



# Water Turbidity Detection System Using Arduino

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## KEYWORD

## ABSTRACT

*Arduino, Turbidity module, Water Quality Measurement.*

*Turbidity is an important parameter used to determine the quality of water by measuring the presence of suspended particles such as dust, silt, microorganisms, and organic matter. High turbidity affects the clarity of water and may indicate contamination, making it unsafe for drinking and other uses. This study focuses on the detection and measurement of turbidity using standard methods such as visual observation and turbidity meters (nephelometers), which measure light scattering in water. The turbidity level is expressed in Nephelometric Turbidity Units (NTU). Accurate measurement of turbidity is essential for water treatment processes and environmental monitoring. This experiment helps in understanding the significance of water clarity and ensures the maintenance of safe and clean water quality.*

## 1. Introduction

Water is a basic necessity that cannot be replaced and is utilized for a number of things, including drinking, making it essential for human survival. Depending on this, water can either be a source of life and wellness or a source of illnesses and fatalities for people. Drinking water services in metropolitan areas and water delivery to consumer taps face significant issues in protecting water sources from contamination, whether intentional or unintentional. Additionally, 3.4 million people worldwide perish annually from diseases associated with water; the majority of them are children, according to the World Health Organization (WHO) [1].

There is a need for a system to check the water quality in the distribution system as a result. An indicator of how foggy the water is called as turbidity. Water with low turbidity typically has great clarity, whereas water with high turbidity typically has low clarity. Fine particles like silt, sludge, and organic matter can reduce water clarity; therefore the Arduino with turbidity sensor detects the turbidity level to determine the quality of the water. By monitoring the changes in light transmittance and scattering rate caused by the amount of TSS in the water, particles that are suspended in the water can be seen. As a result, the water is measured by the turbidity sensor, and the LCD panel shows the results of the measurement, including the water's clarity, cloudiness, and dirtiness.

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## 2. Materials and Equipment

### 2.1 ArduinoUNO

Arduino UNO can be used in a wide range of electronic projects, a microcontroller board that can be programmed that is opensource, inexpensive, and user-friendly was created by Arduino.cc. The Microchip ATmega328P microcontroller serves as its central component. A variety of expansion boards and other devices can be connected to the board's sets of digital and analogue input/output pins [2]. This board connects to other Arduino boards, Arduino shields, and Raspberry Pi boards and has the ability to operate relays, LEDs, servos, and motors as output devices.



Fig1: Arduino UNO



Fig2: Turbidity Sensor

### 2.2 TurbiditySensor

Light scattering from suspended particulates in water is measured using turbidity sensors [6]. Together with the turbidity level, the total suspended solids (TSS) content of water rises (and cloudiness or haziness).

### 2.3 16\*2I2CLCD

The 16×2 I2C LCD display is a commonly used output device in embedded systems and Arduino projects. It can display 16 characters per line across 2 lines, making it suitable for showing text, numerical data, and ASCII characters. This module uses the I2C (Inter-Integrated Circuit) communication protocol, which significantly reduces the number of pins required to interface with microcontrollers like Arduino.

#### Key Features

- 16 characters × 2 lines display
- Supports ASCII characters, text, and simple data
- Built-in I2C interface for easy communication
- Typically comes with a blue or green backlight and white text
- Adjustable contrast via onboard potentiometer



Fig 3: 16\*2 I2C LCD

### 2.4 CommoncathodeRGB-LED

The typical cathode for RGB-LEDs, which the three LEDs all possess, is connected negatively (cathode). The three LEDs in a common anode RGB LED are positively connected to one another (anode). As a result, the LED has four pins total—one for each LED and either one common cathode or anode.



Fig 4: Common cathode RGB LED

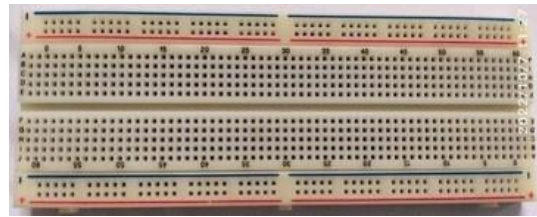


Fig 5: Breadboard

### 2.5 Breadboard

Building temporary circuits requires the use of a breadboard, often known as a plug block. Because components can be removed and replaced with ease, it is helpful to designers. The ability to design a circuit, demonstrate how it works and then reuse the components in another circuit is helpful.

### 2.6 Jumper Wires

Jump wires are cables made up of several electrical wires that have connectors or pins at either end. It's typically used to attach pieces of a prototype or test circuit inside or to other machinery or components without soldering a breadboard or other prototype or test circuit.



Fig 6: Jumper wires

## 3. SYSTEM TESTING

Calibration is carried out to check the measurement accuracy

- 1) Gather some samples of clean, hazy, and dirty water.
- 2) Properly insert the sensor into the water samples.
- 3) Run the Arduino Software application in parallel.
- 4) Write down the value that the sensor read.
- 5) Compare the recorded value to the values listed in the programme.
  - If the turbidity of the water is (turbidity < 15), show it as clear water.
  - Display water as cloudy if the turbidity is ((turbidity > 15) && (turbidity < 50)).
  - Display water as unclean if the turbidity is (turbidity > 50).
- 6) The turbidity of the water is tested when samples are delivered, and the results are shown on an LCD.

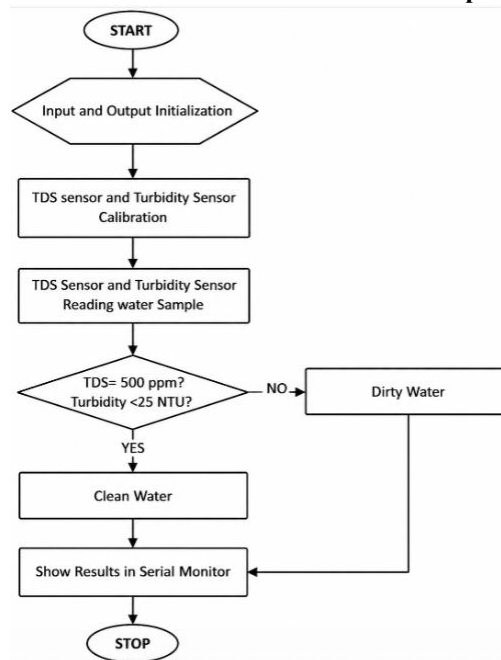


Fig 7: Flowchart demonstrating how hardware operates

### 3.1 System Architecture

The circuit consists of an Arduino Uno, a turbidity sensor, a 16×2 LCD display, and a breadboard used for organizing the connections. The turbidity sensor is connected by linking its VCC to the Arduino’s 5V supply, GND to ground, and its analog output pin to the Arduino’s A0 pin, allowing the system to measure water clarity. The LCD display is connected to the Arduino either through an I2C interface or parallel communication; in the case of I2C, the SDA and SCL pins are connected to A4 and A5 respectively, while VCC and GND are connected to 5V and ground. If a parallel LCD is used, multiple digital pins are utilized for data and control signals, along with a potentiometer for contrast adjustment. The breadboard helps distribute power and manage wiring efficiently. In operation, the Arduino reads the analog signal from the turbidity sensor, processes the data to determine water quality, and displays the result, such as “clean water” or “dirty water,” on the LCD screen.

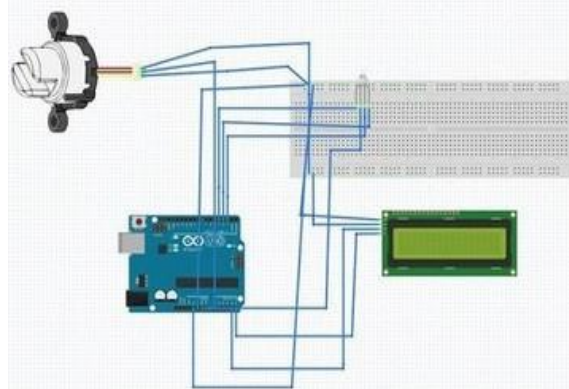


Fig 8: Connection Diagram

#### 4. Methodology

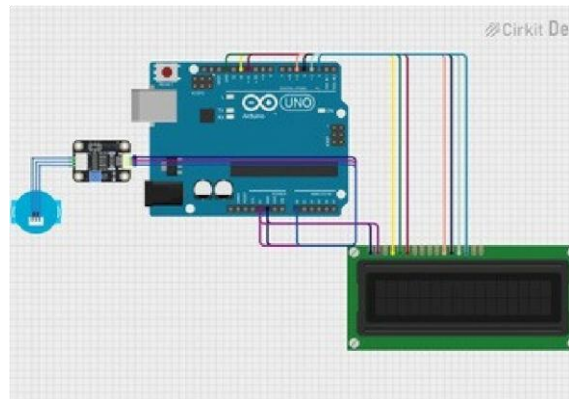


Fig 9:Schematic Diagram

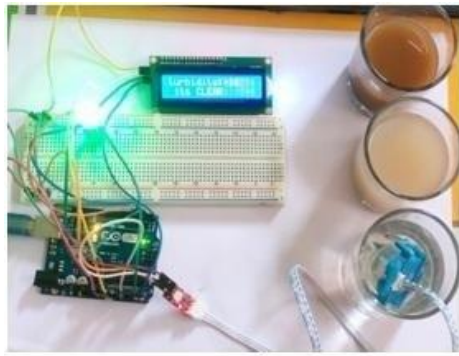
The SCL and SDA pins of the I2C interface are connected to the Arduino's A5 and A4 pins, respectively, to interface the I2C LCD with the Arduino. The turbidity sensor provides an analog output; therefore, it is connected to the Arduino's analog pin A0. The RGB LED is connected using digital pins D2, D3, and D4. Specifically, the red, green, and blue pins are connected to D2, D3, and D4, respectively, while the common ground of the RGB LED is connected to the Arduino's GND. All components share a common ground connection. The VCC of the turbidity sensor is connected to the Arduino's 5V supply, and its output pin is connected to A0. Similarly, the I2C LCD module is powered by connecting its VCC to 5V and GND to the Arduino's ground. The SDA and SCL lines are connected to A4 and A5, respectively.

#### 5. Result and Discussion

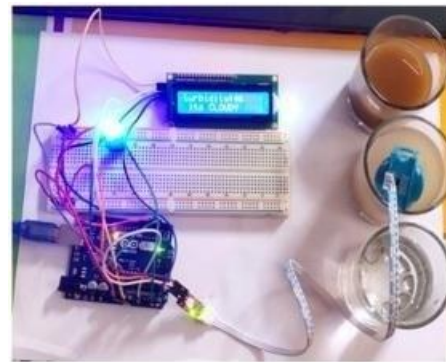


Fig 10:Water Samples with different mixtures

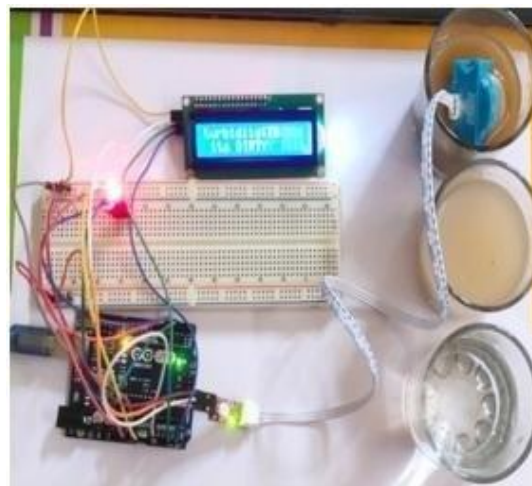
After taking a water sample, the turbidity sensor is utilized to assess the water's quality [7]. The Arduino board was used to process the sensor readings. The water's suitability for human consumption was determined using these numbers. Regular checks are made to the water's quality to determine if there have been any changes; even a small adjustment will have an impact on the outcomes. The outcomes are then shown on the LCD.



**Fig. 11 Result of Clear Water**



**Fig 12: Result of Cloudy Water**



**Fig 13: Result of Dirty Water**

## 6.CONCLUSION

The "Measuring Water Quality Using Arduino and Turbidity Sensor" project has been built and tested successfully. System that tracks water quality in real time at the water sources. Researchers can forecast natural processes in the environment, gain knowledge from them, and identify how humans affect an ecosystem by using the Water Quality Monitoring (WQM). In addition to helping with restoration projects, these measurement efforts can guarantee that environmental regulations are being met. The WQM, which makes use of IoT technologies, must be a practical and effective system for tracking drinking water quality.

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