International Journal of Future Generation Communication and Networking
Vol. 13, No. 3, (2020), pp. 1916–1922

Water Trademark Analysis Using IoT

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Abstract

Drinking water crisis is one among major issue facing nowadays. As most of the water resources are polluted, water borne diseases like diarrhea, fluorosis spread through water. Drinking contaminated water causes about 3.5 million deaths per year. So there is a need of checking the quality of water on a regular basis. Even though there is advancement in technologies there is not any sufficient water quality checking systems. This paper proposes a low cost smart water quality checking system using the emerging technology IoT with the help of different sensors such as pH sensor, dissolved oxygen sensor, temperature sensor, turbidity sensor etc which determines the chemical composition of water. The addition of dissolved oxygen sensor makes an advantage that this system can be used in fish tank monitoring, aquaculture, swimming pools. This system takes many advantage over the existing systems and it reduces the human intervention to a greater extend.

Keywords**:** *IoT, pH sensors, turbidity sensor, temperature sensor, raspberry pi.*

1. Introduction

Water is one among the basic needs, we can't survive without water. Because of limited water resources and increasing inhabitants water has become one among the major resources for mankind. Now a days most of the diseases are spread through water, a smart water quality checking system is needed. Existing solution is that random samples of water are collected from different places and are checked in laboratories weekly or monthly accordingly. This method is not much efficient as it is time consuming and water samples from only few locations can be collected and analysed.

To overcome these problems, this paper proposes real time system which can be used to check the quality of water through various sensors such as pH sensor, turbidity sensor and temperature sensor, which determines the chemical parameters and contaminants in water. The values from the sensors are then passed to Raspberry Pi which has an inbuilt Wi-Fi segment, and using this the data is passed to a storage space. Then the sensor values are displayed in a web page or an application.

Turbidity sensor is used to measure the large number of invisible contaminants in the water. If turbidity is higher, then the risk of water borne diseases like diarrhoea and cholera is also high. If the turbidity value is low, then the water is clean. Besides turbidity, pH is also an important which measures the acidic level of drinking water. [1] Whenever the value of turbidity reaches predefined threshold a message alert will be generated informing about the situation. Temperature sensor measures whether the water is, cold or hot. Temperature can affect the dissolved oxygen levels in water therefore using a temperature sensor helps to detect the sources of thermal pollution and ensure the health of living organisms. [12]

2. Literature Review

In the previous years, several work related to this paper can be found and reviewed, out of which some have advantages and disadvantages.

[1]Nikhil Kumar Koditala, Dr. Purnenhu Shekhar Pandey "Water Quality Monitoring System using IoT and Machine Learning"

This paper discusses about a sensor based system.This system introduced a cloud computing architecture into IoT that makes worldwide access to the sensor data. But worldwide access may affect the integrity and confidentiality of the data.

[2] Pradeep Kumar M, Monisha J, Pravenisha R, Praiselin V, Suganya Devi K "The Real Time Monitoring of Water Quality in IoT Environment"
This paper tells about a sensor based system with cloud computing architecture into IoT which makes worldwide access to sensor data. This system works with different sensors and a microcontroller.

[3]Atif A, Wasai Shadab, Mohammad Hassan, Shamim, Alelaiwi and Anwar Hossain"A Survey on Sensor-Cloud: Architecture, Applications, and Approaches".
It is a survey on the sensor-cloud infrastructure, approaches and applications. The research tells about the existing solutions and also future research directions.

[4]Nikhil Kedia et.al **"Water Quality Monitoring for Rural Areas-A Sensor Cloud Based Economical Project"**
The concept in the paper directly contacts the particular authorities informing the conditions and can take actions accordingly. This is an embedded sensor system which is a highlight and it also tells about the challenges that may happen in the system when involving Mobile Network Operator and Government.

[5] R.Karthik Kumar, M.ChandraMohan, S.Vengateshapandiyan, M.Mathan Kumar, R.Eswaran Solar based advanced Water quality monitoring system using wireless sensor network'.

According to is a system with wireless sensor network which uses a solar node for power and results are displayed on a GUI which is created using Mat lab. The drawback is that it may fail during rainy days.

[6] Vaishnavi V. Daigavane, Dr. M.A Gaikwad "Water Quality Monitoring System Based on IOT".
This paper measures the water quality by using different sensors such as pH , turbidity and flow sensor to measure the flow of water. This system uses the GSM network to pass the sensor values. This is a convenient method to use by everyone.

[7]Jayti Bhatt and Jignesh patoliya "IoT based water quality monitoring system"
The paper tells about water quality monitoring system using different sensors such as pH, turbidity, dissolved oxygen and temperature sensor. Here the core controller is Raspberry Pi and Zigbee protocol is used to transmit data remotely.

3.Proposed Method

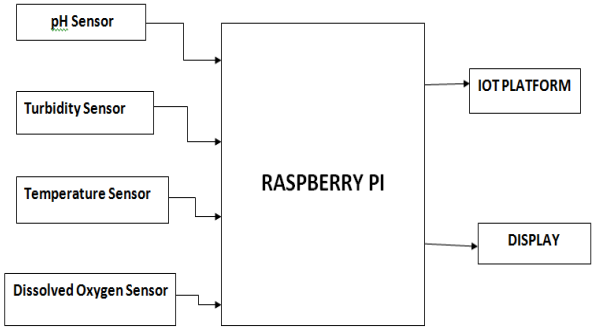

Fig1: Block diagram-Water quality checker

The block diagram shows the proposed model. In this developing world most of the design is based on the emerging technology IoT. This system consists of hardware and software parts. The real time values are measured with the help of hardware parts that is, sensors along with Raspberry Pi and the output is displayed. The connection between hardware and software parts are provided through inbuilt Wi-Fi module. The various sensors such as pH sensor, turbidity sensor, temperature sensor, dissolved oxygen sensors are connected to Raspberry Pi, the microcontroller. These sensors measures the chemical parameters in the water.

The temperature sensor demonstrates the temperature control module of the system. Internal temperature is calculated using DS18b20 waterproof temperature sensor. If the internal temperature is hot i.e. greater than 25◦C and water temperature is hot(>15◦C)and it will give out a alert .[1]

Turbidity function calculates the turbidity and when the turbidity goes greater than 4.0 NTU, the system generates an alert message that water is contaminated. The turbidity value should be ideally below 1 NTU. Then the system generates the message that the water is fit for drinking purpose.

The pH value of the water is calculated using pH sensor and if the pH value is in the range of 6 to 14 then water is good for drinking purpose. Then a signal is generated, water is safe if the value of pH ranges in between 6 and 14 otherwise water is unsafe. The pH value of normal water lies close to 7, which is ideal.[1]

Result: Taking the input pin for microcontroller

```
CODE :  pinMode(LED,OUTPUT);
        pinMode(A1,INPUT);
        Serial.begin(9600);
```

Result: Reading the values of DS18B20 temperature sensor

```
CODE 1:  sensors.requestTemperatures();          // read the temperature of all 1-wire sensors
connected to the 1-wire bus
      temp = sensors.getTempCByIndex(0);         // get the temperature of the first sensors in Celcius
(lists start with 0 not 1)
```

Result:Reading the values of Turbidity Sensor

```
CODE 2: turbidity = analogRead(A1)*5.0/1024;
          turbidity = (1-turbidity)*100.0; //turbidity in percentage
```

4. Components Used In Implementation

The Water Quality Checker consists of following sensors- temperature sensor, pH sensor, turbidity Sensor, Dissolved Oxygen sensor and Raspberry Pi.

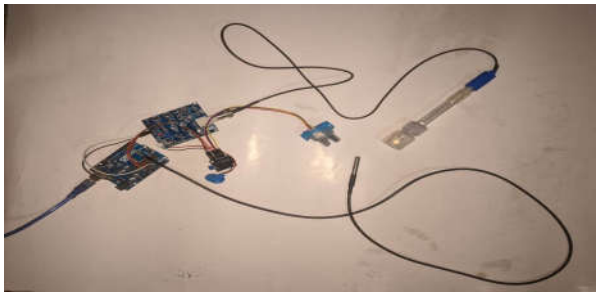

Fig 2. Hardware components

A.Temperature Sensor (DS18b20)

The DS18B20 is a type of 1-wire programmable temperature sensor from maxim integrated. It is used to measure temperature in chemical solutions, mines or soil etc since it is waterproof. The core functionality of the DS18B20 is its direct-to-digital temperature sensor.[9]

Fig 3.1

B. pH Sensor

A **pH meter** is a scientific instrument that measures the hydrogen-ion activity in water-based solutions, indicating its acidity or alkalinity. This measures the difference in electrical potential between a reference electrode and a pH electrode and the difference between these electrodes in electrical potential relates to the pH or acidity of the solution. It is used in many applications ranging from laboratory experimentation to quality control.[8]

C. Turbidity Sensor

The large amount of suspended particles that are invisible in water is measured using turbidity sensor. Higher the measure of turbidity value there is high risk for diarrhoea, cholera. If the turbidity value is low,then it is a clean water and safe to drink. Turbidity sensor measures the large amount of suspended particles that are invisible in a fluid. Thus the turbidity measures the transparency of water, the value lies less the 4 NTU(Nephelometric turbidity units). If the turbidity value is greater than 4NTU,the system shows that water is not fit for drinking purpose and if it is less than 4NTU,it is good . It consumes operating current of 40mA.[1]

Fig 5. Turbidity Sensor

D. Dissolved Oxygen Sensor

Dissolved Oxygen (DO) is a type of liquid process measurement for determining the quantity of oxygen carried in or dissolved in the liquid. This sensor is used in water treatment plants, effluent activated sludge process sewage treatment works, and potable water treatment. It can be used in fish farming, river monitoring, aquaculture and other fields where quality of water is important.

Fig 6. Dissolved oxygen sensor

E. Raspberry Pi

Raspberry Pi is a powerful, low cost and a small card sized device which is a perfect platform for interfacing with many devices. The board consists of a graphics chip, processor, RAM memory and interfaces to other devices and connectors for external devices, of which some are essential and some are not necessary. The CPU is powerful , cheap and efficient and it consumes only less power. In this, SD card is used as the same way as that of the hard disc in the computer. It can be connected to the internet through a LAN (Local Area Network) cable / Ethernet or through a USB modem. The Raspberry-Pi runs on Linux based OS, an open source operating system. Here we used Raspbian OS which is Linux based OS. Python is the programming language for the Raspberry-Pi for the system implementation.[10]

Fig 7. Raspberry pi

5. Experimental Result

The System water quality checker was implemented and the system worked efficiently. The values from the sensors are obtained as output. Initially raw values are obtained and it need about 5-10 minutes to get stabilised. These values are then integrated and generates a alert message whether water is contaminated or not.

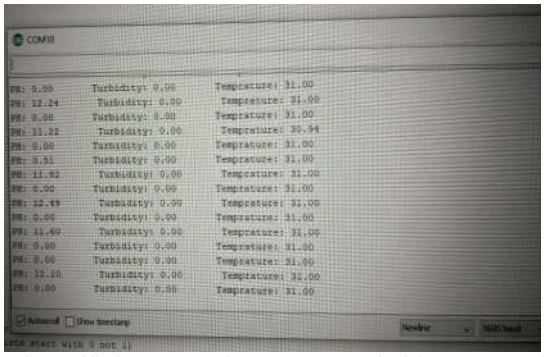

Fig 8. Sample readings from the sensor

The efficiency and accuracy of this system is determined by checking with different water samples, different outputs are obtained.

a)Normal water : The pH value of the normal water is almost 7, when it get stabilised. The temperature value of the water is less than the atmospheric temperature. The turbidity value should be ideally below 1 NTU. Then the system generates the message that the water is fit for drinking purpose.

b)Hot water : The pH value lies close to 7. When it checked with hot water initially the temperature value rises and it will be greater than the atmospheric temperature. Thus the turbidity measures the transparency of water , the value lies less the 4 NTU. If the turbidity value is greater than 4NTU,the system shows that water is not fit for drinking purpose and if it is less than 4NTU,it is good .

c)Contaminated water : The pH value will be either greater than or less than 7. The temperature value varies accordingly to water sample temperature. The turbidity value will be greater than 4 NTU. Therefore the system generates the message that the water is not fit for drinking.
This system mainly focused for checking the quality of the drinking water. The same system can be used in fish tank monitoring, swimming pool monitoring etc in any need of checking the quality of liquids.

Graphical representation of the sample data from different sensors are plotted using thingspeak.

Fig 9. Data of pH sensor

The pH value of normal water lies close to 7. The pH sensor takes some time to stabilise the value.

Fig 10. Data of turbidity sensor

The turbidity of normal water should be ideally 1 NTU(nephelometric turbidity units). According to World Health Organisation , the turbidity of drinking water should be less than 4NTU.

Fig 11. Data of temperature sensor

6. Application And Relevance

One of the main application is the prevention of drinking unsafe water to an extent. People affected by floods, people who are entirely dependent on pipeline water and from water tankers and also those who use river waters (since rivers are polluted too). This system may helps to update the life of people in rural areas by saving them from various dangerous water borne diseases and by implementing this system, we can bring the awareness among people about the water pollution and its consequences. This is also applicable to the people living in urban areas since most of the people living in cities depends on pipeline water which can contain invisible contaminants.

By using a special dissolved oxygen sensor , the application can be extended to improve the life of Aquatic animals and plants i.e for Fish farming, Fish tank monitoring, Aquaculture, Aquaponics and can also used for swimming pool remote measurement.

7. Conclusion And Future Works

The paper proposed will be a effective solution to check the quality of water particularly in rural areas, flood effected areas and aquaponics without any human involvement. This is a cost less smart water quality checking system by using evolving technology such as IoT which can switch the old method of water quality monitoring. This system may helps to update the life of people in rural areas by saving them from various dangerous water borne diseases and by implementing this system, we can bring the awareness among people about the water pollution and its consequences. This system can be used in swimming pools, fish farming etc where the regular quality of water is need to be monitored. This system will be a good solution for improving the life of people in both urban and rural areas thus reducing the human efforts.

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