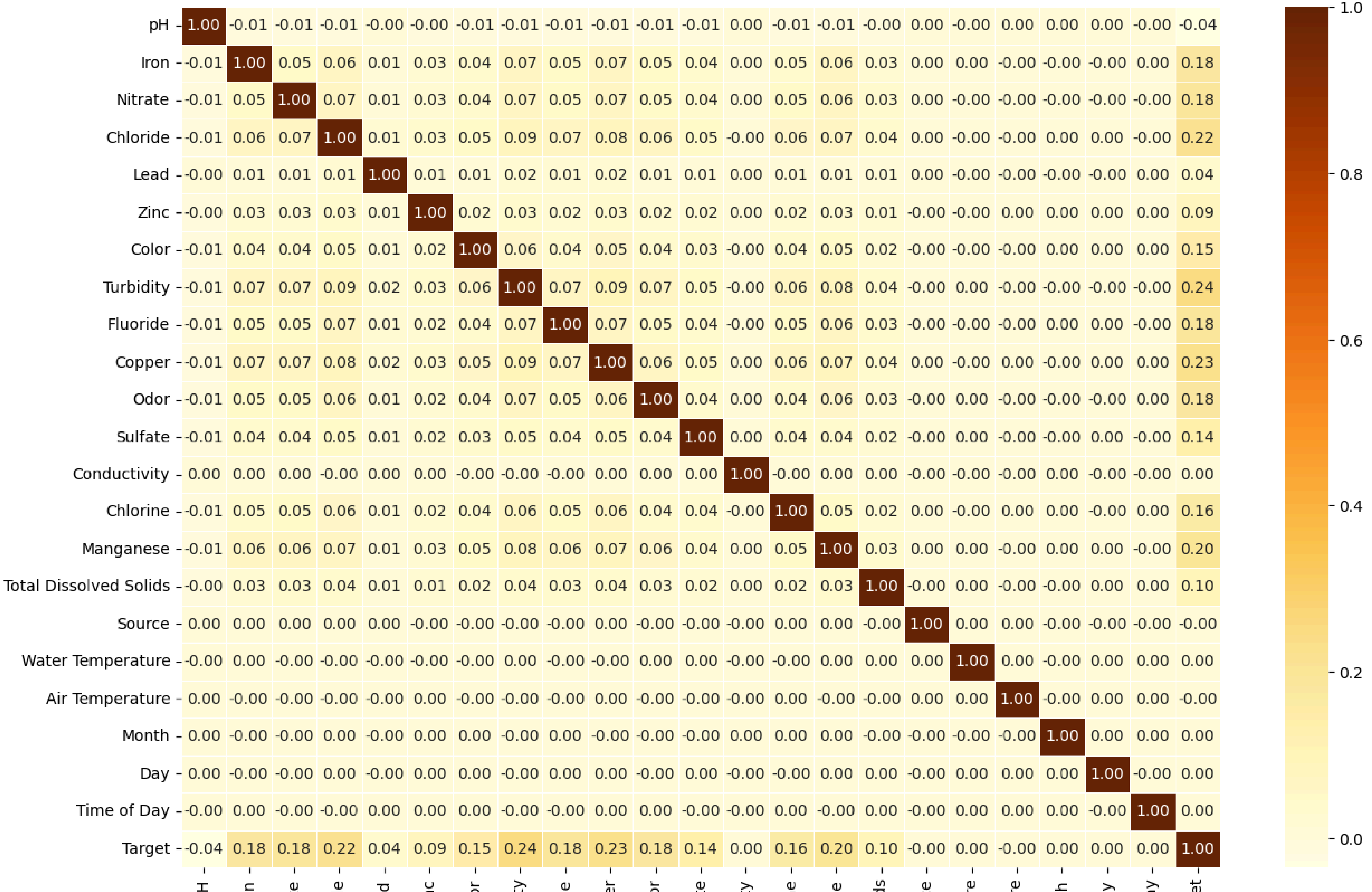
Phase 4 – Cloud Computing Integration

- Sensors Gather Data
- Data sent to Cloud
- Data transfer to ML model via cloud
- Real-time monitoring & analysis

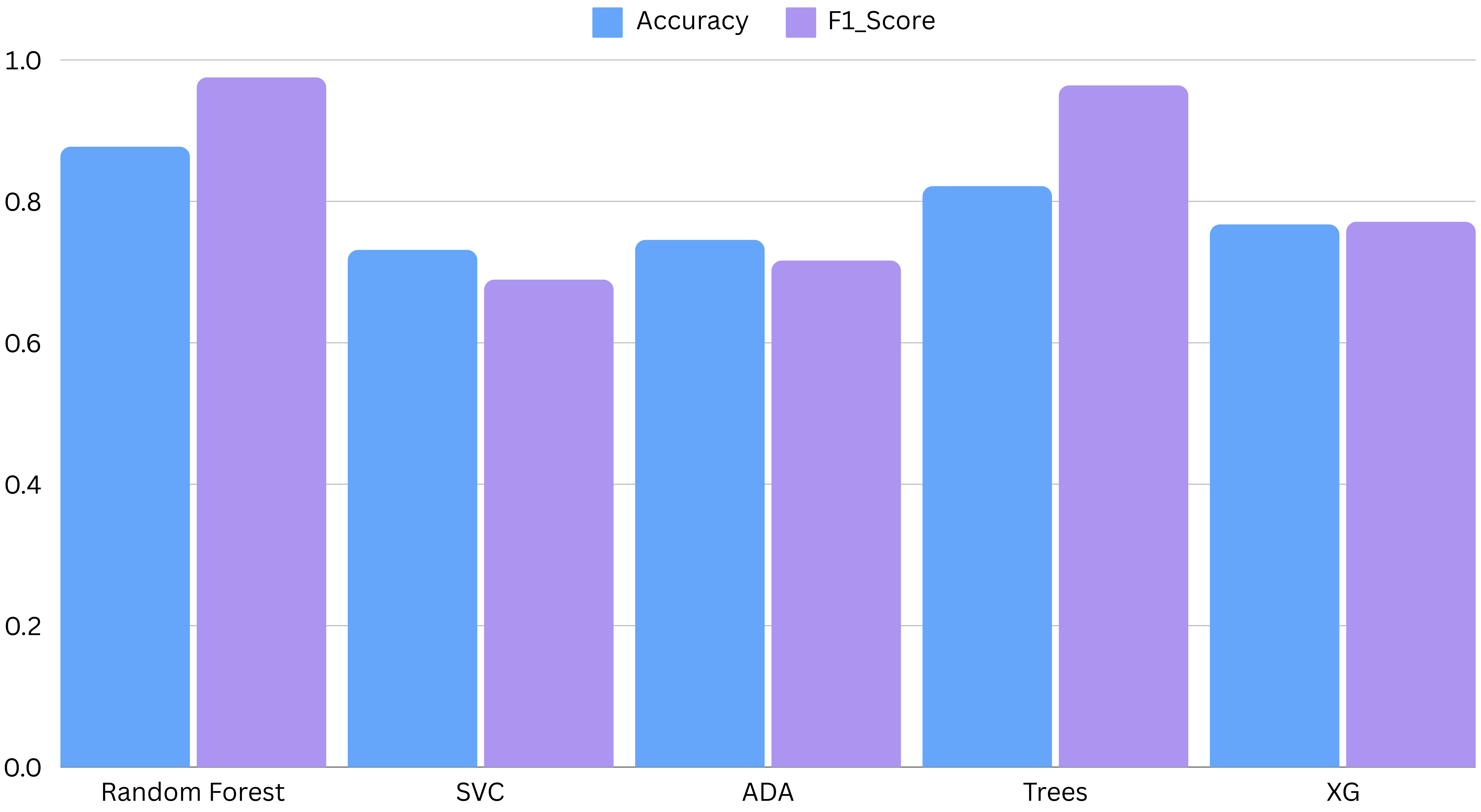
GOAL

"Seamless data collection and real-time monitoring via cloud integration."

Progress so far



Progress so far



Progress so far

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Confusion Matrix for Random Forest:
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1   1434  23566
F1 Score for SVC: 0.6893066942622503
Confusion Matrix for SVC:
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1  17844  7156
F1 Score for ADA: 0.7163498303084852
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 'XG': 0.7711777154303139}
```

Progress so far

What is Random Forest??

Random Forest is an ensemble learning algorithm that builds multiple decision trees from randomly selected subsets of data and features. It improves prediction accuracy and reduces overfitting.

- Bootstrap Sampling: Create random subsets of data with replacement.
- Random Features: Train each tree on a random set of features.
- Tree Construction: Independently grow multiple decision trees.
- Voting/Averaging: Trees vote for the final prediction (classification)

01. Dataset
02. Bootstrap Sampling
03. Multiple Decision Tree
04. Averaging
05. Final Prediction

Conclusion

This project aims to deliver a **scalable**, **real-time** water quality monitoring solution by leveraging **IoT sensors** and **machine learning**.

The phased approach ensures systematic development:

- Create and train a machine learning model using a readily available dataset.
- Integrate real-time sensor data, validate the machine learning model with live inputs, and implement cloud-based monitoring for remote data access and prediction.

This structured method guarantees efficient progress from initial data training to full-scale real-time monitoring.

This project lays the foundation for future scalable and real-time environmental monitoring solutions

Reference

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Q&A

Thank you for your Attention

Contact Details:
prskore@nitgoa.ac.in
kalyansharma855@nitgoa.ac.in
ayushrj59@nitgoa.ac.in