REAL TIME WATER QUALITY MONITORING AND ANALYSIS SYSTEM

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AIM:

To design and implement an IoT-enabled water quality monitoring system that continuously measures water parameters like pH, turbidity, dissolved oxygen, conductivity, and temperature, processes the data, and transmits it to the cloud dashboard for real-time monitoring and analysis.

COMPONENTS REQUIRED:

- ESP8266 (Microcontroller)
- PH sensor
- Turbidity sensor
- Water proof Temperature sensor
- TDS sensor
- DO(Dissolved Oxygen) sensor

ESP8266:

- The ESP8266 is a low-cost, highly integrated Wi-Fi System-on-Chip (SoC) from Espressif Systems, designed for Internet of Things (IoT) applications, that provides a built-in Wi-Fi transceiver, CPU, and TCP/IP protocol stack.
- It allows microcontrollers to connect to a Wi-Fi network and enables the creation of simple Wi-Fi applications or offloads networking tasks.
- The ESP8266 operates at the 2.4 GHz frequency band, specifically from 2400 MHz to 2500 MHz (or 2.4GHz-2.5GHz)

pH SENSOR:

- Measures the acidity or alkalinity of water, indicating its chemical balance.
- pH sensor can measure the range of 0 to 14 pH
- The safe pH range of water is 6.5 to 8.5.
- Values below 6.5 indicate acidic water
- Values above 8.5 indicate alkalinity, both of which can be harmful.

TEMPERATURE SENSOR:

- Monitors the water's temperature, a crucial factor affecting other water quality
- Temperature range from -40 ºF to 400 ºF (-40 ºC to 204 ºC)

- Water temperature should ideally be in the range of 20°C to 30°C.
- Extremely low or high temperatures affect aquatic organisms and dissolved oxygen levels.

TURBIDITY SENSOR:

- Detects the clarity of water caused by suspended particles.
- Turbidity should be less than 5 NTU for safe drinking water.
- Higher turbidity indicates suspended particles, reducing clarity and increasing contamination risks.

TDS SENSOR:

- Indicates the total concentration of dissolved impurities in the water, such as salts and minerals.
- TDS should be less than 500 mg/L as per WHO standards.
- Values between 150–300 mg/L are considered good, while anything above 500 mg/L is unsafe for consumption.

DISSOLVED OXYGEN SENSOR:

- Measures the concentration of dissolved oxygen in the water, which is vital for aquatic life and overall water health.
- Healthy water should have a DO level of 6.5 – 8 mg/L.
- Levels below 3 mg/L can be dangerous for aquatic life, while 0 mg/L leads to lifeless water.

AVAILABLE COMPONENTS:

- ESP8266
- Breadboard
- OLED display
- Turbidity sensor
- DS18B20 (Temperature sensor)
- Connecting wires
- USB cable
- LED

PIN CONFIGURATION:

OLED DISPLAY(SSD1306, I2C type)

COMPONENTS	**ESP8266 PIN**
OLED VCC	3.3 V
OLED GND	GND
OLED SDA	D5(GPIO4)
OLED SCL	D6(GPIO5)

TURBIDITY SENSOR:

COMPONENTS	**ESP8266 PIN**
VCC	3.3V
GND	GND
ANALOG OUTPUT	A0(ANALOG PIN)

DS18B20 (TEMPERATURE SENSOR):

COMPONENTS	**ESP8266**
VCC	3.3V
GND	GND
DATA	D2(GPIO4)

LED:

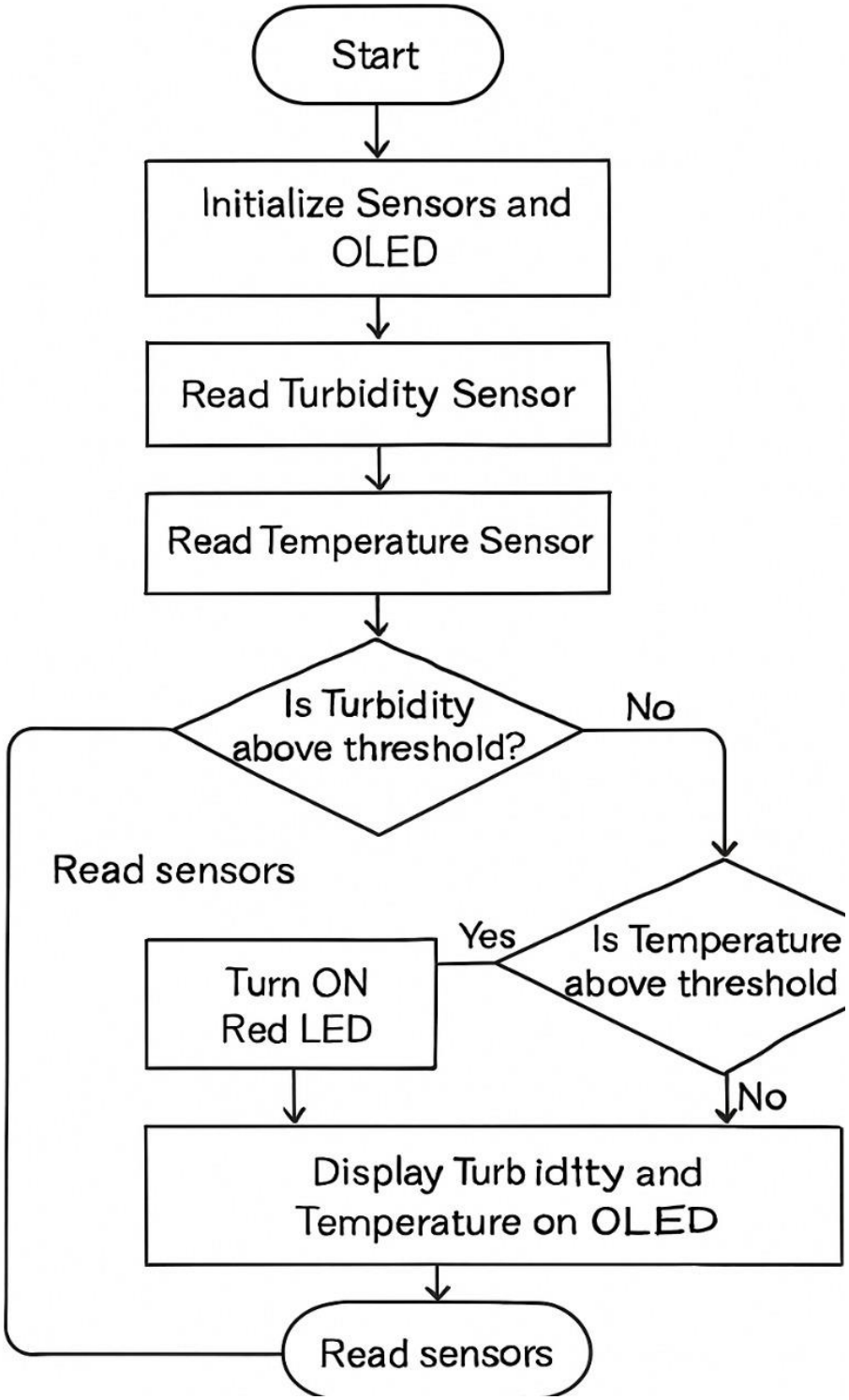
COMPONENTS	**ESP8266**
LED 1	D7(GPIO13)
LED 2	D8(GPIO15)
CATHODE OF BOTH LEDs	GND

PROCEDURE:

- Initialize system – Set up ESP8266 in Arduino IDE and initialize all sensors (temperature, turbidity) and OLED display.
- Collect sensor data – Continuously read turbidity and temperature values from connected sensors.
- Process data – Compare readings with safe threshold ranges to determine water quality.

- Display results – Show real-time values and water status (Safe/Unsafe) on the OLED screen.
- Indicate status – Turn ON green LED for safe water, red LED for unsafe water, and test with different water samples.

FLOWCHART:



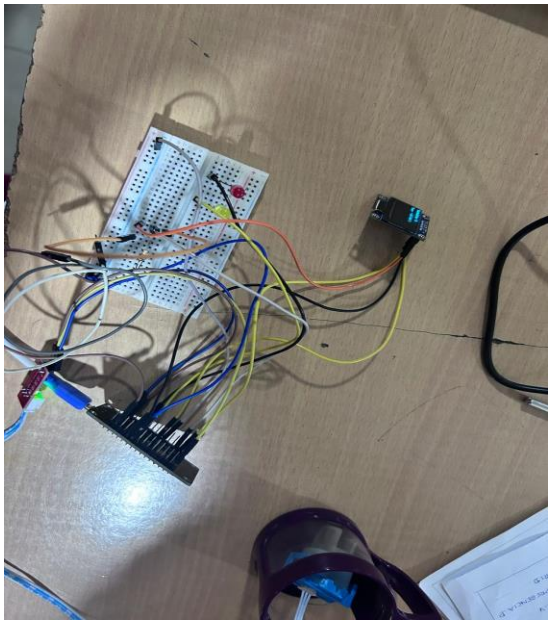
PROGRAM:

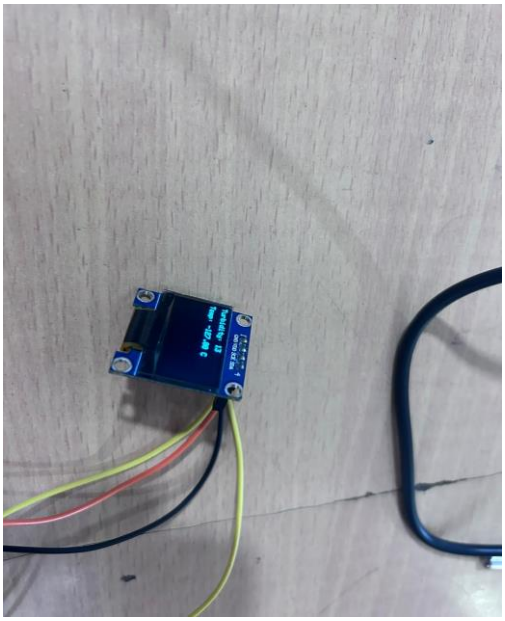
```
#include <Wire.h>
#include <Adafruit_GFX.h>
#include <Adafruit_SSD1306.h>
#include <OneWire.h>
#include <DallasTemperature.h>
#define SCREEN_WIDTH 128
#define SCREEN_HEIGHT 64
Adafruit_SSD1306 display(SCREEN_WIDTH, SCREEN_HEIGHT, &Wire, -
1);
#define ONE_WIRE_BUS 4   // GPIO4
OneWire oneWire(ONE_WIRE_BUS);
DallasTemperature sensors(&oneWire);
#define LED1 13  // GPIO13
#define LED2 15  // GPIO15
#define TURBIDITY_PIN A0
void setup() {
  Serial.begin(115200);
  if (!display.begin(SSD1306_SWITCHCAPVCC, 0x3C)) {
    Serial.println(F("SSD1306 allocation failed"));
    for (;;);
  }
  display.clearDisplay();
  display.display();
  sensors.begin();
  pinMode(LED1, OUTPUT);
  pinMode(LED2, OUTPUT);
}
```

```
void loop() {
  int turbidityValue = analogRead(TURBIDITY_PIN);
  sensors.requestTemperatures();
  float temperatureC = sensors.getTempCByIndex(0);
  if (turbidityValue > 600) {
    digitalWrite(LED1, HIGH);
    digitalWrite(LED2, LOW);
  } else {
    digitalWrite(LED1, LOW);
    digitalWrite(LED2, HIGH);
  }
  Serial.print("Turbidity: ");
  Serial.println(turbidityValue);
  Serial.print("Temperature: ");
  Serial.print(temperatureC);
  Serial.println(" *C");
  display.clearDisplay();
  display.setTextSize(1);
  display.setTextColor(SSD1306_WHITE);
  display.setCursor(0, 0);
  display.print("Turbidity: ");
  display.println(turbidityValue);
  display.setCursor(0, 16);
  display.print("Temp: ");
  display.print(temperatureC);
  display.println(" C");
  display.display();
```

```
  delay(1000);
}
```

EXECUTION:





RESULT:

The system successfully monitors key water quality parameters like pH, turbidity, temperature, and dissolved oxygen in real time. It provides instant analysis and alerts, ensuring safe and efficient water management.