Water Monitoring System Using Arduino

***Abstract*—Water is very important for everyone. To survive on the earth every living being need water but this water is being polluted every day. The first step in preventing pollution is to identify the contaminant. This system is designed to develop, implement, monitor, and control water parameters such as pH, temperature. Our suggested system is prepared as a low-cost, real- time water quality testing device that can be used in remote rivers, lakes, coastal areas, and other bodies of water.**

***Index Terms*— *Water quality, Arduino uno, sensors, LED***

# I. INTRODUCTION

## A. Background information

Water is very important for everyone. To survive on the earth every living being need water. When the water is polluted, it is not only devastating to the environment, but also human body. Constant testing of water can prevent this pollution. The water quality measuring system is difficult. Each water body can comprise intensely different level of pollution. Water quality measures the physical, chemical, biological and microbiological characteristic of water. Keeping track of water quality in current era is big challenge because of the large amount of chemical use in day-to-day activities. Clean water is very important for the health of human as well as for aquatic animals. Also, the utilization of water health issues is growing intensively.

## B. Project Objectives

The main objective of our project is from testing water, we can measure temperature, pH level. We aim to implement sensors remotely monitors and control of water quality parameters. Our objectives also range from detecting violations of water quality standards to determining the state of the ecosystem and analyzing temporal water quality trends. Our suggested system is prepared as a low-cost, real- time water quality testing device that can be used in remote rivers, lakes, coastal areas, and other bodies of water.

## C. A brief outline of the report

This paper is structured as follows-To implement our idea first of all we identify the problems that we have to solve. Then we review some papers to find out the probable solutions. While finding the solutions we also keep in mind for the cheapest and effective one. For this we have come up with the sensors that are required for our water quality testing system. The basic working process of our proposed system are also stated here.

# II. LITERATURE REVIEW

The paper by Yuda Irawan et. al. [[1]](#_VII._References) tried to implement water quality measurement and filtering tools. In this project Arduino Uno, Hydrogen Potential Sensor (pH), temperature sensor are used. The value of pH and TDS content in the water is received successfully in this paper which aims for people to know whether the water is drinkable or not. Total five samples were taken and the result showed that temperature ranged from 28’C to 31’C with an average of 29.5’C and a pH ranging from 6.85 to 9.33 with an average of 8.09 [[1].](#_VII._References)

S.Gokulanathan et. al. [[2]](#_VII._References) proposed a water quality monitoring system through a wireless sensor network. This system can detect water-borne diseases and measure the quality of water by using a PH sensor, Electric Conductivity (EC) sensor, a temperature sensor, and Arduino. The GSM module will show the data that is collected by the Arduino to the webpage.

The paper by Vaishnavi V. Daigavane et. al. [[3]](#_VII._References) developed a low-cost system for real-time monitoring of the water quality in IoT (internet of things). With the help of several sensors, the physical and chemical parameters of the water are measured successfully. The parameters such as temperature, PH, turbidity, flow sensor of the water can be measured [3]. The Arduino model is used as a core controller. In this project, after collecting and analyzing the water samples, the sensor data can be viewed on the internet by using a WI-FI system.

In a research paper by I M Hakimi [[4],](#_VII._References) it was shown that regular water quality monitoring of water bodies is essential to ensure it is within the allowing standard limits. The development of a simple and low-cost water quality measurement device for real time monitoring using Internet of Things (IoT) technology is presented in this study. Kolora meter is an alternative to the existing commercial monitoring devices. It was developed using the open-source platform Arduino UNO model and NodeMCU board as the microcontroller and Wi-Fi connection respectively. Two sensors such as temperature and turbidity were selected to be installed in the early stage of Kolora meter development. The physical parameters (temperature and turbidity) of water were measured and the measured data collected are able to be viewed and monitored on the mobile phone using Kolora Mobile Application via Wi-Fi connection. Therefore, this surface water quality device has potential to be applied in real time monitoring for early pollution detection and during COVID-19 pandemic spread due to limited movement.

In the paper by K. Saravanan [[5],](#_VII._References) he and his team proposed a new Supervisory Control and Data Acquisition (SCADA) system that integrates with the Internet of Things (IoT) technology for real-time water quality monitoring. It aims to determine the contamination of water, leakage in pipeline, and also automatic measure of parameters (such as temperature sensor, flow sensor, color sensor) in real time using Arduino Atmega328 using Global System for Mobile Communication (GSM) module. The system is applied in the Tirunelveli Corporation.

# III. Methodology and Modeling

## A. Introduction

The system built with Arduino UNO as the main controlling unit. The function of the temperature sensor is to measure the temperature of water and send the data to Arduino UNO. The Arduino UNO use as Controller unit is read the analog values from the sensors and converted into the voltage form then calibrate. After taking input from all the sensor Arduino Uno calculate what is the condition of the water. The calculation will be done as we program it to do.

## B. Working principle of the proposed project

We will be using Arduino Uno and two sensors for this project. The sensors are pH sensor, temperature sensor. The Arduino UNO use as Controller unit is read the values from the In this project Arduino UNO interface with I2C 16x2 Arduino LCD Display**.** It is used as a Display unit in the system. Table 1 show that the specification of parameter to monitoring the system. The water quality will be determined by the parameter of the following table. Arduino Uno collect the reading from the two sensors. Then it will compare with the table.

|  |  |  |  |
| --- | --- | --- | --- |
| Parameters | Unit | Range | Quality Range |
| Temperature | Degree Celsius | 0-100 | More than 18 degree Celsius and less than 35 degree Celsius |
| PH | PH | 0-14 | 6.5-8.5 |

*Table 1*: Water quality monitoring parameter

## C. Description of the important component

We will use an Arduino Uno, a temperature sensor, a turbidity sensor, an oxygen sensor, a PH meter, and a LCD display in this project.

Arduino Uno: The Arduino Uno is an open-source microcontroller board designed by Arduino.cc. It is based on the Microchip ATmega328P microprocessor. The board has a variety of digital and analog input/output pins that may be used to communicate with expansion boards and another circuitry.

Temperature sensor: A temperature sensor is a device that is used to determine the ambient temperature. This might be the temperature of the air, a liquid, or a solid. There are several kinds of temperature sensors available, and each one measures temperature using a distinct set of technologies and principles.

The sensor is used for project is DS18B20 waterproof temperature sensor.

PH sensor: pH sensors are intended to test the acidity or alkalinity of a solution and display the results on a digital readout. In a variety of applications such as agriculture, wastewater treatment, industries, environmental monitoring and other similar areas of usage, it is widely employed. The sensor is used to measure pH is Gravity: Analog pH Sensor

LCD display: The LCD (Liquid Crystal Display) is a kind of show that operates by using liquid crystals in order to display information. In this section, we will take serial input from the PC and upload the program to the Arduino board. It will be possible to see all of the characters on the LCD screen.

## D. Implementation

Temperature Sensors:

Temperature of water is one of most important property because of other parameter depends on temperature for accuracy. The DS18B20's primary function is to deliver immediate digital temperature measurements. The DS18B20 is a 1-wire programmable Temperature sensor from maxim integrated. It is widely used to measure temperature in hard environments like in chemical solutions, mines or soil etc. The constriction of the sensor is rugged and also can be purchased with a waterproof option making the mounting process easy. It can measure a wide range of temperature from **-55°C to +125°** with a decent accuracy of **±5°C**. Each sensor has a unique address and requires only one pin of the MCU to transfer data so it a very good choice for measuring temperature at multiple points without compromising much of your digital pins on the microcontroller.

pH sensor:

The pH of water is a critical characteristic. It's used to determine if water is acidic or alkaline. The relative hydrogen ions h+ or relative hydroxyl ions OH- present in the water determine the acidity or alkalinity. Acidic solutions have a higher amount of hydrogen ions in the water, whereas alkaline solutions have a higher number of hydroxyl ions. pH can be expressed on a scale of 1 to 14. The scale from 0 to 6.0 indicates that the solution is acidic, the scale from 7.0 to 8.0 indicates that the solution is neutral, and the scale from 8.0 to 14.0 indicates that the solution is alkaline.

## E. Experimental Setup

Firstly, we took the Arduino Uno board then we connected the sensor to the breadboard as a common and then from breadboard connect to port of the Arduino uno board. pH sensor is connected to A0 port. To get the accurate result we connected a LC module with the output of the pH sensor. Temperature Sensors is connected to the digital pin 2 port. 16\*2 I2C module LCD is connected to both Arduino and pH, temperature sensors to display. After calculating the result of each sensor, the result is shown on the display.

|  |
| --- |
| Diagram  Description automatically generated with medium confidence |
| Figure 1: Experimental setup  We programed code to run the system. Code does the work as per instruction is given. There are mainly four conditions in the code. First part detects if the pH value of the water is suitable or not. Second part detect the temperature.   |  | | --- | |  | |  | |

# IV. Results and Discussion

## A. Simulation analysis

In order to create the water quality testing device, we have used Arduino UNO, pH meter, temperature sensor, turbidity sensor, Oxygen sensor and LCD screen. A voltage supply of 5 volts have been used to power the pH meter. The code portion is written on the Arduino IDE with the necessary conditions to determine from the sensor results if the water quality is safe for drinking and fishing.

|  |  |  |
| --- | --- | --- |
| Sensor | Range | Safe or  Harmful |
|  | 5.5 to 8.5 | Safe & Drinkable |
| pH meter | 0 to 5.5 | Harmful and Acidic |
|  | 8.5 to 14 | Harmful and Alkalic |
|  | Less than 34 °C | Safe |
| Temperature | More than 34 °C | Harmful |

*Table 2*: Result analysis

## B. Simulation Results

The pH meter, temperature are simulated in a way to show results on the LCD screen. If the pH meter sensor has detected pH of 5.5 to 8.5 then the LCD screen will show that the water is safe and drinkable. If the pH is lower than 5.5 and more than 8.5 then it will show acidic and alkalic accordingly and harmful for drinking and fishes. If the Temperature sensor detects a temperature less than 34 °C, the LCD screen will show that it’s suitable for water living creatures but if the temperature is more than 34 °C, the LCD screen will show that the temperature is not suitable for water living creatures.

# V. Limitations

The limitations of the project are the device only tests the pH value, temperature but not any sensor to measure or detect the germs, turbidity, dissolved oxygen. Also, we could not find the sensors for turbidity and dissolved oxygen, so we reused the temperature sensor to act as also the turbidity and dissolved oxygen sensors and wrote the codes in that way so it will give the desired results from the simulation.

# VI. Conclusion

This water quality testing system is a low-cost, real-time water testing technology that may be implemented in a range of environments, including drinkable water, distant lakes, rivers, coastal areas, and other similar environments, amongst many others. The system keeps track of a variety of water parameters including temperature, pH level. Maintaining healthy water for human consumption and for natural purposes may be a challenging task at times. Therefore, monitoring water quality is a difficult process. As a result of these considerations, this approach may be quite useful for evaluating all the parameters.

## VII. References

[[[1] Yuda Irawan, Anita Febriani, Refni Wahyuni, Yesica Devis, “Gesture Controlled Laptop Using Arduino & Ultrasonic Sensor”, Journal of Robotics and Control (JRC) Volume 2, Issue 5, September 2021 ISSN: 2715-5072 DOI: 10.18196/jrc.25107](https://ieeexplore.ieee.org/abstract/document/8282722/)

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[[3] Vaishnavi V. Daigavane and Dr. M.A Gaikwad, “Water Quality Monitoring System Based on IOT”, Advances in Wireless and Mobile Communications. ISSN 0973-6972 Volume 10, Number 5 (2017), pp. 1107-1116.](https://www.researchgate.net/profile/Gokulanathan-S/publication/332527278_GSM_Based_Water_Quality_Monitoring_System_Using_Arduino/links/5cc6d0ea4585156cd7b9f1b6/GSM-Based-Water-Quality-Monitoring-System-Using-Arduino.pdf)

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[[5] S. Gokulanathan, P. Manivasagam, N. Prabu, T. Venkatesh, “A GSM Based Water Quality Monitoring System using Arduino”, Shanlax International Journal of Arts, Science and Humanities, vol. 6, no. 4, 2019, pp. 22–26, ISSN: 2321-788X.](https://ieeexplore.ieee.org/abstract/document/6637139/)