KIT-KALAIGNARKARUNANIDHI INSTITUTE OF TECHNOLOGY
COIMBATORE -641 402

Approved by AICTE Affiliated to AnnaUniversity, Chennai Accredited With'A'Grade by NAAC & By NBA

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

IOT Based Smart Water Quality System

B19EEE504 - IoT Term Project Review -III

Batch Member:

DEEPAK KUMAR B - 711522BEE010

PERARASU S - 711522BEE040

VIMAL KUMAR S - 711522BEE063

Under the Guidance of

Mr.K.Pradheep
AP/EEE

Abstract

A smart water quality system using Arduino and NodeMCU is designed to monitor and manage water quality in real-time through IoT technology. The system employs an Arduino board to interface with various sensors, such as TDS, turbidity, and temperature sensors, to measure crucial water quality parameters. The NodeMCU, a low-cost Wi-Fi microcontroller, is used to wirelessly transmit the sensor data to a cloud server for storage and analysis. Users can access the data through a web dashboard or mobile application, receiving alerts if any parameter deviates from the safe range. This setup allows for continuous monitoring and early detection of water quality issues, making it ideal for applications in agriculture, aquaculture, and potable water systems.

Objective

The objectives of the proposed system are:

- To understand the existing water purification systems.
- To build a system to determine various water parameters such as temperature, conductivity, turbidity and to measure the level of water.
- To design a system to purify the polluted water using a filter.
- To analyze and store the recorded data and to use it for future purpose.

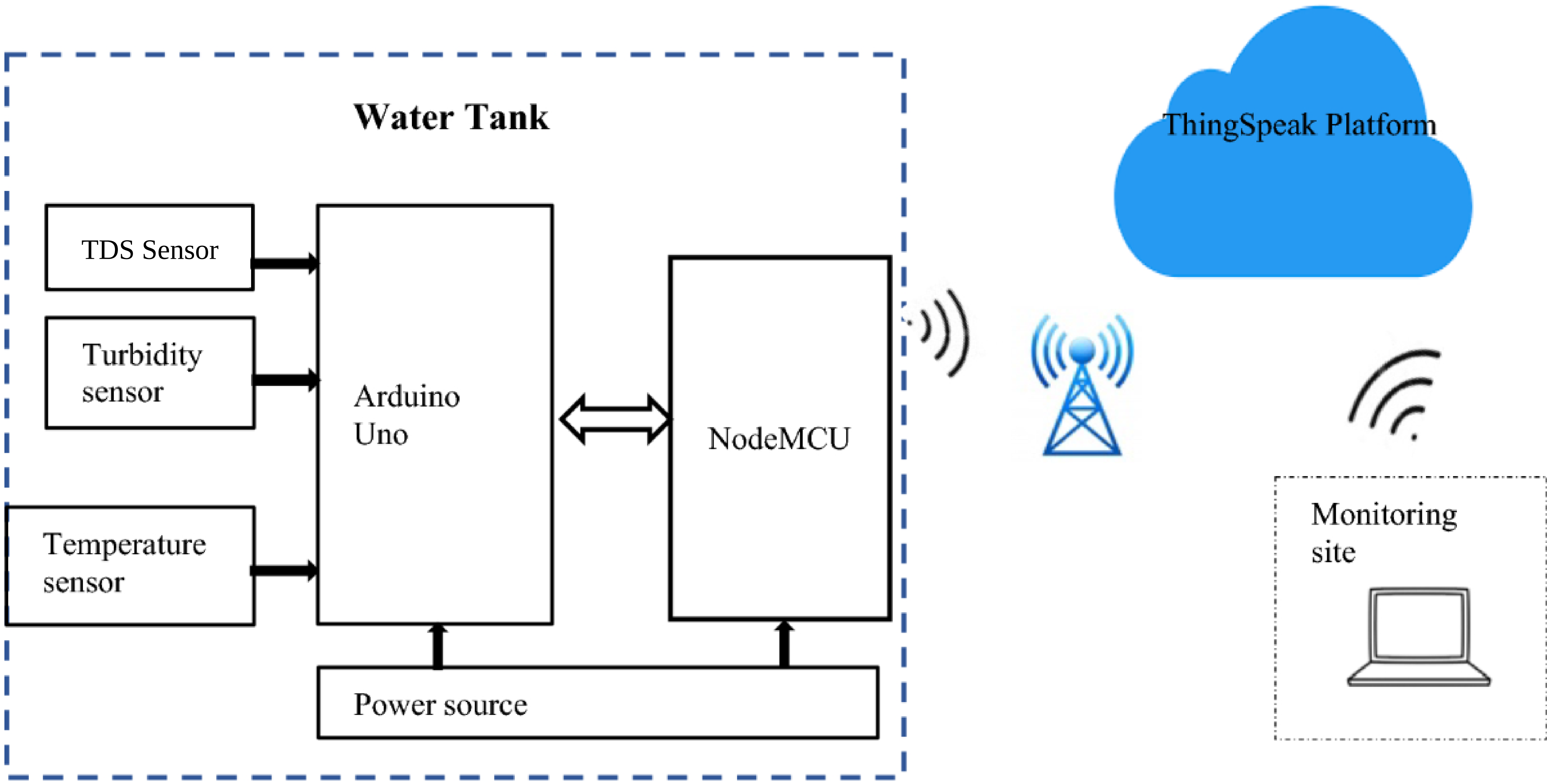
Existing system

Several existing smart water monitoring systems leverage IoT technology to provide real-time data on water quality. Examples include HydroNet, Libelium's Smart Water Platform, and KETOS Shield, which offer comprehensive monitoring of parameters like TDS, turbidity, and dissolved oxygen. These systems are equipped with features such as cloud-based analytics, remote access, and customizable alerts, making them ideal for applications in municipal water supplies, agriculture, and industrial water management. Their ability to continuously track water quality ensures timely responses to potential issues, enhancing the safety and sustainability of water resources.

Proposed System

The proposed smart water quality system integrates Arduino and NodeMCU microcontrollers with various sensors to provide real-time monitoring of water quality parameters such as TDS, turbidity, and temperature. The Arduino collects data from the sensors, while the NodeMCU transmits this information wirelessly to a cloud platform for storage and analysis. Users can access this data via a web dashboard or mobile app, receiving instant alerts if any parameters deviate from safe levels. This system ensures efficient, remote water quality management, making it suitable for applications in agriculture, aquaculture, and potable water monitoring.

Block Diagram



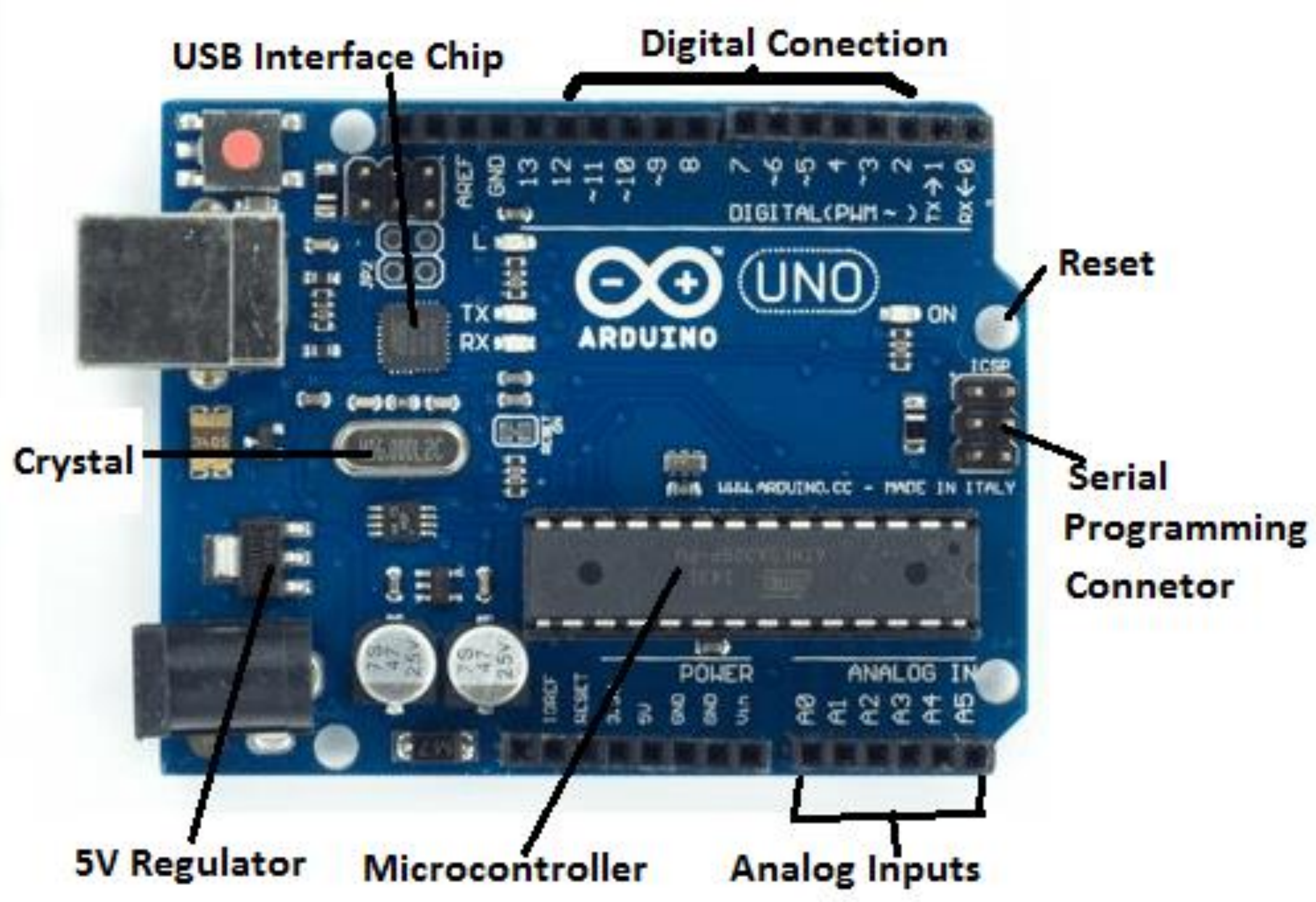
Components

- Arduino uno
- NodeMCU
- TDS sensor
- Turbidity sensor
- Temperature sensor

Arduino Uno

The Arduino Uno is a popular microcontroller board based on the ATmega328P. Here are its key Specifications:

1. Microcontroller: ATmega328P
2. Operating Voltage: 5V
3. Input Voltage (recommended): 7-12V
4. Digital I/O Pins: 14 (of which 6 can be used as PWM outputs)
5. Analog Input Pins: 6
6. DC Current per I/O Pin: 20 mA
7. DC Current for 3.3V Pin: 50 mA



NodeMCU

NodeMCU is an open-source IoT platform based on the ESP8266 Wi-Fi module.

Specifications:

1.Microcontroller: ESP8266

2.Operating Voltage: 3.3V

3.Digital I/O Pins: 16 (some can be used as PWM outputs)

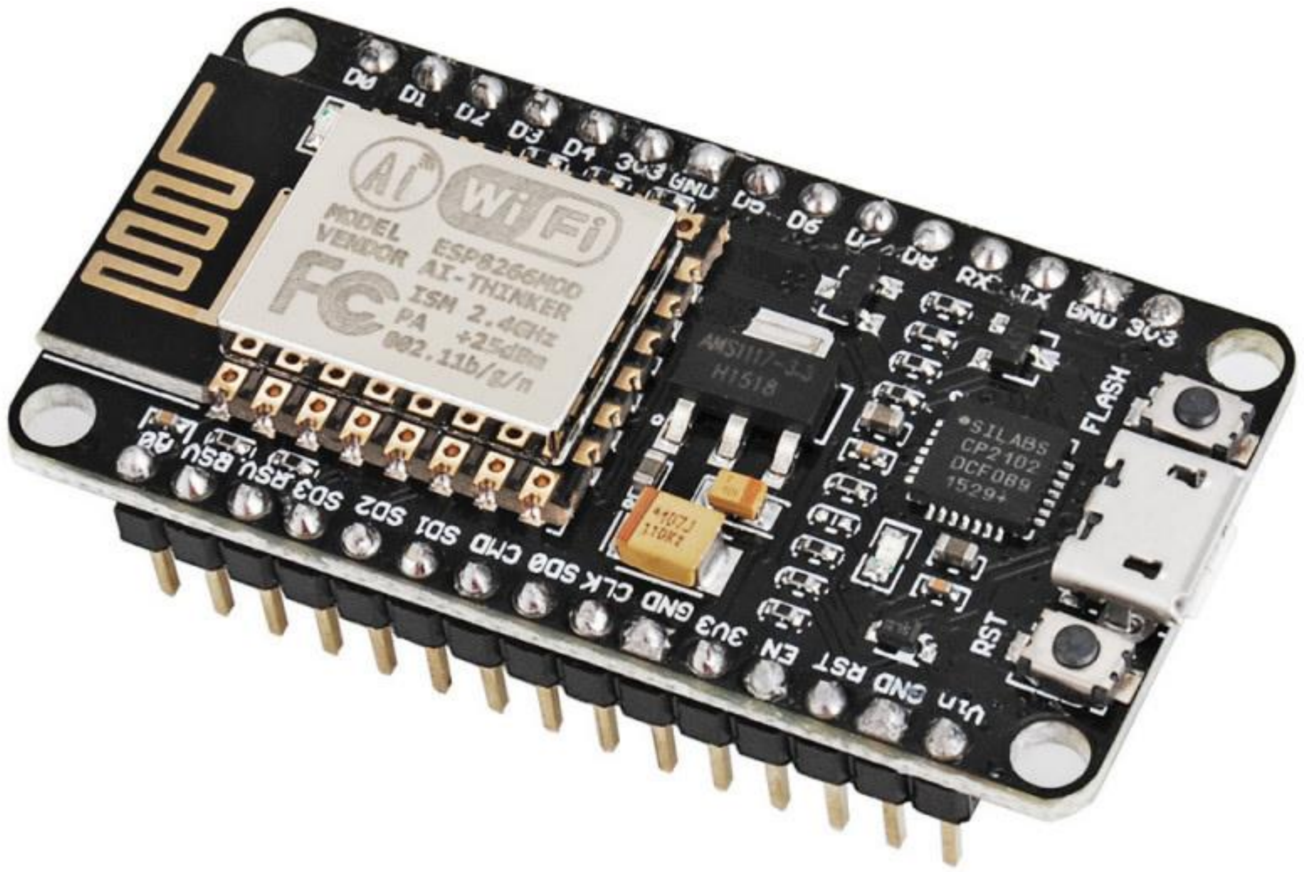
4.Analog Input Pins: 1 (10-bit resolution)

5.Flash Memory: Typically 4 MB (varies by module)

6.RAM: 80 KB

7.Wi-Fi: 802.11 b/g/n

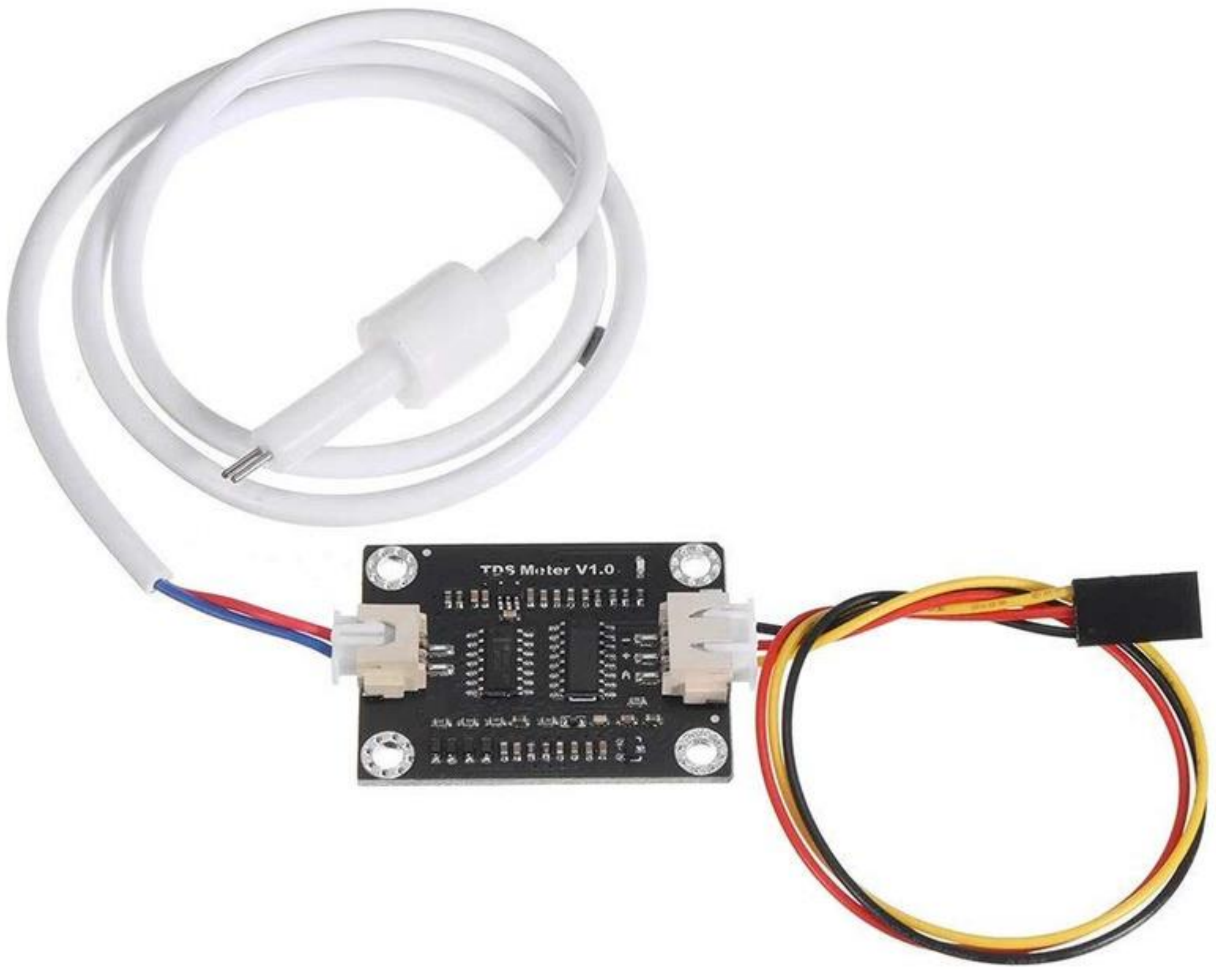
8.Clock Speed: 80 MHz (can be set to 160 MHz)



TDS sensor

Total Dissolved Solids (TDS) sensors measure the concentration of dissolved solids in water. Specifications :

1. Measurement Range: 0 to 1000 mg/L (or ppm), but some models can measure up to 2000 mg/L or more.
2. Output Type: Analog output (e.g., 0-5V) or digital output (UART, I2C).
3. Power Supply Voltage: Typically 3.3V to 5V DC.
4. Operating Temperature: Usually from 0°C to 50°C.
5. Response Time: Typically a few seconds.



Turbidity sensor

Turbidity sensors are used to measure the clarity of water by detecting suspended particles. Specifications :

1.Measurement Range:0 to 1000 NTU (Nephelometric Turbidity Units) for most sensors, but this can vary by model.

2.Output Type: Analog output or digital output .

3.Power Supply Voltage: Typically 3.3V to 5V DC.

4.Operating Temperature:Typically from 0°C to 50°C.

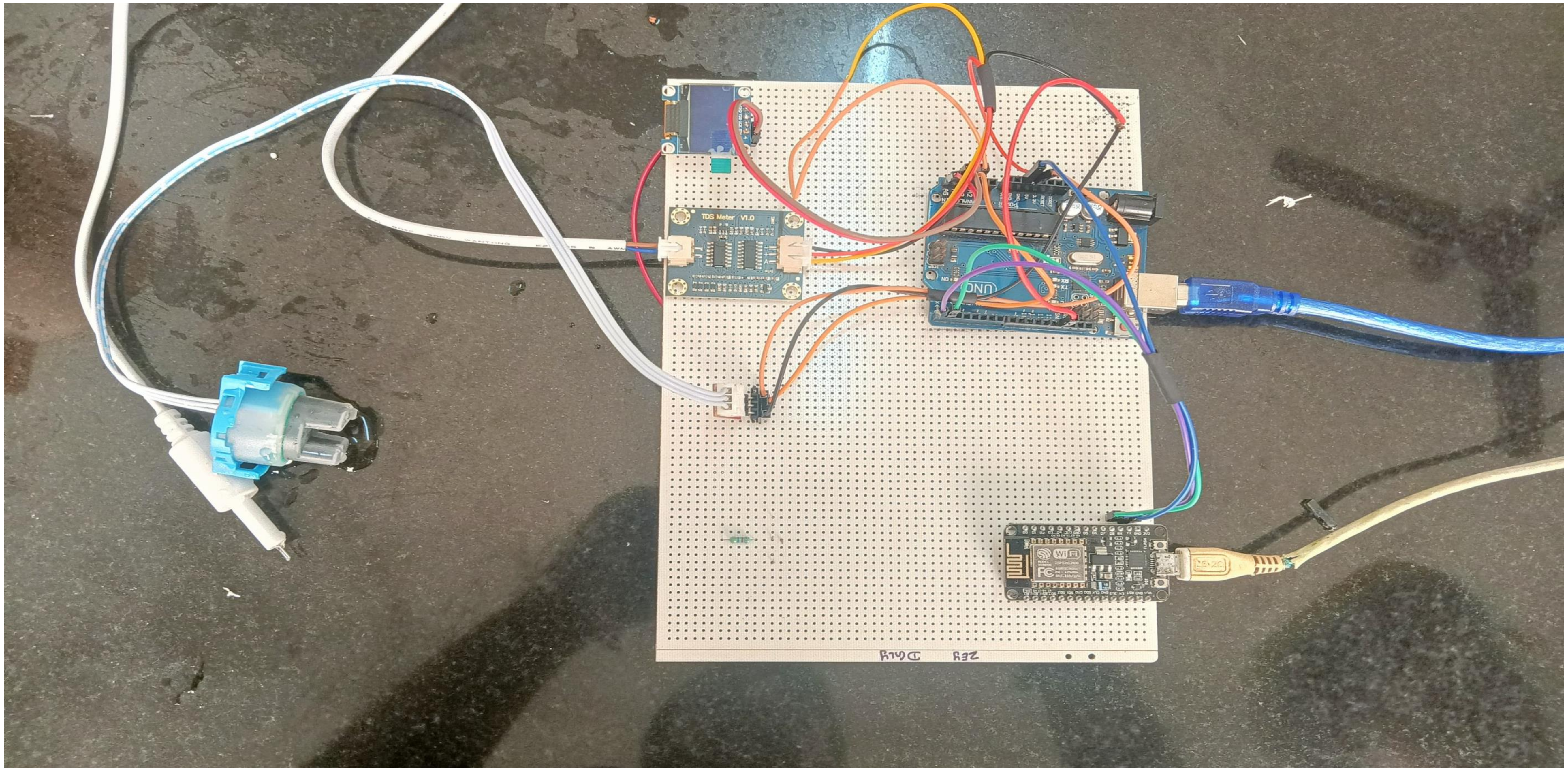
Temperature sensor

The DS18B20 is a popular digital temperature sensor known for its accuracy and ease of use.

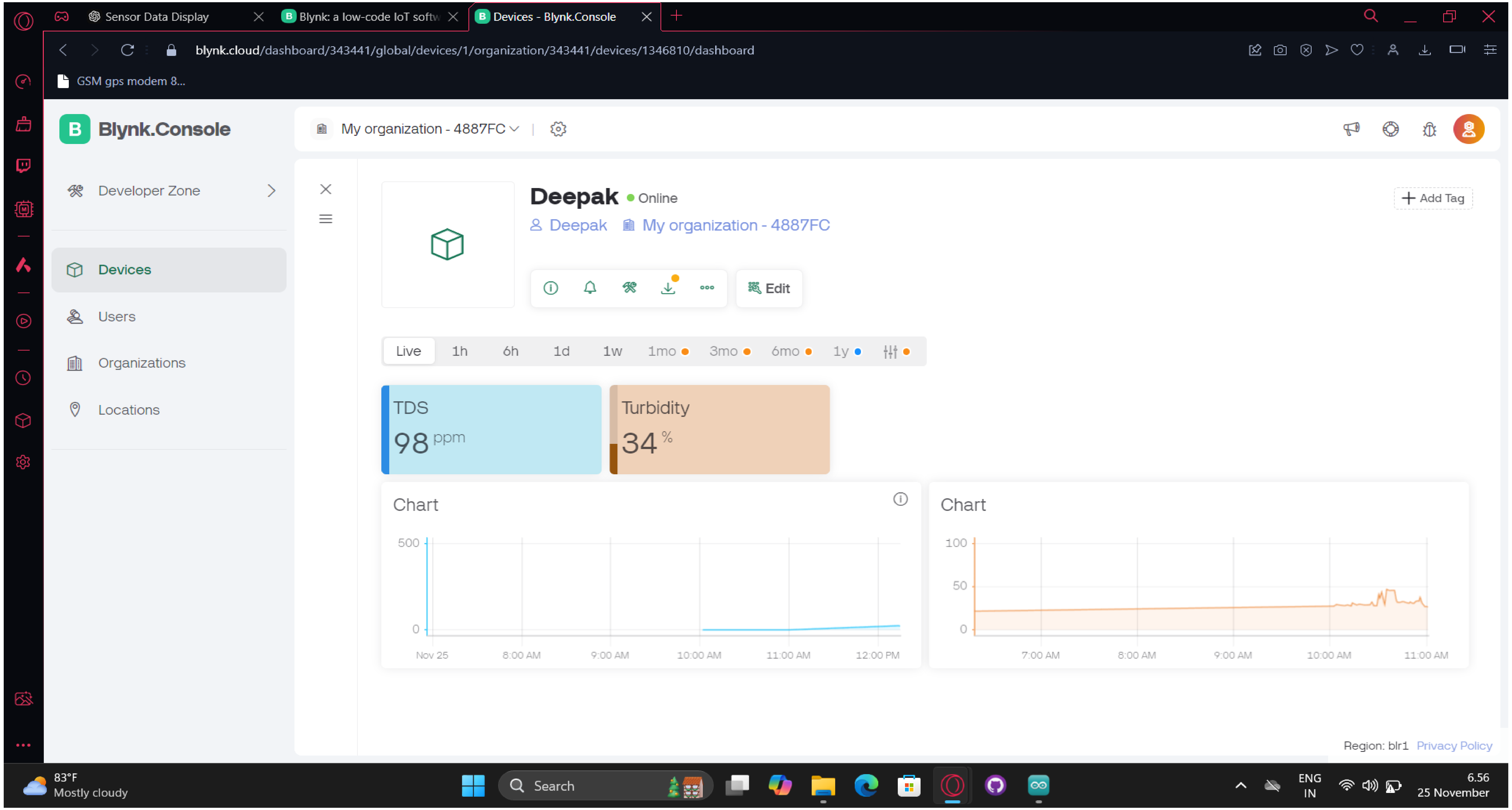
Specifications

1. Type: Digital temperature sensor (1-Wire interface)
2. Temperature Range:-55°C to +125°C
3. Accuracy: ±0.5°C from -10°C to +85°C
4. Resolution: Programmable from 9 to 12 bits (0.5°C to 0.0625°C)
5. Response Time: Typically around 750 ms for a complete conversion at 12-bit resolution
6. Output Signal: Digital (1-Wire interface)
7. Power Supply: Operating voltage: 3.0V to 5.5V

Result:



Output:



Sensor Data Display
Blynk: a low-code IoT softw
Devices - Blynk.Console
blynk.cloud/dashboard/343441/global/devices/1/organization/343441/devices/1346810/dashboard
GSM gps modem 8...
Blynk.Console
My organization - 4887FC
Developer Zone
Devices
Users
Organizations
Locations
Deepak
Online
Deepak
My organization - 4887FC
Add Tag
Edit
Live
1h
6h
1d
1w
1mo
3mo
6mo
1y
TDS
98 ppm
Turbidity
34 %
Chart
500
0
Nov 25
8:00 AM
9:00 AM
10:00 AM
11:00 AM
12:00 PM
Chart
100
50
0
7:00 AM
8:00 AM
9:00 AM
10:00 AM
11:00 AM
Region: blr1
Privacy Policy
83°F
Mostly cloudy
Search
ENG
IN
6.56
25 November

Literature Survey

Title	Author	Year	Publication	Methodology	Summary
Smart Water Quality Monitoring System Using IoT and Machine Learning	Emily Johnson, Mark Lee	2024	International Journal of Environmental Monitoring	This paper presents a smart water quality monitoring system that integrates Internet of Things (IoT) sensors with machine learning algorithms. The system continuously collects data on parameters such as pH, turbidity, and temperature. Data is analyzed in real-time to predict potential contamination events.	The study demonstrates the effectiveness of using IoT devices for real-time water quality monitoring, showing significant improvements in response time to contamination risks. The machine learning component enhances predictive accuracy, allowing for proactive measures to ensure water safety. The authors also discuss the challenges of sensor calibration and data integration across different platforms.
IoT-Based Water Quality Monitoring System	Kumar, A., & Singh, R.	2023	Journal of Ambient Intelligence and Humanized Computing	Experimental design and prototype development	This study presents the design and implementation of an IoT-based water quality monitoring system. The prototype uses multiple sensors to measure parameters such as pH and turbidity, providing real-time data transmission for effective monitoring

Title	Author	Year	Publication	Methodology	Summary
A Review of Smart Water Quality Monitoring Systems	Al-Khatib, I.	2023	Environmental Monitoring and Assessment	Systematic literature review.	This paper reviews existing smart water quality monitoring systems, highlighting various technologies and methodologies used. It discusses the integration of IoT, sensor networks, and data analytics in enhancing water quality management.
Real-Time Water Quality Monitoring Using Smart Technologies	Torres, J., & Ramírez, E.	2022	Journal of Water Supply: Research and Technology	Field experiments and data analysis	This study focuses on real-time water quality monitoring technologies. Through field experiments, it demonstrates how smart technologies can provide timely data, enabling quicker responses to water quality issues and enhancing public health protection.

Title	Author	Year	Publication	Methodology	Summary
Smart Water Quality Monitoring: Technologies and Applications	Bhatnagar, A., & Sethi, S.	2022	Environmental Monitoring and Assessment	Comprehensive literature review	This paper reviews various technologies used in smart water quality monitoring systems, including IoT, remote sensing, and data analytics. It discusses the implications of these technologies for environmental monitoring and management.
Real-Time Water Quality Monitoring System Using Wireless Sensor Networks	Rahman, A., & Deb, S.	2022	Journal of Sensors	Design and implementation of a wireless sensor network	This study presents a wireless sensor network designed for real-time water quality monitoring. The system is tested in field conditions, demonstrating its capability to monitor multiple water quality parameters effectively.

Title	Author	Year	Publication	Methodology	Summary
The Application of Remote Sensing in Water Quality Assessment	Wu, J., & Zhang, Y.	2022	Remote Sensing of Environment	Remote sensing data analysis	This paper discusses the application of remote sensing technologies for assessing water quality in large water bodies. The findings indicate that remote sensing can provide valuable data for monitoring and managing water resources.
Real-Time Water Quality Monitoring System Based on Wireless Sensor Networks	Stojanovic, J., & Henao, H.	2021	IEEE Sensors Journal	Development and testing of a wireless sensor network	This paper presents a wireless sensor network designed for real-time water quality monitoring. The authors discuss the system architecture and demonstrate its effectiveness in detecting changes in water quality parameters.

Title	Author	Year	Publication	Methodology	Summary
Smart Water Management: A Review of Current Technologies	Pahlavan, K., & Krishnamurthy, S.	2021	Journal of Water Resources Planning and Management	Comprehensive literature review	This review discusses current technologies in smart water management, including monitoring systems. It highlights the role of sensor networks and data analytics in improving water quality management practices.
A Review of Smart Water Quality Monitoring Technologies	Rojas, F., & Esquivel, A..	2021	Water Science and Technology	Systematic literature review	This review analyzes smart water quality monitoring technologies, discussing the integration of sensors, data communication, and analytics. It identifies trends and gaps in current research, suggesting areas for future exploration.

Research Gap

- **Sensor Limitations:** Need for more affordable sensors capable of detecting a wider range of contaminants, beyond basic parameters like pH and turbidity.
- **Energy Efficiency:** Development of energy-efficient, solar-powered systems for use in remote or off-grid areas.
- **Scalability:** Creation of modular, customizable systems adaptable to various environments and industrial needs.
- **Interoperability:** Standardized protocols for better integration with other smart city and environmental monitoring systems.

Thank you