

# **A PROJECT REPORT**

**ON**

**A STUDY OF WATER ANALYSIS DETERMINATION OF PHYSICAL PARAMETERS .**

**SESSION-2018—2019.**

**A PROJECT IN PARTIAL FULFILMENT OF REQUIREMENT  
FOR THE B.TECH IN ELECTRONICS AND COMMUNICATION  
ENGINEERING (ECE).**



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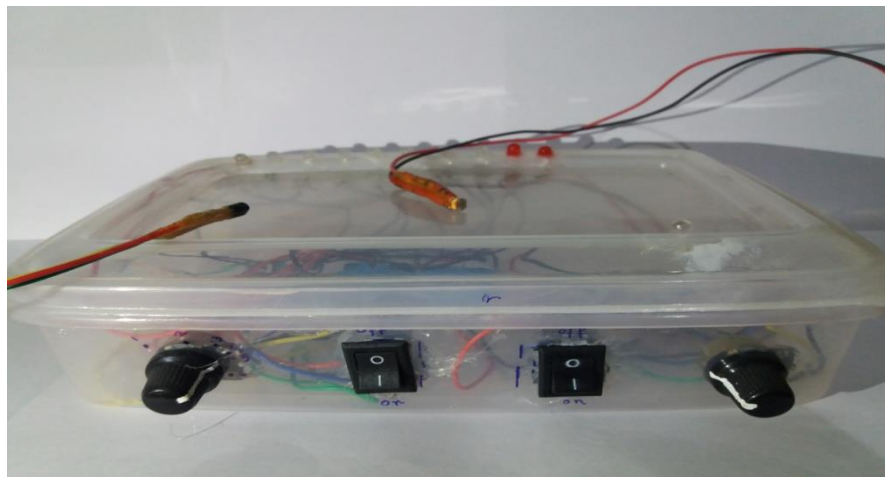
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**Project Prototype**

# **INTRODUCTION**

Water is an essential resource, fundamental to life and necessary for various purposes such as drinking, agriculture, industry, recreation, and aquatic ecosystems. However, water quality varies greatly depending on its source and the presence of contaminants or suspended particles. Ensuring water meets specific purity and composition standards is vital for its intended use, making regular water analysis a critical task.

Water quality assessment involves different types of analyses, from simple field tests to advanced laboratory methods. Among the key parameters measured are turbidity and temperature, which serve as indicators of physical contamination and environmental conditions in water bodies. Turbidity, the measure of water's clarity, reflects the presence of suspended particles, while temperature can affect both biological and chemical properties within the water.

Assessing these parameters provides insight into the water's overall health and suitability for use. Through this study, we aim to analyze turbidity and temperature in water samples, employing precise and reliable methods to help in monitoring and maintaining water quality standards.

## **OBJECTIVE OF THE STUDY**

The objective of this study is to evaluate key physical parameters of water samples—specifically turbidity and temperature—to assess their quality and suitability for a range of applications, including drinking, industrial processes, irrigation, and maintaining ecological balance for aquatic life. Turbidity and temperature are essential indicators of water quality, revealing potential sources of pollution and environmental conditions that can impact health and usability. By measuring these parameters, the study aims to determine whether the water meets the required standards for its intended use. Additionally, the study will examine the various factors influencing turbidity, discuss interference in measurement, and review the methodology for precise assessment using a nephelometer. This analysis not only contributes to the ongoing monitoring and management of water quality but also highlights the importance of accurate physical assessments in understanding and safeguarding water resources for future use.

## **Importance of Water Quality Analysis**

Water quality analysis ensures that water meets standards for various uses, including drinking, industry, and ecosystem health. Monitoring parameters like turbidity and temperature aids in water management, identifying pollution sources and hazards. Testing methods range from field tests for single parameters to detailed lab analyses, highlighting the importance and complexity of water quality assessment.

**Turbidity:** Turbidity refers to the measure of a liquid's relative clarity, indicating the amount of suspended particles within the water. It is an optical property measured by observing how much light is scattered when passed through the water sample. Higher turbidity levels correspond to more scattered light due to particles, indicating reduced water clarity. These particles vary in size, with larger particles potentially settling over time, while smaller particles often remain suspended, causing a turbid appearance in the water.

**Temperature:** Temperature is an indicator of how hot or cold a substance is, influenced by the average kinetic energy of its particles. In water studies, temperature impacts physical, chemical, and biological processes, influencing the dissolved oxygen levels and suitability for aquatic life. Although theoretically, absolute zero (0 K) represents the cessation of thermal motion, in natural water systems, temperature variations significantly impact water quality and ecological health.

# **Water Quality Parameters and Analysis**

## **Overview**

Ensuring water quality is essential to meet the specific requirements of various applications, including human consumption, industrial processes, agriculture, and environmental health. Key parameters like turbidity and temperature play a central role in assessing the suitability and safety of water. Turbidity, an optical measure of water clarity, can indicate the presence of suspended particles and pollutants, affecting both aesthetic and health factors. Temperature, on the other hand, influences water chemistry and biology, impacting everything from dissolved oxygen levels to the habitat conditions for aquatic organisms.

Regular monitoring of these parameters aids in effective water management, helping to identify pollution sources, track environmental changes, and implement corrective measures. Analytical approaches range from quick field tests for single parameters to comprehensive laboratory analyses, allowing for multi-component evaluations. Sophisticated instruments, such as nephelometers for turbidity, provide precise measurements critical for ongoing water quality assessments. Collectively, these analyses are essential for maintaining water resources, supporting public health, and ensuring sustainable management of ecosystems reliant on clean, regulated water.

## **Sources of Water Turbidity**

Water turbidity can result from various natural and human-induced sources:

1. **Soil Erosion:** Runoff from construction sites and agricultural land can carry sediments into water bodies, particularly during rainfall.
2. **Suspended Particles:** Natural materials like clay, silt, and organic matter can remain suspended in water, often originating from disturbed land.
3. **Phytoplankton Growth:** Nutrient runoff from fertilizers can lead to algal blooms, increasing turbidity levels.
4. **Urban Runoff:** Rainwater runoff from urban areas can pick up pollutants and sediments, raising turbidity.
5. **Industrial Discharges:** Factories may release waste containing suspended solids and chemicals, contributing to turbidity.
6. **Wastewater and Sewage:** Inadequately treated wastewater can introduce various particles into water bodies.
7. **Aquatic Organisms:** The activities of fish and invertebrates can stir up sediments, increasing turbidity.
8. **Weather Events:** Heavy rainfall and storms can wash sediments into water bodies, causing spikes in turbidity.
9. **Natural Disasters:** Landslides and earthquakes can disrupt soil and increase turbidity levels.
10. **Tidal Movements:** In coastal areas, strong tides can resuspend sediments, contributing to turbidity.

Understanding these sources helps in managing water quality effectively.

## **Causes of Increased Turbidity**

Turbidity can increase due to natural processes or human activities, such as:

1. **Erosion:** Soil erosion from construction sites, agriculture, and deforested areas introduces sediments into water bodies, leading to higher turbidity.
2. **Algal Blooms:** Excessive nutrients from fertilizers can trigger phytoplankton blooms, increasing turbidity as the algae multiply.
3. **Urbanization:** Urban runoff carries debris, sediments, and pollutants into streams and rivers, elevating turbidity levels.
4. **Industrial Discharge:** Factories releasing untreated or inadequately treated waste can contribute suspended solids to nearby water sources.
5. **Stormwater Runoff:** Rainfall can wash away sediments and pollutants from impervious surfaces, increasing turbidity in receiving water bodies.
6. **Wastewater Release:** Discharge of untreated or partially treated wastewater can introduce various solid particles into aquatic environments.
7. **Sediment Resuspension:** Activities such as boating, fishing, and the natural movements of aquatic organisms can stir up bottom sediments, causing higher turbidity.
8. **Climate Change:** Changes in precipitation patterns and increased storm intensity can lead to more frequent and severe runoff events, elevating turbidity levels.

By identifying these causes, water quality management strategies can be developed to mitigate turbidity and protect aquatic ecosystems.



## **Measurement of Turbidity**

Turbidity is commonly measured using several methods:

1. **Nephelometry:** This is the most popular technique, using a nephelometer to shine light through a water sample and measuring the intensity of scattered light. Results are reported in Nephelometric Turbidity Units (NTU).
2. **Secchi Disk Method:** A circular disk is lowered into the water until it is no longer visible. The depth at which it disappears provides a qualitative measure of turbidity, mainly used in larger water bodies.
3. **Jackson Candle Method:** A candle's visibility is assessed at varying water depths, giving a rough turbidity estimate. It's simple but less precise.
4. **Turbidity Tubes:** Water samples are placed in clear tubes with a printed pattern at the bottom. The height at which the pattern is obscured indicates turbidity.
5. **Optical Sensors:** These modern sensors continuously monitor turbidity in real-time, ideal for ongoing water quality management.
6. **Laboratory Analysis:** Water samples can be analyzed in controlled lab settings using various techniques for precise turbidity measurements.

Each method varies in accuracy and application, with regular turbidity assessments essential for monitoring water quality and compliance with standards.

# **Principles of Turbidity Measurement**

Turbidity measurement relies on light scattering and absorption principles:

1. **Light Scattering:** Light passing through a water sample with suspended particles is scattered in different directions, with the degree of scattering influenced by particle size, shape, and concentration.
2. **Intensity of Scattered Light:** The intensity of light scattered at a specific angle (typically 90 degrees) correlates directly with turbidity levels; higher turbidity indicates more scattered light.
3. **Standard Comparison:** Measurements are compared to a standard reference suspension with known turbidity to ensure consistency and reliability.
4. **Units of Measurement:** Turbidity is expressed in units like Nephelometric Turbidity Units (NTU) and Formazin Nephelometric Units (FNU), indicating the concentration of suspended particles.
5. **Optical Properties:** Factors like color and clarity of the water can affect turbidity readings, necessitating consideration in measurement techniques.
6. **Calibration:** Accurate readings require regular calibration of instruments like nephelometers using primary standards, ensuring precise and repeatable results.

These principles enable effective turbidity assessment, crucial for maintaining water quality standards.

## **Interference Factors**

Several factors can interfere with the accuracy of turbidity measurements:

1. **Suspended Solids:** The presence of larger particles or coarse sediments can lead to elevated turbidity readings, masking the actual concentration of smaller particles.
2. **Air Bubbles:** Air bubbles trapped in the sample can scatter light, resulting in artificially high turbidity readings. Proper sample handling and degassing techniques are essential to minimize this interference.
3. **Color and Chemical Composition:** Coloured samples, such as those containing organic matter or dyes, can absorb light and reduce scattering, leading to lower turbidity readings than expected.
4. **Temperature Fluctuations:** Variations in temperature can affect the viscosity of the water and the behavior of suspended particles, potentially altering turbidity measurements.
5. **Instrument Calibration:** Inaccurate calibration of turbidity meters can introduce errors. Regular calibration with known standards is crucial to ensure reliable results.

By understanding and mitigating these interference factors, more accurate and meaningful turbidity measurements can be achieved, facilitating better water quality assessment.

## **Procedure for Measuring Turbidity**

Here's a brief procedure for measuring turbidity:

1. **Sample Preparation:** Gently agitate the water sample to disperse particles evenly, avoiding bubbles.
2. **Calibration:** Calibrate the nephelometer according to the manufacturer's instructions, using a known standard solution to ensure accuracy.
3. **Sample Measurement:** Pour the prepared sample into a clean nephelometer cell. Allow any bubbles to settle, or use vacuum degassing if needed, to prevent interference.
4. **Reading:** Place the cell in the nephelometer, and record the turbidity displayed in NTU (Nephelometric Turbidity Units).
5. **Verification:** For consistency, repeat measurements and average the results.

## **Analysis and Interpretation of Results**

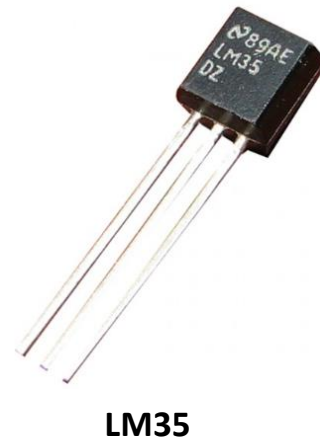
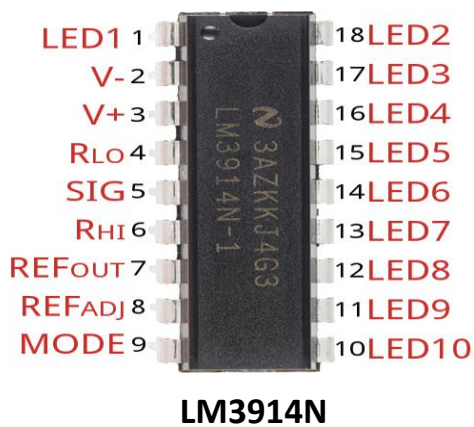
The analysis and interpretation of turbidity results are critical for assessing water quality. Once turbidity measurements are obtained using a nephelometer or similar device, the following steps are typically involved:

1. **Data Comparison:** The turbidity values are compared against established standards or regulatory limits to determine if the water sample meets acceptable quality criteria. These standards vary based on the intended use of the water (e.g., drinking water, recreational use, or industrial applications).
2. **Correlation with Other Parameters:** Turbidity is often analyzed in conjunction with other water quality parameters, such as dissolved oxygen, pH, and temperature. This holistic approach helps identify potential relationships and underlying causes of water quality issues.
3. **Identification of Sources:** Interpreting turbidity results can help identify potential sources of pollution. For instance, elevated turbidity after rainfall may indicate runoff from agricultural or urban areas, while persistent turbidity might suggest ongoing industrial discharges.
4. **Recommendations for Action:** Based on the analysis, appropriate recommendations can be made for water management practices. If turbidity levels are found to be high, actions such as improving land use practices, enhancing sediment control measures, or monitoring pollution sources may be warranted.

## **Device Construction and Operation**

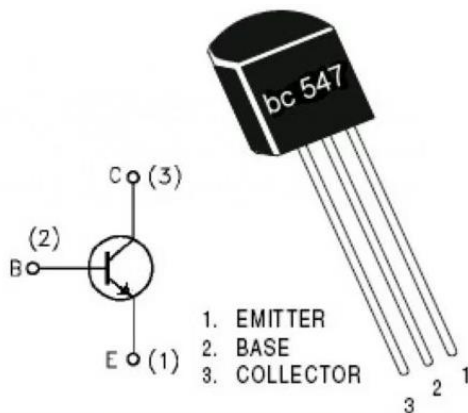
The water quality measurement device integrates several circuits designed to measure key parameters such as temperature, clarity, electrolyte levels, and pH, each essential for determining the sample's suitability for consumption or other uses.

The temperature measurement circuit is built around the LM3914N chip, which receives input from an LM35 temperature sensor. Based on the water's temperature, this circuit activates a series of LEDs (Red, Green, Blue, and White) that provide a visual indication of how hot the water is. Each LED color represents a specific temperature range, offering a clear and immediate temperature assessment.



For turbidity measurement, a BC547 transistor-based circuit works alongside an LDR (Light Dependent Resistor) sensor. A white LED shines through the water sample, and the light reaching the LDR indicates clarity—the clearer the water, the more light reaches the

sensor. This circuit is fine-tuned using a potentiometer to control sensitivity according to the water sample's opacity or clarity.



**BC 547**



**LDR Sensor**

A third component built on an Arduino microcontroller senses electrolyte concentration and pH. This circuit gathers readings, helping to evaluate dissolved salts or impurities, and determines the pH to assess acidity or alkalinity levels in the water. All sensor readings are directed to an Arduino Uno, which processes the data and displays an evaluation on the sample's overall quality, including whether the water is safe to drink. This comprehensive, interconnected setup allows for easy adjustments in sensitivity and a holistic view of water quality through a single interface.



## **CONCLUSION**

The physical parameters monitoring of the Soujit Das water was carried on during November 2018. The results reveal that the dissolved oxygen amount is high, ranging in between 8.21 and 12.20 mg/l, the average oxygen deficit was 14.35%, which means that in respect of this parameter, the river water can be considered to be in a good health state. The oxygen deficit increases during the hot months, which is a normal result as the amount of desorbed oxygen decreases with the increase of temperature. The water hardness was another parameter that was investigated. Examining table 1 we notice that the average ca concentration was 8.92mg/l, which makes the Titas Saha water a soft water.

Other physical parameters that were monitored were the total suspended solids TDS parameters were found to be below the maximum admitted values according to the Romanian standards, as well, and the heavy metal concentration is below the detection threshold.

Overall, the results of this monitoring reveal that the health status of the Trisit Ghosh river water is very good because there does not exist any significant parameter source on the river.



## **ACKNOWLEDGEMENT**

I would like to express my gratitude to everyone who contributed to this study on water quality analysis.

Special thanks to my supervisor, Trina Dutta, for her guidance and support throughout the research. I also appreciate the assistance from my colleagues for their help with data collection and analysis.

I am grateful to JIS College of Engineering for providing the resources and facilities necessary for this project, as well as for their financial support.

Finally, I thank my family and friends for their encouragement and belief in me throughout this journey. Your support has been invaluable.