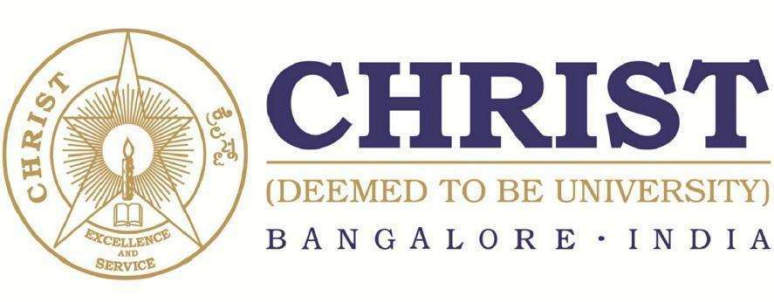


DEPARTMENT OF
COMPUTER SCIENCE AND ENGINEERING

INTRODUCTION TO IOT

(IOT531P)

A Mini-Project on

"Water Quality Monitoring System"

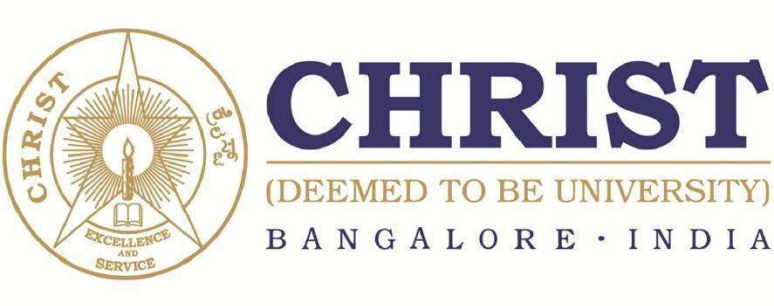
B. Tech Computer Science and Engineering (IOT)

School of Engineering and Technology,

CHRIST (Deemed to be University)

Kumbalagodu, Bengaluru-560 074

April 2023



Certificate

This is to certify that the mini project report on …Water Quality Monitoring System….is carried out by Litesh Dara(2162409),Emauel Soloman(2162406),Lokanath Reddy(2162426) have successfully completed the CIA-3 Component for **IOT531P *Introduction to IOT*** *in partial fulfillment for the award of Bachelor of Technology in the Department of Computer Science and Engineering during the year 2023-2024.*

HEAD OF DEPARTMENT **FACULTY- IN CHARGE**

EXAMINER 1:

EXAMINER 2:

TABLE OF CONTENT

1.INTRODUCTION:

Clean, safe, and accessible water is not only a fundamental requirement for human life but is also essential for the health and well-being of ecosystems. Water quality plays a pivotal role in maintaining the delicate balance of our natural environment. Monitoring the quality of water is essential because it directly impacts public health, aquatic ecosystems, agriculture, and industry.

Turbidity, the cloudiness or haziness of a fluid caused by large numbers of individual particles suspended in the water, is a critical parameter when assessing water quality. It serves as an important indicator of the physical and chemical characteristics of water. Higher turbidity levels are often associated with an increased presence of suspended particles in the water, which can include sediments, algae, or pollutants. Turbidity is not only a measure of water clarity but is also linked to the overall health of aquatic ecosystems.

Water quality can be affected by a multitude of factors. Sedimentation due to erosion, nutrient runoff from agriculture, industrial discharges, and various pollutants can all contribute to diminished water quality. The presence of excess suspended particles can lead to a range of problems, such as reduced light penetration in aquatic environments, which affects photosynthesis and can harm aquatic organisms.

Water quality monitoring systems are crucial tools for assessing and ensuring the health of water resources. These systems help in tracking the variations in water quality over time and provide early warnings about any deterioration in water conditions. By continuously monitoring turbidity and other relevant parameters, it becomes possible to detect and respond to changes promptly.

2.1. PROBLEM STATEMENT:

Despite the critical importance of water quality monitoring, many regions and communities face challenges in effectively assessing and maintaining clean and safe water sources. The problem lies in the lack of efficient and accessible monitoring systems, particularly those focusing on turbidity, a key parameter in evaluating water quality. Therefore, the problem at hand can be summarized as follows:

- **Inadequate Water Quality Monitoring Systems:** Many areas lack a robust, real-time water quality monitoring system that can efficiently measure and analyze turbidity levels. This deficiency can result in the following issues:

- **Delayed Detection of Water Contamination:** Without a reliable monitoring system, the early detection of water contamination or changes in turbidity levels is often hindered. This can lead to health risks and environmental damage, as contaminated water may be consumed before issues are identified.

- **Limited Data for Decision-Making:** The absence of a comprehensive data collection and analysis system makes it challenging for authorities, researchers, and communities to make informed decisions about water management and environmental conservation.

- **Ecosystem and Health Risks:** Insufficient monitoring and control can result in adverse effects on aquatic ecosystems due to excessive turbidity and the presence of pollutants. Moreover, communities relying on these water sources may be exposed to health hazards.

2.2. SOLUTION:

• An IoT-based water quality monitoring system can be used to continuously monitor water quality in real time. the data is analysed and used to identify potential water quality problems.

• Sensor Integration: Create a versatile system that can integrate multiple sensors and measurement techniques to detect and quantify various water quality parameters, such as pH levels, turbidity, dissolved oxygen, temperature, conductivity, chemical contaminants (e.g., heavy metals, organic compounds), and microbial contamination (e.g., bacteria, viruses).

• Real-time Monitoring: Implement a real-time monitoring capability to continuously collect data and provide immediate alerts or notifications in case of sudden water quality deterioration, which could be crucial for public health and environmental protection.

• Data Accuracy and Reliability: Ensure high accuracy and reliability of the collected data by calibrating and maintaining the sensors regularly and accounting for factors like temperature fluctuations, sensor drift, and environmental variability.

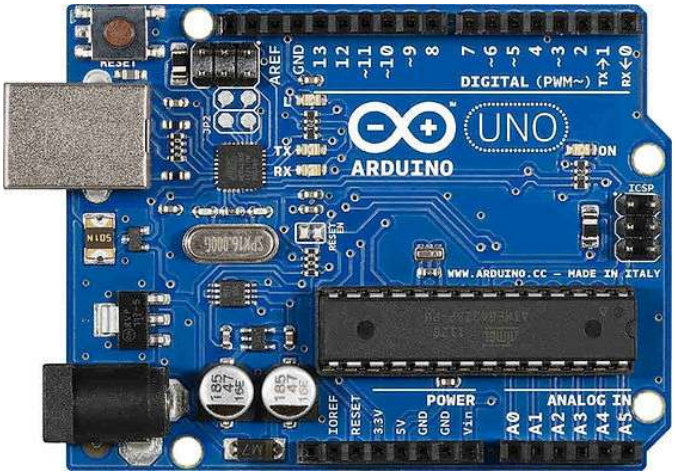
• User-Friendly Interface: Develop a user-friendly interface, possibly via a web or mobile application, that allows users to easily access and interpret water quality data, set threshold values, and receive notifications or recommendations for corrective actions.

• Data Storage and Analytics: Design a data storage and analytics system to securely store historical data, perform trend analysis, and generate reports for regulatory compliance and decision-making purposes.

3.COMPONENTS:

- Arduino uno
- Turbidity sensor
- Jumper wires
- I2c interface
- Lcd display

- **Arduino Uno**: The Arduino Uno is a popular microcontroller board featuring a versatile ATmega328P microcontroller, 14 digital I/O pins, 6 analog input pins, and a 16 MHz clock speed. It can be easily programmed using the Arduino IDE and is widely used for various electronics and DIY projects, making it an ideal choice for both beginners and experienced makers.



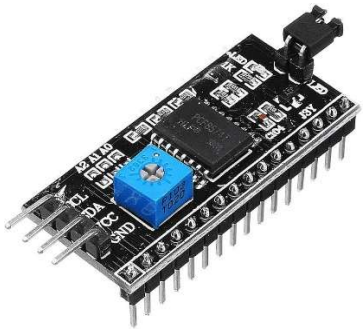
- **Turbidity sensor:** A turbidity sensor is an electronic device used to measure the cloudiness or haziness of a fluid, typically water. It operates by emitting light into the fluid and then detecting the amount of light scattered or absorbed by suspended particles in the water.

  Turbidity sensors play a crucial role in assessing water quality, as higher turbidity levels often indicate the presence of contaminants or suspended particles. They find applications in environmental monitoring, wastewater treatment, drinking water quality control, and

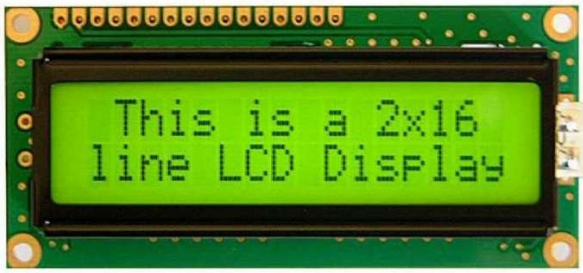
various industrial and scientific settings.

- **Jumper wires:** Jumper wires are essential components in electronics and prototyping. They are flexible wires with connectors on both ends, often used to establish electrical connections between various components on a breadboard or between different parts of a circuit. Jumper wires come in various lengths and colors, making it easy to organize and troubleshoot connections. These wires are a fundamental tool for building and testing electronic circuits, making them indispensable for hobbyists, students, and professionals in the field of electronics and electrical engineering.

- **I2c interface:** The I2C (Inter-Integrated Circuit) interface is a widely used communication protocol for connecting multiple electronic devices. It enables serial data transfer between components, using a two-wire bus with a master-slave architecture. I2C is known for its simplicity and versatility, making it suitable for various applications, including sensor networks and device interconnectivity. It allows multiple devices to share the same bus, each identified by a unique address, making it a preferred choice for many embedded systems and microcontroller-based projects.



- **Lcd display:** An LCD (Liquid Crystal Display) is a common screen technology used in various devices, from digital watches to smartphones and appliances. It operates by manipulating liquid crystals to control the passage of light. LCDs are preferred for their energy efficiency, thin profile, and the ability to display alphanumeric characters, graphics, and more, making them popular in consumer electronics and embedded systems. They are commonly used in information display, offering clear and legible visual output for a range of applications.



4.METHODOLOGY:

- **System Design and Setup:** Select appropriate components, including the turbidity sensor, microcontroller, and user interface (e.g., Arduino or Raspberry Pi).Build a robust and compact system that can be easily deployed in various water monitoring scenarios.Turbidity Sensor Integration: Calibrate the turbidity sensor to ensure accurate measurements.Develop a mechanism for in-situ turbidity measurement, enabling real-time data collection.

- **Data Collection and Transmission:** Establish a data collection system to continuously gather turbidity data.Implement data transmission capabilities to send real-time data to a central repository for analysis.

- **Data Analysis and Interpretation:** Create data analysis algorithms to interpret turbidity readings.Set predefined turbidity thresholds to trigger alerts when water quality falls below acceptable levels.User Interface Development:Design a user-friendly interface (web-based or mobile application) for stakeholders to monitor water quality in real-time.Enable users to configure alert thresholds and access historical data.

- **Data Logging and Storage:** Implement a data logging system to store historical data for trend analysis and reporting.Ensure data integrity and security in the storage and retrieval process.

- **Alert System Implementation:** Develop an alert system that can notify users when turbidity levels exceed predefined limits.Utilize various communication methods, such as email notifications or SMS alerts.

- **Testing and Validation:** Conduct rigorous testing of the system in real-world conditions, including different water bodies and environments.Compare the system's measurements with established water quality standards to ensure accuracy and reliability.

- **User Training and Documentation:** Prepare user manuals and documentation to assist stakeholders in setting up and using the system.Provide training sessions to ensure users can effectively utilize the monitoring system.

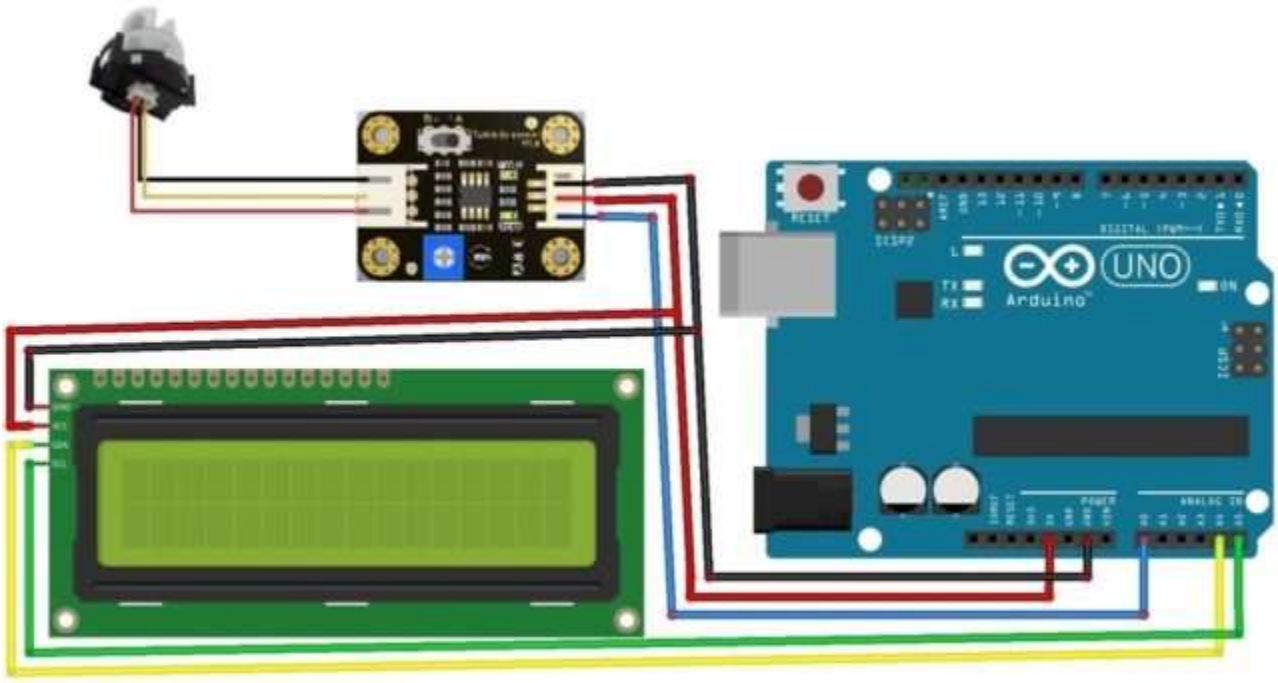
- **Deployment and Future Scaling:** Deploy the Water Quality Monitoring System in target locations, such as drinking water treatment plants, rivers, or lakes.Plan for future scalability and consider options for remote data access and control.

5. CODE:

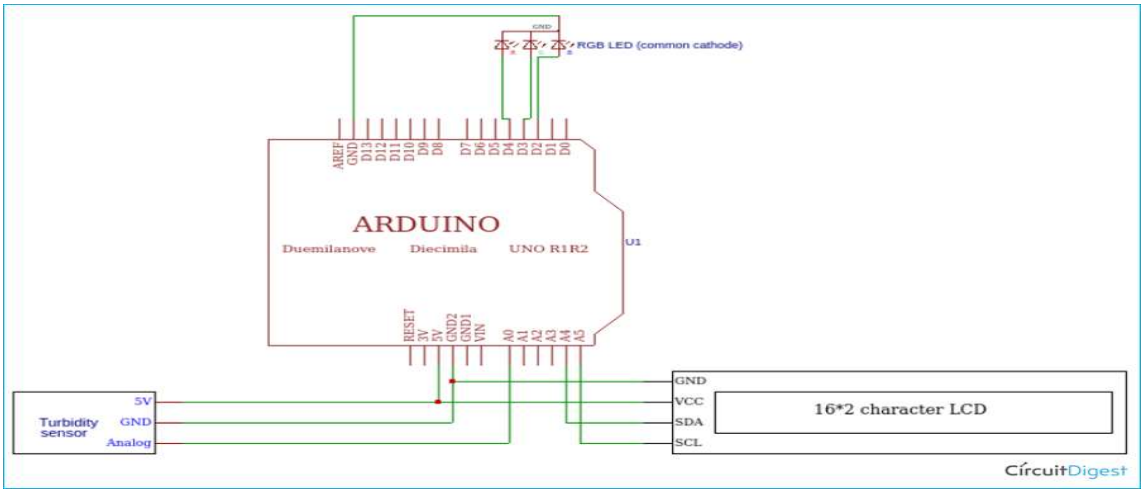
```
LiquidCrystal_I2C lcd(0x27, 2, 1, 0, 4, 5, 6, 7, 3, POSITIVE);

int sensorPin = A0;

void setup()

{

lcd.begin(16,2);

pinMode(3,OUTPUT);

pinMode(4, OUTPUT);

pinMode(5, OUTPUT);



}


void loop() {

int sensorValue = analogRead(sensorPin);

int turbidity = map(sensorValue, 0,640, 100, 0);

delay(100);

lcd.setCursor(0, 0);

lcd.print("turbidity:");

lcd.print("    ");

lcd.setCursor(10, 0);

lcd.print(turbidity);
```

```
delay(100);
if (turbidity < 20) {
digitalWrite(7, HIGH);
digitalWrite(8, LOW);
digitalWrite(9, LOW);
lcd.setCursor(0, 1);
lcd.print(" its CLEAR ");
}
if ((turbidity > 10) && (turbidity < 50)) {
digitalWrite(7, LOW);
digitalWrite(8, HIGH);
digitalWrite(9, LOW);
lcd.setCursor(0, 1);
lcd.print(" its CLOUDY ");
}
if (turbidity > 50) {
digitalWrite(7, LOW);
digitalWrite(8, LOW);
digitalWrite(9, HIGH);
lcd.setCursor(0, 1);
lcd.print(" its DIRTY ");}
```

Architecture of Arduino board



Block diagram of the experiment



6. RESULTS:

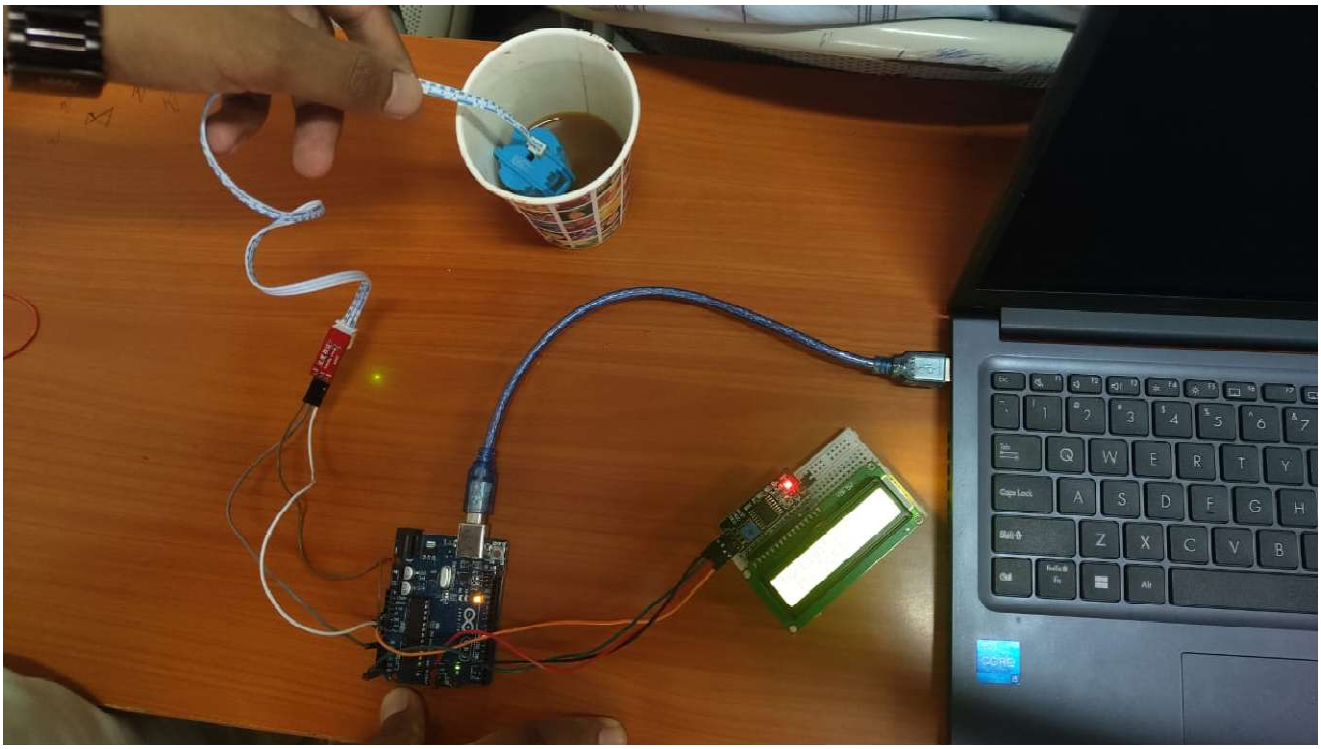
Results from the hardware prototype

1. turbidity: 5
   its CLEAR

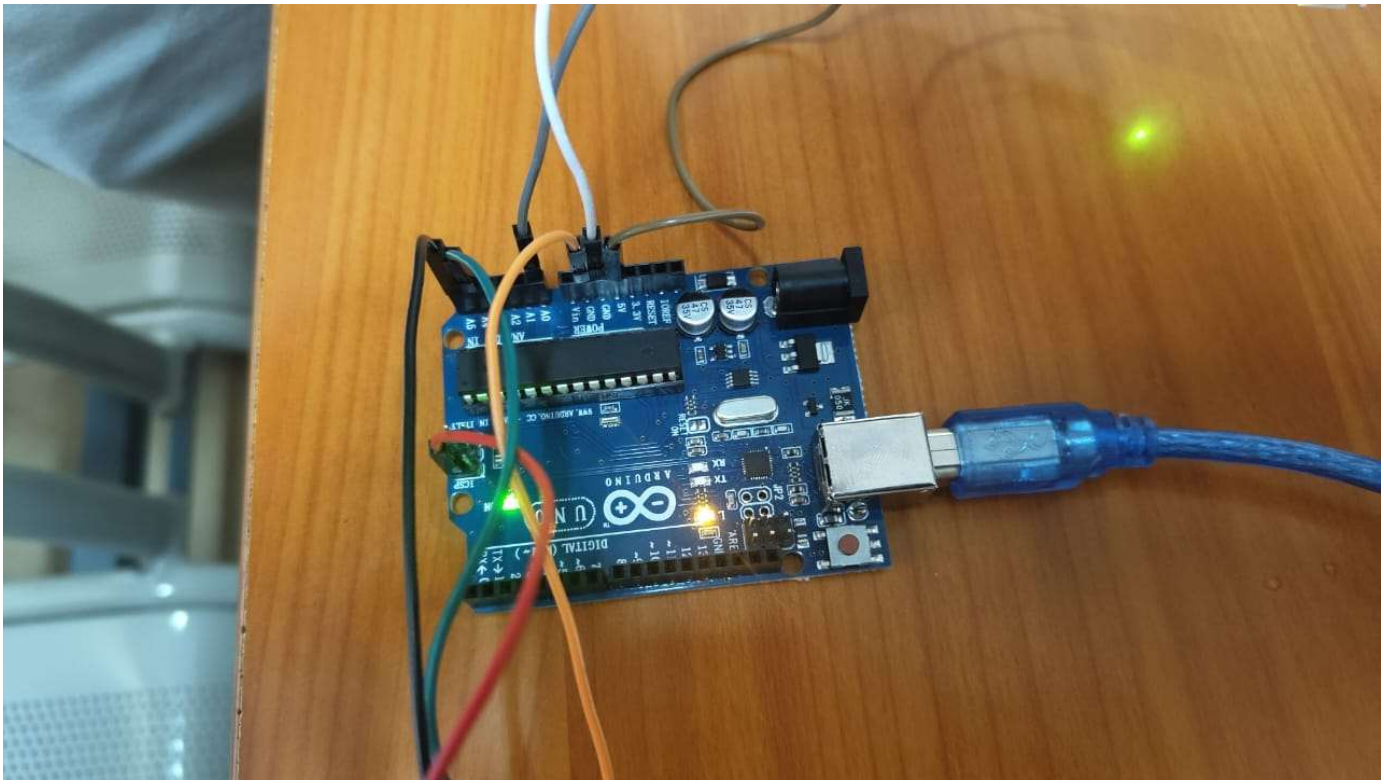
2. turbidity: 35
   its CLOUDY

3. turbidity: 75
   its DIRTY

PHOTOS:




turbidity:93
its DIRTY
Tab
Caps Lock


ARDUINO
UNO

CONCULSION:

- In conclusion, a Water Quality Management System involving IoT technology offers a comprehensive and sophisticated approach to monitoring and maintaining the quality of water in various contexts. This project leverages the power of interconnected devices, sensors, and data analytics to:

- **-->Enhance Water Safety**
- **-->Early Detection of Issues**
- **-->Optimize Resource Management**
- **-->Scalability and Accessibility**
- **-->Integration with Smart Technologies**
- **-->Disaster Preparedness**

- in summary, a Water Quality Management System utilizing IoT technology represents a significant advancement in ensuring the sustainability, safety, and conservation of one of our planet's most critical resources: water. It empowers us to be proactive stewards of the environment, protect public health, and make informed decisions that contribute to a more sustainable future.