Smart Water Quality Detection System

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Abstract:

Body of Humans contains about 80% of water hence, every man needs water as important factor to sustain life on earth. Thus, nature of such profoundly devoured water was a major issue. As improved water quality is favourable for health so every possible effort should be made in this direction for recognizing the nature of devoured water in house a sensor-based framework is clarified in this paper. This framework distinguishes the water quality by estimating different physical and artificial boundaries of water like turbidity, pH, temperature, conductivity, and TDS (all out disintegrated strong) on ongoing premise.

Keywords: Water quality monitoring, pH, Turbidity, Temperature.

I. Introduction

Water is essential for life. Potable water, also known as drinking water or improved drinking water, is water that can be drunk or used for food preparation without the risk of health problems. Globally, in 2012, 89% of people had access to water suitable for drinking [12]. Nearly 4 billion had access to tap water while another 2.3 billion had access to wells or public taps [12] 1.8 billion people still use an unsafe drinking water source which may be contaminated. This can lead to various water-related diseases such as diarrhea, cholera, and typhoid fever. Water quality refers to the chemical, physical, biological, and radiological characteristics of water [12].

This is due to public and administrative ignorance and a lack of water quality monitoring systems, leading to serious health problems. Water is the most important element for all living things, so it must be protected. So, the first step is to do analysis of water quality. Water analysis is the process of testing various parameters using traditional methods by using laboratory equipment. In traditional method, water parameters are detected by collecting samples manually and then send them to the well-equipped laboratories for further analysis where the testing equipment's are stationery and samples are provided to the testing equipment's. It requires too much manpower and material resource. This is a time-consuming process with various limitations such as sample collection and aging laboratory equipment. As such, it suffers from low reliability, lack of real-time water quality information, and lack of on-site monitoring mechanisms.

Such techniques do not provide data in real-time. Another paper referred was proposed by Bande, Priyanka N., Nandedkar, S.J., uber the title Low-Cost sensor network for real-time water quality measurement system.[1]

Barabde, M.N., Danve, S.R., 2015. Continuous water quality monitoring system for Water resources at remote places.[2]

Chen, Yiheng, Han, Dawei, 2018. Water quality monitoring in the smart city: a pilot project. Automat.[3]

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J. Hall *et al.*, "On-line water quality parameters as indicators of distribution system contamination," *J.Amer*.[6]

M. V. Storey, B. Gaag, and B. P. Burns, "Advances in on-line drinking water quality monitoring and early warning systems,".[7]

We referred the paper Hach HST, *GuardianBlue Early Warning System Brochure*.In this paper a system was designed that gives us early warning regarding the water quality through using sensors.[8]

BioSentry Contamination Warning System Overview, JMAR, Wyoming.[9]

BlueBox Intelligent Water Analytics System.[10]

D. Hart, S. McKenna, K. Klise, V. Cruz, and M. Wilson, "CANARY: A water quality event detection algorithm development tool,".[11]

II. Research Methodology

Block Diagram

Fig.1 Block diagram

Algorithm

1. Start
2. Collecting all components required to build the project (pH sensor, Turbidity sensor, Temperature sensor, Ultrasonic sensor).
3. Organizing Arduino UNO and all the sensors accordingly so that they are perfectly ordered.
4. Using Jumper wire to connect al the sensors to Arduino Uno and to each other.
5. Writing the code in Arduino Ide and uploading it in Arduino UNO.
6. Ensuring all the connections are proper and components are perfectly organized.

7. Testing whether the system is working properly and we are getting true readings.
8. Optimizing the connections and the code to increase the efficiency of system.

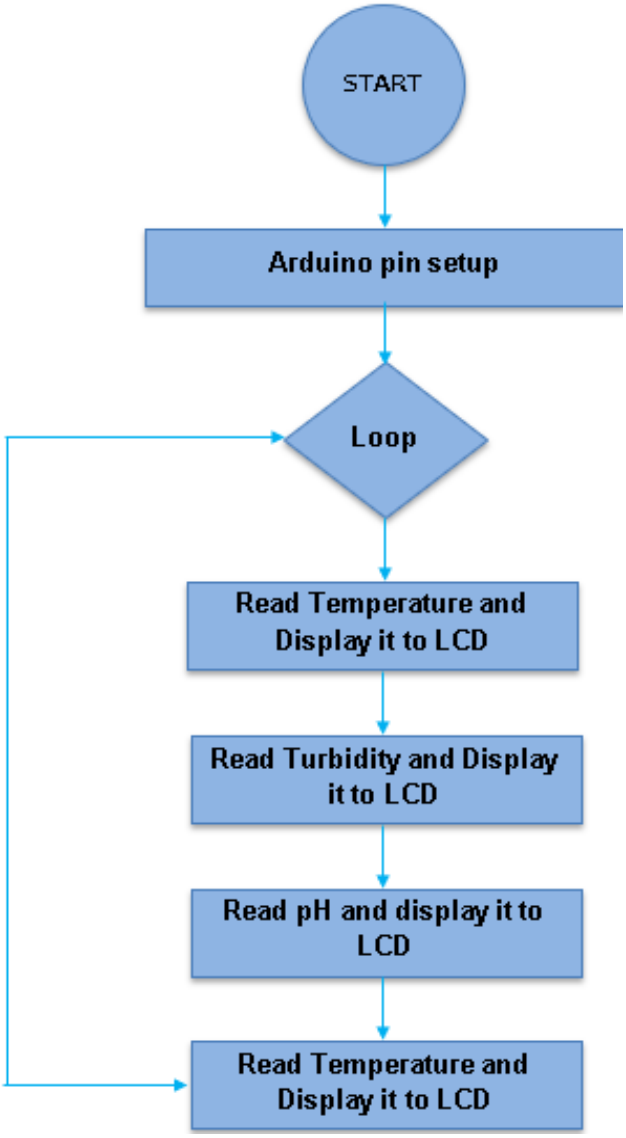

Fig.2. Flowchart

Components

1. **pH Sensor:**

The combination or pH electrode measures the difference in potentials between the 2 sides within the glass electrode. to live the potentials, it must be a circuit. The circuit is closed through the interior solutions of the electrode and also the external solution that's being measured and also the pH meter. The sensor has two electrodes which will detect the pH level of the liquid and then will display it on the serial monitor.

Fig.3. pH Sensor

2. Turbidity Sensor:

The sensor works on the rule that when light is gone through a sample of water, how much light sent through the sample is reliant upon how much soil in the water. As the soil level expands, how much sent light declines. The turbidity sensor estimates quantity of sent light to decide the turbidity of the wash water. The sensor will be crucial for us as water has the NTU between 0.1 to 5, which will define whether water is clear or not.

Fig.4.Turbidity Sensor

3. Arduino UNO:

The Arduino Uno is an open-source microcontroller board upheld the Microchip ATmega328P microcontroller. The board has fourteen computerized I/O pins (six fit for PWM yield), 6 simple I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), through a sort B USB cable. It is frequently controlled by a USB link or by an outside 9-volt battery, however it accepts voltages somewhere in the range of 7 and 20 volts.

This kind of project build will require a Microcontroller to manage the Input and Output, to Calculate the hole or sense the Trigger from Sensor and Process the Output in sort of Servo Sweep in our Example, that we will use any Arduino, which makes it easy to regulate the parameters, fine-tune outputs.

Fig.5.Arduino UNO

4. Jumper wires:

A jump wire (otherwise called jumper, jumper wire, jumper cable, DuPont wire or cable) is an electrical wire, or gathering of them in a link, with a connector or pin at each end (for now and then without them – essentially "tinned"), which is typically used to interconnect the parts of a breadboard or other model or test.

Fig.6.Jumper Wires

5. Temperature Sensor

They are gadgets to live temperature readings through electrical signs. The sensor is shaped of two metals, which create electrical voltage or resistance once it sees a change of temperature.
The temperature sensor assumes a basic part in keeping a specific temperature inside any hardware to make anything from medication to lager. In our project, the temperature sensor is embedded into the pH sensor module, which reduces the wiring, and quite handy.

Fig.7. Temperature Sensor

III. Results and Discussion

Working:

The main function of our project is to monitor the water's nature (pH level, temperature, and Turbidity sensor), so as mentioned in the previous point, the working of each sensor is given in detail. By starting the Arduino UNO, the sensors are initialized, and they are calibrated according to the basis of pure water. As pure water has pH level between 7 to 7.5, which is ideal for drinking purposes, and the turbidity between 0.1 to 5 NTU (Nephelometric Turbidity Unit) as well as the temperature below 50° C.

So, we have calibrated the values using normal drinking water in which the average values of the mentioned parameters are 7.12 pH level, 1.74 NTU, and 24° C. Therefore, by dipping the sensors in multiple samples, we can detect whether the water is contaminated or not and whether drinkable or not. The first sensor called the pH sensor works on the principle of two electrodes contained in a glass probe, naming the reference electrode and a sensor electrode. When the probe is dipped into the solution, then the hydrogen ions are accumulated around the sliver wire. That is a basic idea of working of pH sensor.

The second sensor called the turbidity sensor, which works on the principle of light transmittance and scattering rate. In simple words, it uses light to detect suspended particles in water or any other liquid. So as the suspended particles increases, the light transmission decreases, which directly affects the measurement of transmitted light which determines the turbidity of the water.

As we dip these sensors into the solution, it will tell its traits and readings and we can note it down as we move in different areas where the water supplier change.

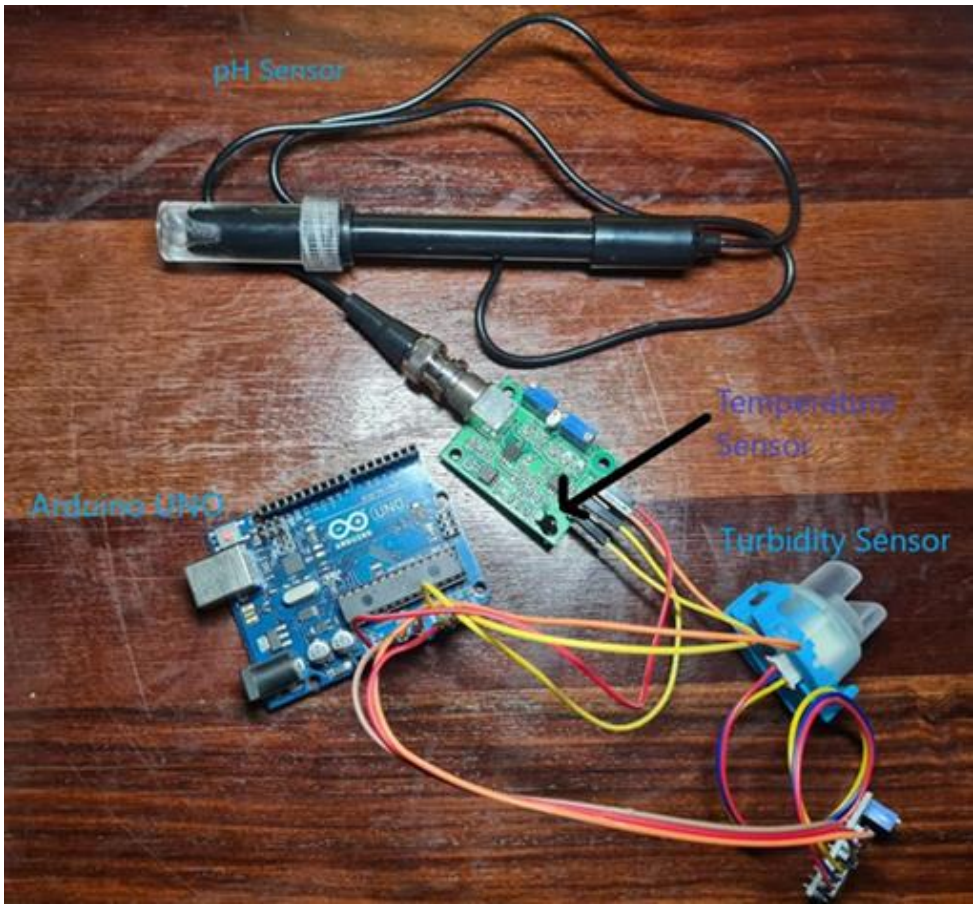

Fig.8. Working Model

IV. Limitations

The only limitations that we will face during the usage is the number of sensors that we are using in our project. There can be various sensors such as Oxygen meter, Density meter, etc. Also, the storage of data is missing in the project which would affect the evaluation.

V. Acknowledgment

We are quite grateful to have received this support during the duration of our project because it required a lot of guidance from numerous people in order for it to succeed and produce the desired results. We wouldn't forget to thank them because their scrutiny is the only reason for anything we have accomplished.

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VI. Future Scope

The framework can be extended to screen hydrologic, air contamination, industrial and agricultural production, etc. It has far-reaching application and expansion esteem. Work can be carried on to incorporate controlling the inventory of water.

VII. Conclusion

The main conclusion of our project is to contribute for the wellbeing of health care. By testing the water quality in the public water supply area. Hence creating awareness among the people regarding the safe drinking water.

VIII.

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