International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 04 Issue: 04 | April -2020 ISSN: 2582-3930

IoT Based Water Quality Monitoring and Pollution Detection using Smart Sensors

Gaurav Chavan
Student, MET BKC IOE
Nashik, India

RushikeshBhawar
Student, MET BKC IOE
Nashik, India

Mahesh Baravkar
Student, MET BKC IOE
Nashik, India

Nikita Phad
Student, MET BKC IOE
Nashik, India

Abstract- Drinking water is precious for all people as water utilities are facing many challenges. These challenges arise due to the high population and fewer water resources. So, different methods are used to monitor the real-time water quality. To make sure that the safe distribution of water, it must be observed in real-time, which can be done by using "Internet of Things (IoT)". For this microcontroller is required, which is connected with different types of sensors and an interface is used to observe those values collected from those sensors. By using Fusion Chart, graphs are also generated from data collected from different sensors. If the quality of water decreases by a certain limit, then the flow of water gets blocked by using a solenoid valve. Message and an email alert are sent to users regarding such a situation.The idea of an economical and effective system for water quality monitoring is discussed in this paper.

INTRODUCTION

Nowadays there are very limited water resources available and out of those finding safe drinking water is one of the most difficult tasks. Water-borne diseases are increasing day by day so it is essential to keep a look over the water which we are consuming. There is a need for some sort of real-time system which can monitor water regularly and gives feedback to consumers. By using different types of sensors like pH sensor, turbidity sensor and TDS senor quality of water is monitored. Those values are passed to the microcontroller for processing, if some value is found exceeding limit then the solenoid valve is closed and alert is sent to the consumer. Turbidity measures the suspended particles in water so, should be low as it can cause some severe water-borne diseases like diarrhea and cholera. pH is also an important factor that should be considered while measuring the quality of water as it measures the acidic level of water. At any point of time if the turbidity of water reaches the threshold then an alert will be sent to the higher authority which will help them to take immediate actions. The solenoid valve gets closed until the good quality of water is available.

In the 21st century, there were lots of inventions, but at the same time were pollutions, global warming and so on are being formed, because of this there is no safe drinking water for the world's pollution. Nowadays, water quality monitoring in real-time faces challenges because of global warming, limited water resources and growing population. Hence, there is a need for developing better methodologies to monitor the water quality parameters in real-time. It shows the water is acidic or alkaline. Pure water has 7pH value, but 7pH has acidic, quite 7pH has alkaline. The range of pH is 0-14 PH. For drinking purpose, it should be 6.5-8.5pH. Turbidity measures a large number of suspended particles in water that is invisible. Higher the turbidity higher the danger of diarrhea, cholera. Lower the turbidity then the water is clean. TDS sensor measures the alkaline in the water, the traditional methods of water quality monitor involves the manual collection of water samples from different locations. Currently obtaining drinking water is costly for all the humans. Recently development of infrastructure, increase in population, leakage in pipes, uncontrolled usage and wastage of water, pollution, etc. leading to scarcity of water faced by human beings. So it is necessary to find the alternative system which can help to reduce the water wastage issues for which Internet of Things (IoT) is the solution which helps in building an automated system for real time water monitoring. Embedding different sensors with a micro controller we can create such a system using the cloud services for data storage. As there is uneven distribution of water across the city so automated system must be developed so that the water is distributed equally with equal pressure to the residents in the city. For checking the water quality, the parameters like pH, turbidity, temperature, TDS, etc. must be calculated.

LITERATURE REVIEW

N. Kedia entitled "Water Quality Monitoring for Rural Areas-A Sensor Cloud-Based Economical Project." This paper highlights the entire water quality monitoring methods type of sensors, embedded design, and information dissipation procedure, role of government for governance, network operator and villagers in ensuring proper information dissipation. It also can explore the Sensor Cloud domain. While automatically improving the water quality isn't feasible at now, efficient use of technology and economic practices can help improve water quality and awareness among people [1].

Jayti Bhatt Patoliya entitled "Real-Time Water Quality Monitoring System". This paper describes to make sure the safe supply of beverage to the individuals and therefore the quality should be monitored in real-time for that purpose new approach IoT (Internet of Things) based water quality monitoring has been proposed. In this paper, we present the design of an IOT based water quality monitoring system that monitors the quality of water in real-time. This system consists of some sensors which measure the water quality parameter like pH, turbidity, conductivity, dissolved oxygen, temperature. The measured values from the sensors are processed by microcontroller Finally, sensors data can view internet browser application using cloud computing [2].

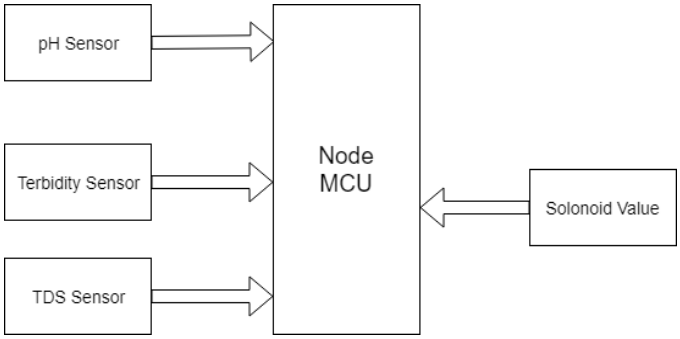
Zhanwei Sun, Chi Harold Li, ChatschikBisdikian, Joel W.Branch and Bo Yang entitled "QOI-Aware Energy Management in Internet-of-Things Sensory Environments".

This paper includes an efficient energy management framework which provides satisfactory QOI experience of IoT sensor environments. Based on past efforts, it is transparent and compatible to lower protocols in use, and having energy-efficiency in the long run without sacrificing any of QOI levels. The new concept of QOI-aware "sensor-to-task relevancy" to explicitly consider the sensing capabilities offered by a sensor to the IoT sensory environments, and QOI requirements required by a task. An important concept of the "critical covering set" of any given task in selecting the sensors to service a task over time. Energy management decision is formed dynamically at runtime, because the optimum for long-term traffic statistics under the constraint of the service delay. Finally, an extensive case study based on utilizing the sensor networks to perform water level monitoring is given to demonstrate the ideas and algorithms proposed in this paper, and a simulation is made to show the performance of the proposed algorithms [3].

SokratisKartakis, Weiren Yu, Reza Akhavan, and Julie A. McCann entitled "Adaptive Edge Analytics for Distributed Networked Control of Water Systems" This paper presents the burst detection and localization scheme that combines lightweight compression and anomaly detection with graph topology analytics for water distribution networks. We show that our approach not only significantly reduces the amount of communications between sensor devices and the back end servers, but also can effectively localize water burst events by using the difference within the arrival times of the vibration variations detected at sensor locations. Compared with traditional periodical reporting situations this can save up to 90% communications [4].

ARCHITECTURE

In this, we present the theory on real-time monitoring of water quality in the IoT environment. The overall diagram of the proposed method is explained. Every block of the system is explained in detail. In this proposed block diagram consist of several sensors (TDS Sensor, pH, turbidity, solenoid value) is connected toNodeMCU.



The Node MCU are accessing the sensor values and processing them to transfer the data through the internet. Arduino is used as a core controller. The sensor data can be viewed on the SMS system.

pH SENSOR

The pH of a solution is the quantity of the acidity or alkalinity of that solution. The pH may be a scale whose range is from 0-14 with a neutral point being 7. Values that are above 7 indicate a basic or alkaline solution and values below 7 indicates an acidic solution. It operates on 5V power supply and it's easy to interface with Arduino.6 to 8.5 is normal range of pH of water.

Fig: pH sensor

TURBIDITY SENSOR

Turbidity may be a measure of the cloudiness of water. The degree at which water loses its transparency can be termed as turbidity. It is considered a good measure of the quality of water. Turbidity blocks out the sunshine needed by submerged aquatic vegetation. Suspended particles ear the surface of water absorbs heat from sunlight which results in rise of surface water temperature.

Fig: Turbidity sensor

PRODUCT PERSPECTIVE

Aim to water quality testing is important because it identifies contaminants and prevents water-borne diseases.Water quality should meet local and international standards after water quality testing to ensure safe drinking water. Water should be tested before any human and animal use.

Product features: -

- Improve water quality.
- Prevent the waterborne diseases.

Technical Expertise: - Should be comfortable in using any of general–purpose applications on a computer. The admin should train the manager on how to use the device properly. And the manager is responsible for any misuse of the device.

Operating environment: - Simplify the water quality activities and ensure about consistency and data integrity by gathering all of the permit related information in one central, web-based location. Define the outfalls, related parameters and certain limits all of them placed within the user-friendly system.

Software quality attributes

- Availability
- Correctness
- Maintainability
- Usability

MATHEMATICAL MODEL

- Let S is the System

  S= {I, O, F, DD, NDD, Success, Failure}

- I Input to the system

  I = {Username, Password, Manager Details}

- output of system

  O = {View Current status of kit, Graphical representation of sensor, manager view own location values, view graphical chart}

- F Set of functions

  F = {F1, F2, F3, F4, F5, F6, F7}

  F1: Register

  F2: Login

  F3: Add manager

  F4: view manager

  F5:View current Status of kit

  F6: View own location value

  F7:View graphical Chart

- DD= {Null}
- NDD=Non Deterministic Data
- NDD= {Username, Password, Manager Details, View Current status of kit, Graphical representation of sensor, manager view own location values, view graphical chart}
- Success {All functionality working successfully}
- Failure {Internet connection unavailable or any problem in computer hardware}

A key part of the study investigates that reviews regards costs and benefits and put forward a course of action based on operational, technical, economic, and time factors. The purpose of the study is to determine if the systems request should proceed further.

FEASIBILITY STUDY

Technical Feasibility: The system being developed is economic. It is cost effective in the sense that it has eliminated the registered work completely. The system is also time effective because the calculations are automated which are made at the end of the paper or as per the student requirement. The result obtained contains fewer errors and are highly accurate as the data is required.

Economic feasibility: The technical requirement for the system is economic and it does not use any other additional Hardware and software.

Behavioral Feasibility: The system is sort of easy to use and learn due to its simple but attractive interface. User will not require any special training for operating the system.

PROPOSED OUTCOMES

We have identified a suitable implementation model that consists of different sensor devices and other modules, their functionalities are shown in figure. In this implementation model we used Node MCU internet. Sensors are connected to Arduino UNO board for monitoring, ADC will convert the corresponding sensor reading to its digital value and from that value the corresponding environmental parameter will be evaluated. After sensing the data from different sensor devices, which are placed in particular area of interest. The sensed data will be automatically sent to the web server, when a proper connection is established with sever device.

CONCLUSION

Monitoring of Turbidity, PH & Temperature of Water makes use of water detection sensor with unique advantage and existing system. Automatically the system can monitor quality of water and it is cost effective and requires less manpower. So the water quality testing will become more economical, convenient and fast. The system has good flexibility. By changing the corresponding sensors and modifying the relevant software programs, this system can be used to monitor other

water quality parameters. The operation is simple. By making some required modifications and changes this system can be expanded to monitor hydrologic, air pollution, industrial and agricultural production and so on.

REFERENCES

[1] Nikhil Kedia, Water Quality Monitoring for Rural Areas- A Sensor Cloud Based Economical Project, in 1st International Conference on Next Generation Computing Technologies (NGCT-2015) Dehradun, India, 4-5 September 2015. 978-1-4673-6809-4/15/$31.00 ©2015 IEEE

[2] Jayti Bhatt, JigneshPatoliya, Iot Based Water Quality Monitoring System, IRFIC, 21feb,2016.

[3] Michal lom, ondrejpriby&miroslavsvitek, Internet 4.0 as a part of smart cities, 978-1-5090-1116-2/16/$31.00 ©2016 IEEE

[4] Zhanwei Sun, Chi Harold Liu, ChatschikBisdikia_, Joel W. Branch and Bo Yang, 2012 9th Annual IEEE Communications Society Conference on Sensor, Mesh and Ad Hoc Communications and Networks