RESEARCH ARTICLE OPEN ACCESS

Water Quality Monitoring System using IoT and Machine Learning

Abhinandhan E*, Kuldeepak Kumar**
**(Department of Computer Science and Engineering, N.D.R.K.Institute of Technology, Hassan*
*** (Department of Mechanical Engineering, N.D.R.K.Institute of Technology, Hassan*
Corresponding Author; Abhinandhan E

ABSTRACT
Drinking water crisis is one the global risk, in which around 200 children are dying per day. Drinking unsafe water alone causes around 3 million deaths per year. Despite the advancements in technology, efficient quality measures are not present to measure the quality of drinking water. In order to avoid this problem, This proposed work proposes a low cost water quality monitoring system using emerging technologies such as Machine Learning, IoT, and Cloud Computing which can replace the traditional way of quality monitoring. This will help the people who lives in rural areas to save their lives from dangerous diseases such as cholera, fluorosis, bone deformities etc. The proposed model has a capacity to control temperature of water and adjusts it so as to suit for environment temperature.

Keywords – IoT,

DATE OF SUBMISSION: 20-12-2019 DATE OF ACCEPTANCE: 31-12-2019

I. INTRODUCTION

Nowadays, due to limited water resources and increasing population water has become a vital resource for mankind. Clean and safe drinking water is the most important resource for mankind. As most of the diseases these days spread through water there is a need for online real time water quality monitoring system. The methods used for water quality assessment at present involve collection of random samples of water at various locations weekly or monthly and analyzing them in the laboratories. This approach is not much efficient because they have various drawbacks such as long time consumption, only water samples from few areas can be determined simultaneously. This method also involves manual work to monitor the quality of water regularly. These methods are also costly and are not capable enough in large populated countries like India, China. In order to overcome these drawbacks we need a real time system which monitors water quality through sensors such as pH, turbidity and temperature and updates those values in cloud service.

This system consists of sensors which measure the chemical composition of water. These sensor values are then passed to NodeMCU micro controller which has inbuilt Wi-Fi module, using which the data is passed over to Azure Event Hub. From Event Hub data is stored in Azure Storage hub in the form of structured data. Thereafter using Stream hub data is streamed to external services. PowerBI which is also a Microsoft platform is used to display the sensor values in the form of Web page. This project also uses MQTT client broker architecture to transmit data from micro controller to external MQTT broker service. Turbidity measures the large number of suspended particles in water that is invisible. Higher the Turbidity higher the risk of diarrhea, cholera. Lower the turbidity then the water is clean. Besides turbidity, pH is also an important measure which measures the acidic level of drinking water. Temperature sensor measures how the water is, hot or cold. Other part of this project is to sense the external temperature near the water storage and control heater or cooler respectively depending on temperature.

This part of project uses machine learning, where the system predicts the weather conditions using previous label dataset and controls heater and cooler according to external weather conditions. This makes the system completely automated without any manual interventions. Whenever the value of turbidity reaches predefined threshold an email alert will be sent to concerned authorities informing the situation, forcing them to take immediate action.

II. OBJECTIVES

- To overcome some of the disadvantages and limitations of existing water quality monitoring systems.
- To measure various chemical and physical properties of water like temperature and particle density of water using sensors.

- Send the data collected to a Node MCU, show the data in display and send it to a cloud based Database using Wired/Wireless Channel.
- Data visualization and analysis using cloud based visualization tools

III. METHODOLGY

To measure various chemical and physical properties of water like temperature and particle density of water using sensors. Send the data collected to a Node MCU, show the data in display and send it to a cloud based Database using Wired/Wireless Channel. Data visualization and analysis using cloud based visualization tools. The algorithms used in our system are adjusting temperature algorithm and e-mail sending algorithm.

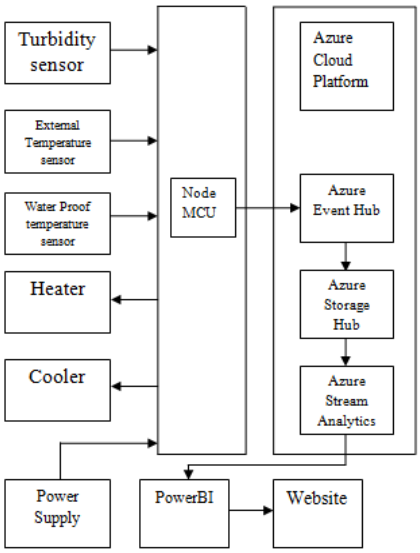

Fig: shows the System Architecture of proposed system

- **Adjusting Temperature**

This model demonstrates the temperature control module of the system. External temperature is calculated from getExternal() function, which is explained in detail at machine learning section. We also calculate the temperature of water using DS18B20 waterproof temperature sensor. If the external temperature is hot i.e. greater than 25◦C and water temperature is hot (>15◦C) then cooler gets turned ON and heater gets turned OFF. Similarly in cold climates the second if statement controls the temperature.

- **Sending Email**

This explains the email module of the system. Turbidity is calculated from getTurbidity() function and whenever the turbidity is greater than 4.0, the system sends the email to concerned authorities. At the same time it also keeps a check on count so that the authorities are not busy with emails continuously.

IV. ADVANTAGES

1. Due to automation it will reduce the time to check the parameters.
2. This is economically affordable for common people.
3. Provides the prevention from diseases caused by water
4. Accuracy in measurement
5. Email alert is sent to the user .

V. LIMITATIONS

1. System hardware need to be handled with care: As we are using different sensors and NodeMCU controller it is mandatory to handled them with care.
2. Only limited users are added to handle the system: Only the persons who are authorized to system able to access it.

VI. CONCLUSION

This proposed work presents a practical and economical solution to monitor the quality of water especially in rural areas without any human intervention. On combining three technologies, we are able to solve one of the basic and emerging problem of human survival to certain extent.

REFERENCES

[1]. Pradeepkumar M, Monisha J. “The Real Time Monitoring of Water Quality in IoT Environment” 2016 International Journal of Innovative Research in Science, Engineering and Technology, 2015 ISSN(Online).

[2]. Kedia, Nikhil. “Water Quality Monitoring for Rural Areas- a Sensor Cloud Based Economical Project” 2015 1st International Conference on Next Generation Computing Technologies (NGCT), 2015.

[3]. Fiona Regan, Antoin, McCarthy. “Smart Coast Project Smart Water Quality Monitoring System” 2006, Marine Institute/Environmental Protection Agency Partnership, 2006.

[4]. Vaishnavi V. Daigavane, Dr. M.A Gaikwad. “Water Quality Monitoring System Based on IOT” 2017 Advances in Wireless and Mobile Communications, Nov 2017 ISSN 0973-6972.

Abhinandhan E "Water Quality Monitoring System using IoT and Machine Learning" International Journal of Engineering Research and Applications (IJERA), vol. 9, no. 12, 2019, pp 18-19