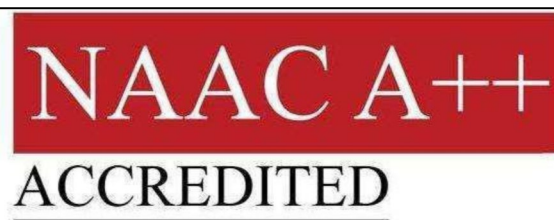# Manav Rachna International Institute of Research and Studies

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📑 Project Documentation: Water Quality Monitoring System

1. Problem Statement

Water bodies such as rivers, lakes, ponds, and reservoirs often face pollution due to industrial waste, sewage discharge, agricultural runoff, and human activities. Monitoring water quality is essential to ensure:

- Safe drinking water

- Protection of aquatic life

- Environmental health

- Early detection of pollution hazards

However, manual monitoring is time-consuming, inefficient, and prone to errors. There is a need for an automated system that can **continuously track important water quality parameters** and instantly raise alerts when values become unsafe.

2. Parameters Affecting Water Quality

Water quality depends on several measurable parameters:

Parameter	Description	Safe Range
pH	Indicates acidity/basicity	6.5 – 8.5
Temperature	Affects aquatic life & oxygen levels	≤ 32°C
Turbidity	Measures suspended particles	≤ 5 NTU
Dissolved Oxygen (DO)	Essential for aquatic organisms	≥ 6 mg/L

If any of these parameters go outside the safe range, water becomes hazardous.

3. Purpose of the System

The purpose of the **Water Quality Monitoring System** is to:

1. **Collect sensor readings** (pH, temperature, turbidity, DO).

2. **Store all readings** for future reference.

3. **Automatically compare** the readings with safe environmental standards.

4. **Generate alerts** if any parameter exceeds the accepted limits.

5. **Help take immediate action** to control pollution or treat water.

4. What Problem Does This System Solve?

This system solves multiple real-world environmental monitoring problems:

✔ Problem 1: Lack of Real-Time Monitoring

Manual checks are not continuous.
Solution: System instantly checks every reading and gives alerts.

✔ Problem 2: Delayed Detection of Pollution

Water contamination can spread before authorities notice.
Solution: Alerts immediately notify unsafe conditions, helping to take fast corrective actions.

✔ Problem 3: Data Recording Issues

Manual data logging is inaccurate and difficult to maintain.
Solution: System stores all sensor readings automatically.

✔ Problem 4: Human Error in Interpretation

People may misread or misunderstand values.
Solution: System uses defined safe limits and compares values without errors.

✔ Problem 5: No Unified Platform

Different readings are often stored in different places.
Solution: Program combines all water-quality parameters in one organized system.

5. Significance of the System

- Helps ensure **drinking water safety**

- Protects **aquatic ecosystems**

- Prevents **disease outbreaks** caused by contaminated water

- Useful for **environment agencies, industries, Water Boards, NGOs**

- Can be expanded into an **IoT-based real-time monitoring system**

6. Conclusion

The Water Quality Monitoring System provides an efficient, automated, and reliable method to monitor water conditions.
By analyzing crucial water parameters and generating alerts for unsafe values, the system helps prevent environmental damage and ensures public health and safety.

Program:

```java
import java.util.ArrayList;

import java.util.Scanner;


class WaterQualityData
    { double pH; double
    temperature; double
    turbidity; double
    dissolvedOxygen;


    public WaterQualityData(double pH, double temperature, double turbidity, double
dissolvedOxygen) { this.pH = pH;
        this.temperature = temperature;
        this.turbidity = turbidity;
        this.dissolvedOxygen = dissolvedOxygen;
    }


    @Override public
    String toString() {
        return "pH: " + pH +
            ", Temp: " + temperature + "°C" +
            ", Turbidity: " + turbidity + " NTU" +
            ", DO: " + dissolvedOxygen + " mg/L";
    }
}


class WaterQualityMonitor {
    ArrayList<WaterQualityData> records = new ArrayList<>();
    final double MIN_PH = 6.5; final
    double MAX_PH = 8.5; final double
```

```java
MAX_TURBIDITY = 5.0; final

double MIN_DO = 6.0; final double

MAX_TEMP = 32.0;


public void addReading(WaterQualityData data)
    { records.add(data); checkSafety(data);
}



public void checkSafety(WaterQualityData d) { System.out.println("\n--
    - Checking Water Quality ---");

    if (d.pH < MIN_PH || d.pH > MAX_PH)
        System.out.println("⚠ ALERT: pH level unsafe!");


    if (d.temperature > MAX_TEMP)
        System.out.println("⚠ ALERT: High temperature!");


    if (d.turbidity > MAX_TURBIDITY)
        System.out.println("⚠ ALERT: Turbidity too high!");


    if (d.dissolvedOxygen < MIN_DO)
        System.out.println("⚠ ALERT: Low dissolved oxygen!");
                    System.out.println("Check complete.\n");
}
```

```java
    public void displayAll()
        { if
        (records.isEmpty()) {
            System.out.println("No sensor data recorded yet.");
            return;
        }
        System.out.println("\n--- All Sensor Readings ---");
        for (WaterQualityData d : records) {
            System.out.println(d.toString());
        }
    }
}


public class WaterQualitySystem
    { public static void main(String[] args)
    {
        Scanner sc = new Scanner(System.in);
        WaterQualityMonitor monitor = new WaterQualityMonitor();

        while (true) {
            System.out.println("\n--- Water Quality Monitoring System ---");
            System.out.println("1. Add Sensor Reading");
            System.out.println("2. View All Readings");
            System.out.println("3. Exit");
            System.out.print("Enter choice: ");
            int choice = sc.nextInt();

            if (choice == 1) {
```

```java
            System.out.print("Enter pH: ");
            double pH = sc.nextDouble();


            System.out.print("Enter Temperature (°C): ");
            double temp = sc.nextDouble();


            System.out.print("Enter Turbidity (NTU): ");
            double turbidity = sc.nextDouble();


            System.out.print("Enter Dissolved Oxygen (mg/L): ");
            double DO = sc.nextDouble();


            WaterQualityData data = new WaterQualityData(pH, temp, turbidity, DO);
            monitor.addReading(data);
        }
        else if (choice == 2) {
            monitor.displayAll();
        }
        else if (choice == 3) {
            System.out.println("System Closed.");
            break;
        }
        else {
            System.out.println("Invalid choice. Try again.");
        }
    }
    sc.close();
}
```

}

OUTPUT:

```
--- Water Quality Monitoring System ---
1. Add Sensor Reading
2. View All Readings
3. Exit
Enter choice: 1
Enter pH: 12
Enter Temperature (°C): 12
Enter Turbidity (NTU): 12
Enter Dissolved Oxygen (mg/L): 12

--- Checking Water Quality ---
? ALERT: pH level unsafe!
? ALERT: Turbidity too high!
Check complete.


--- Water Quality Monitoring System ---
1. Add Sensor Reading
2. View All Readings
3. Exit
Enter choice: 1
Enter pH: 98
Enter Temperature (°C): 98
Enter Turbidity (NTU): 98
Enter Dissolved Oxygen (mg/L): 98

--- Checking Water Quality ---
? ALERT: pH level unsafe!
? ALERT: High temperature!
? ALERT: Turbidity too high!
Check complete.


--- Water Quality Monitoring System ---
1. Add Sensor Reading
2. View All Readings
3. Exit
Enter choice:
```