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INTRODUCTION

This system involves the continuous monitoring of the Total Dissolved Solids (TDS) in river water using a TDS sensor, specifically the SEN0244 model, alongside the measurement of turbidity to assess dust pollutants. The collected data is then transmitted to the Thing Speak cloud platform for real-time monitoring and analysis of the river water quality. By deploying multiple instances of this monitoring system at various locations along a river, it becomes possible to identify and assess the sources of pollution.

The TDS sensor (SEN0244) is a crucial component that quantifies the concentration of dissolved solids in the river water. This includes various ions, minerals, and other substances that contribute to the overall TDS value. Concurrently, turbidity measurements provide insights into the clarity of the water by gauging the presence of suspended particles, such as dust pollutants. Together, these parameters offer a comprehensive understanding of the water quality.

The flow of river takes a huge roleplay when it comes about the quality of Water in River. And that’s why necessary sensors being used to also measure flow of river.

The Proposed system has various diagnostic features that can be used to determine any fault. The System also features Solar Charger and the Charging power can also be observed remotely for Power and Charge diagnostics.

The integration with the ThingSpeak cloud serves as a centralized platform for data storage, analysis, and visualization. This allows stakeholders, environmentalists, and relevant authorities to access real-time information about the river's health. Moreover, it facilitates the identification of trends and anomalies in the water quality data.

One notable advantage of implementing this system at multiple locations along a river is the ability to establish a gradient of sensed values. Monitoring variations in TDS and turbidity levels across different points helps pinpoint areas of the river that exhibit higher pollution levels. By analyzing the spatial distribution of these measurements, it becomes possible to infer the potential sources of contamination. This strategic deployment enables a more targeted and effective approach to addressing and mitigating pollution in rivers.

ADVANTAGES OF PROPOSED SYSTEM:

- **Prevention of Impact on Aquatic Flora and Fauna**:

The continuous monitoring of Total Dissolved Solids (TDS) and turbidity in river water is crucial for preventing adverse effects on aquatic flora and fauna.

- **Identification of Pollution Sources**:

The system's capability to measure TDS and turbidity at multiple locations along a river provides a valuable tool for identifying sources of pollution. By analyzing variations in sensor readings, it becomes possible to pinpoint specific areas where pollution levels are elevated. This information is instrumental in implementing targeted pollution control measures and addressing the root causes of contamination.

- **Facilitation of Dissolved Salts and Contaminants Tracking:**

The monitoring system facilitates the tracking of dissolved salts and contaminants in river water. This is essential for understanding the composition of the water and identifying any substances that may pose a threat to the ecosystem. Continuous tracking enables prompt responses to changes in water quality, ensuring that corrective actions can be taken swiftly to maintain a healthy aquatic environment

- **Conservation of Wildlife Reservoirs and Biodiversity:**

By actively monitoring and managing water quality, the system contributes to the conservation of reservoirs of wildlife and biodiversity in and around rivers. Healthy water ecosystems are essential for supporting diverse flora and fauna. Protecting these reservoirs not only preserves the natural balance of the ecosystem but also ensures the sustainability of wildlife populations

DESCRIPTION AND WORKING:

The **TDS sensor** measures the **Total Dissolved Solids** in the water, which is the total amount of mobile charged ions, including minerals, salts, or metals dissolved in a given volume of water. The **turbidity sensor** measures the **cloudiness** of the water caused by suspended particles. The **ESP-01 WiFi module** is used to connect the system to the internet and upload the data to the cloud.

1. **Sensor Connections**:

• The Total Dissolved Solids (TDS) sensor and the turbidity sensor are both physically connected to the Arduino Uno microcontroller. These sensors are responsible for measuring the concentration of dissolved solids and the cloudiness of the water, respectively.

2. **WiFi Module Integration:**

• The ESP-01 WiFi module is integrated into the system and connected to the Arduino Uno. This module serves as the communication bridge between the sensor data and the internet.

3. **Data Acquisition by Arduino Uno:**

• The Arduino Uno reads data from both the TDS sensor and the turbidity sensor. This involves collecting information about the total dissolved solids and the turbidity level in the river water.

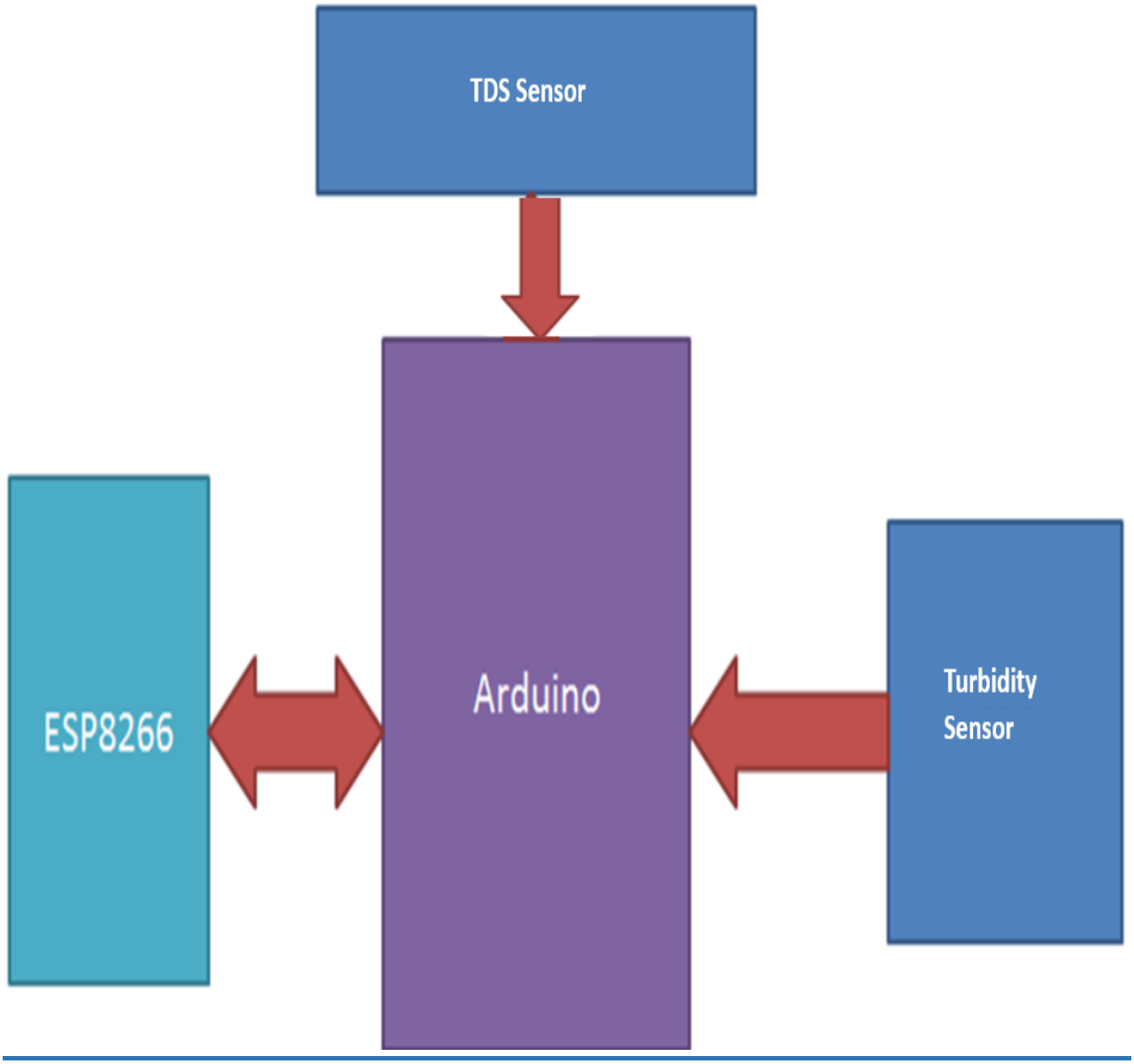
4. **Data Transmission to WiFi Module:**

• The Arduino Uno processes the sensor data and sends it to the ESP-01 WiFi module. This transfer of information is a crucial step in preparing the data for internet transmission.

5. **Internet Connectivity and Cloud Upload:**

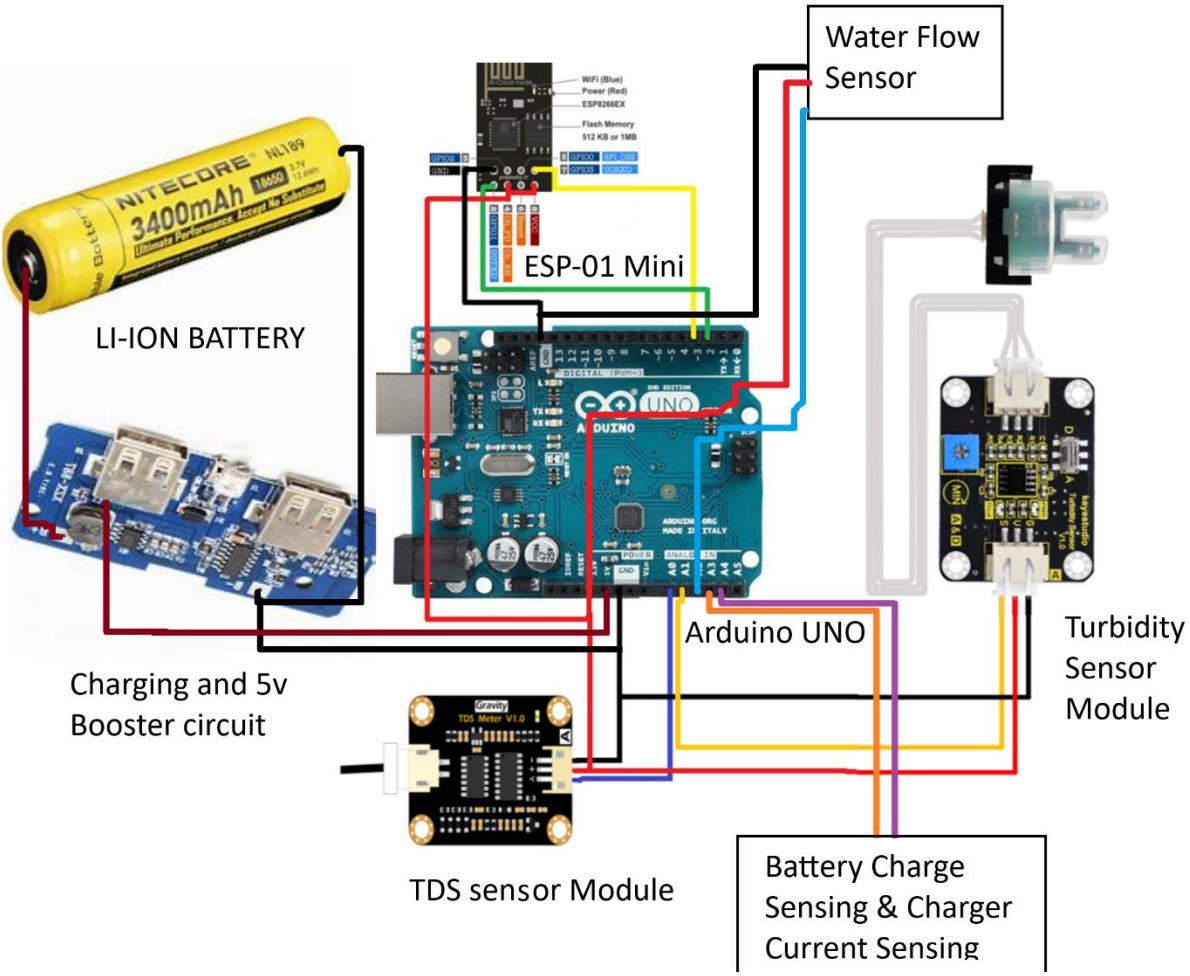
• The ESP-01 WiFi module establishes a connection to the internet, enabling the system to transmit data over the web. It connects to the ThingSpeak cloud platform.

Block Diagram



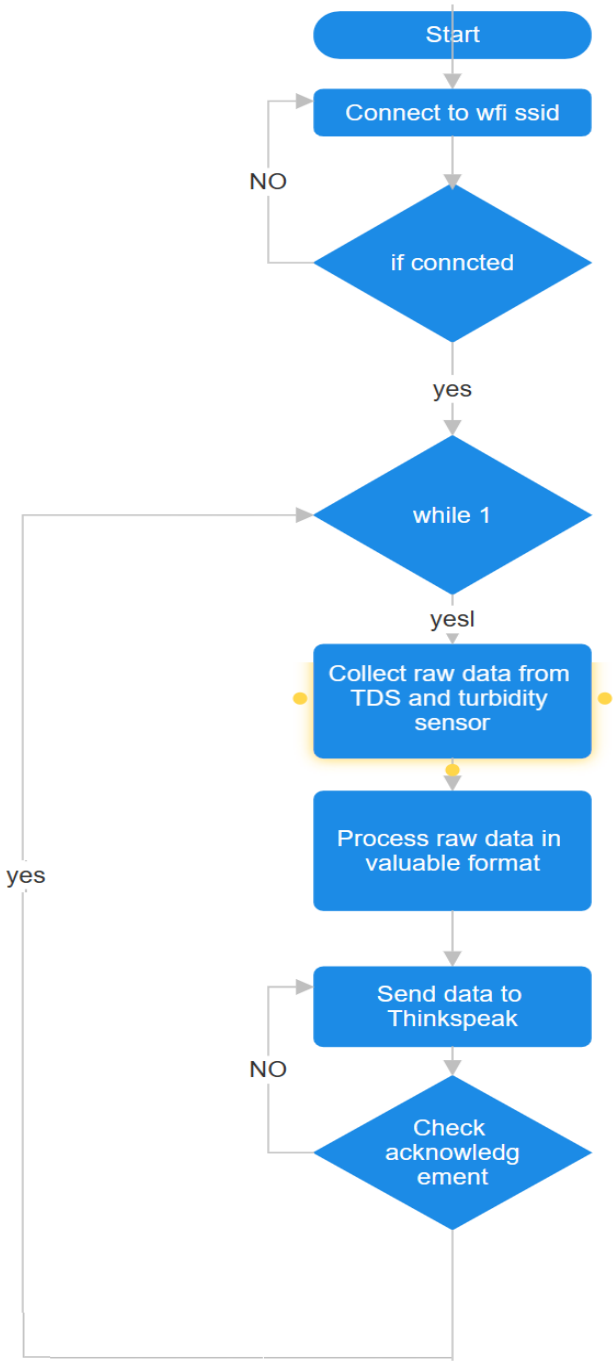
Arduino Uno connectivity with Wi-Fi module

CIRCUIT DIAGRAM



Circuit diagram connectivity of arduino and peripheral

FLOW CHART



Flow chart of overall setup

COMPONENTS	SPECIFICATION	PRICE(Rs)
Arduino Uno R3	Microcontroller development board	300
Turbidity Sensor	Measure Cloudiness	600
TDS sensor	Measure values of Dissolved salts	600
ESP-01	Wi-Fi Module	150

Turbidity Sensor

A turbidity sensor is an analytical sensor that measures the cloudiness or haziness and the concentration of total dissolved/suspended solids of a solution . It is a highly useful and effective instrument to identify the clarity and particle content in a solution, like water. Turbidity sensors are used to reduce waste, improve yields, and analyze water quality in a wide range of industries.

Turbidity sensors operate on the principle of light scattering. They emit a beam of light, typically infrared or white light, into the liquid sample. When this light encounter suspended particles in the sample, it scatters in various directions. The sensor then detects the scattered light and quantifies its intensity.

Internal structure of Turbidity Sensor

A turbidity sensor consists of a fixed light beam that passes through a sample to measure how much light is transmitted, and how much light is scattered via photodetectors . The sensor features an LED lamp and two light detectors positioned in 90 and 135 degree angles . Solid particles in the medium cause the incident light emitted by the lamp to scatter. The turbidity or solids content of the medium is calculated from the amount of the scattered light received by the detectors .

The outer structure of a turbidity sensor is typically made of plastic and some metal-alloy traces . The sensor has two horn-like structures and a top-to-bottom mono-material body. A black-colored cap is placed at the bottom of the sensor. Thick alloyed contact legs provide means for various connectors to hold to the sensor. A white plastic slab protects the legs from damage and acts as a fixture for good clamping of the sensor .

TDS Sensor

A TDS sensor is a water quality sensor that measures the concentration of total dissolved solids (TDS) in a solution . TDS refers to the total amount of organic and inorganic substances present in a liquid, including minerals, salts, and metals .
TDS sensors are used to assess the overall quality of water by measuring the concentration of dissolved solids in it. Higher TDS values may indicate a higher concentration of impurities, while lower values may indicate purer water .

How does a TDS Sensor Works

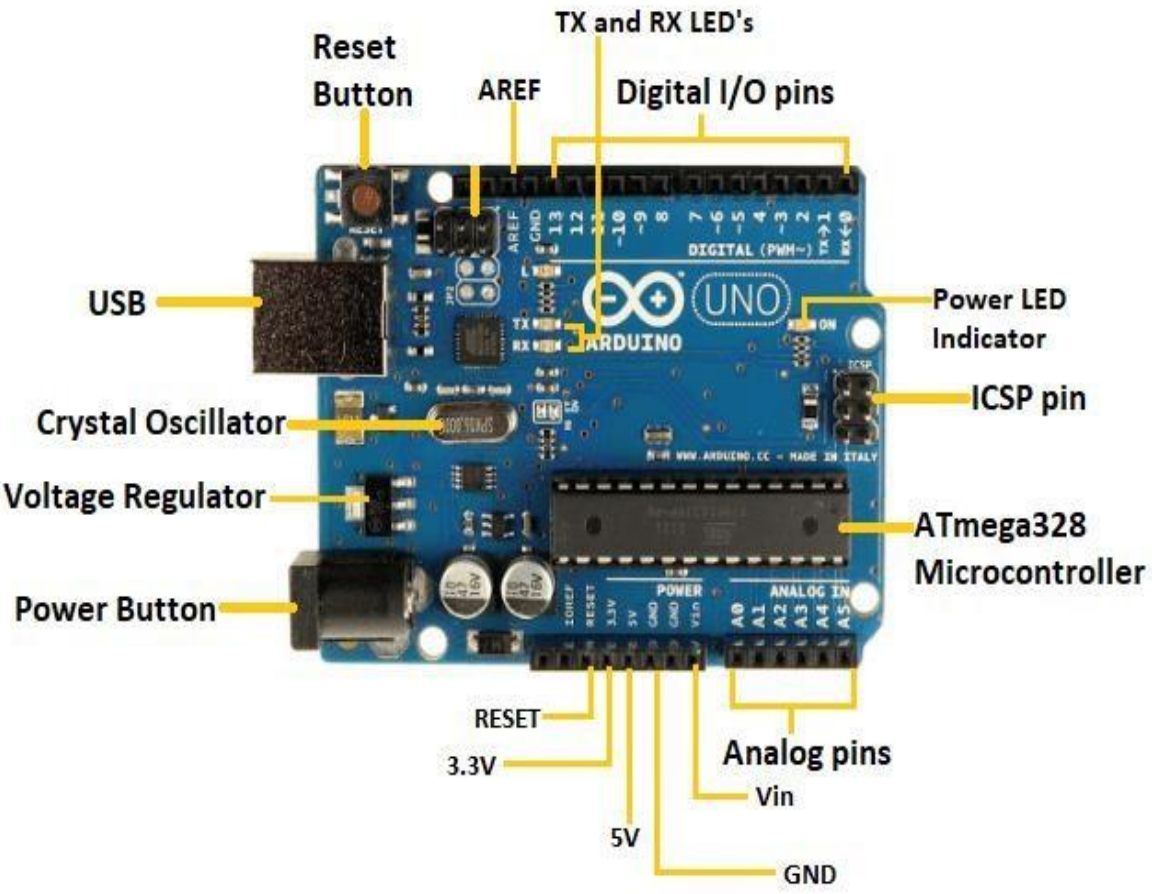
A TDS sensor is a water quality sensor that measures the concentration of total dissolved solids (TDS) in a solution . TDS refers to the total amount of organic and inorganic substances present in a liquid, including minerals, salts, and metals .
TDS sensors operate on the principle of electrical conductivity. They measure the electric charge discharge between the two needles of a sensor probe. When an excitation source is given to the sensor probe immersed in water, electric charges are conducted by the ions of dissolved materials between the needles .
The internal structure of a TDS sensor is composed of a sensor probe, a circuit board, and a display unit . The sensor probe is made up of two metallic probes that are inserted into the liquid sample. The circuit board is responsible for processing the signal from the sensor probe and displaying the TDS value on the display unit .
The TDS sensor probe is made up of two metallic probes that are inserted into the liquid sample. The probes are usually made of platinum or

titanium, which are highly resistant to corrosion and can withstand high temperatures . The probes are connected to the circuit board via wires, which transmit the signal from the probes to the circuit board .

ESP-01 Module

The ESP-01 is a Wi-Fi module that allows microcontrollers to access a Wi-Fi network . It is a self-contained SOC (System On a Chip) that doesn't necessarily need a microcontroller to manipulate inputs and outputs as you would normally do with an Arduino, for example, because the ESP-01 acts as a small computer . Depending on the version of the ESP8266, it is possible to have up to 9 GPIOs (General Purpose Input Output) .

Arduino UNO



ATmega328 Microcontroller- It is a single chip Microcontroller of the
ATmega family. The processor code inside it is of 8-bit. It combines Memory (SRAM, EEPROM, and Flash), Analog to Digital Converter, SPI serial ports, I/O lines, registers, timer, external and internal interrupts, and oscillator.

ICSP pin - The In-Circuit Serial Programming pin allows the user to program using the firmware of the Arduino board.

Power LED Indicator- The ON status of LED shows the power is activated. When the power is OFF, the LED will not light up.

Digital I/O pins- The digital pins have the value HIGH or LOW. The pins numbered from D0 to D13 are digital pins.

TX and RX LED's- The successful flow of data is represented by the lighting of these LED's.

AREF- The Analog Reference (AREF) pin is used to feed a reference voltage to the Arduino UNO board from the external power supply.

Reset button- It is used to add a Reset button to the connection.

USB- It allows the board to connect to the computer. It is essential for the programming of the Arduino UNO board. Crystal Oscillator- The Crystal oscillator has a frequency of 16MHz, which makes the Arduino UNO a powerful board.

Voltage Regulator- The voltage regulator converts the input voltage to 5V.

GND- Ground pins. The ground pin acts as a pin with zero voltage.

Technical Specifications of Arduino UNO

There are 20 Input/Output pins present on the Arduino UNO board. These 20 pis include 6 PWM pins, 6 analog pins, and 8 digital I/O pins.

The PWM pins are Pulse Width Modulation capable pins.

The crystal oscillator present in Arduino UNO comes with a frequency of 16MHz.

The input voltage of the UNO board varies from 7V to 20V.

Arduino UNO automatically draws power from the external power supply. It can also draw power from the USB.

Reference

- Turbidity Sensor with Arduino for Water quality monitoring, Turbidity Meter (electroniclinic.com)
- Arduino with TDS Sensor (Water Quality Sensor) | Random Nerd Tutorials
- IoT Analytics - ThingSpeak Internet of Things