A Study on IOT Approach for Monitoring Water Quality Using MQTT Algorithm

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Abstract – *Degradation of water resources has become a common problem. The conventional methods of water quality monitoring involves the manual collection of water sample from different locations. These water samples were tested in the laboratory using rigorous skills. Such approaches are time consuming and no longer considered to be efficient. The older method of water quality detection was time consuming, low precision and costly. By focusing on the above issues, a low cost water quality monitoring system is developed and designed that can monitor water quality in real time using IOT. In the proposed system water quality parameters are measured by different sensors such as pH, temperature and dissolved oxygen for communicating data onto a platform via microcontroller system. So in order to meet all these requirements, other technologies can be used such as MQTT (Message Queuing Telemetry Transport) which allows publishing and subscribing of data between the sensor and end device. And with the help of MQTT algorithm there will be simultaneous flow of data between the sensors and the servers.*

Key Words: **Internet of Things (IOT), MQTT, Raspberry Pi, Naive Bayes' theorem, Arduino etc.**

1.INTRODUCTION

Since the time IOT has evolved a lot of problems have been solved in this world. By using IOT in this water quality monitoring system various issues such as communication, data collection, data analysis, early warnings have been worked on. But in order to get this into picture, technologies and protocols are combined to get the desired output. Here the use of MQTT makes the whole procedure fast and reliable.

1.1 Purpose

The main purpose of using IOT approach to monitor water quality using MQTT algorithm is to develop a system which provides the end user a useful data used. Conventionally, the water samples are collected from different places and tested rigorously by scientists in the laboratory using many techniques to determine the water quality. Therefore older methods were time consuming process but now the IOT has the potential to modernize the water production, as more and more of its technology is connected to the web. This IOT approach is far better than conventional methods since it is cost friendly, faster and easy to use.

1.2 Background

The parameters for testing the water quality are monitored with the help of GSM (Global Messaging Service) technology but there are various limitations to this technology. First of all by using GSM over all development cost increases. Not only this, GSM faces security issues as well since the user identity confidentiality is violated by transmitting the identities in unprotected form.

During the transmission of data, it is sent one after the other which creates a buzz and delay in transmission. However the data transmission should be simultaneous, fast and secure. So instead of using GSM network or any other technology, MQTT algorithm will be implemented in order to make the system feasible, modular, scalar and cost efficient. Not only will this, with the help of MQTT algorithm there will be simultaneous flow of data between the sensors and server.

1.3 Method of investigation

In order to meet the requirements for developing the system some work has been done prior to achieve the desired result. The system created earlier use sensors to gather information regarding the water parameters. After that the information gathered was sent to raspberry pi, through which it was displayed to the computer or any devices. After analysis of the data obtained, the communication part was carried out with the use of GSM technology. This system was helpful but had limitations as well such as expensive, no real time data could be generated and security issues.

1.4 Scope

To overcome these limitations, changes are done in this system with the help of IOT, a new water monitoring system is developed in which all the water parameters are inspected using sensors.

After that the useful data will be sent to the end user via MQTT algorithm. MQTT makes the communication and transmission of data reliable and fuzz free. Apart from this it makes the system cost friendly as the overall cost of the system decreases. The main advantage of using the MQTT is that there will be simultaneous flow of data between the sensors and the server. Thus making it an ideal choice in terms of connectivity.

2. CHALLENGES

There are basically three common challenges this system faces they are security, sensor network and the communication.

2.1 Security

Security is an essential factor for any system. Security at both the device and network level is critical to the operation of IOT.

a. Secure booting: When power is first introduced to the device, the authenticity and integrity of software on the device is verified using cryptographically generated digital signatures.

b. Access control: Next the different form of resource and access control are applied. Mandatory or roll based access control built into the operating system limit the privileges of device components and applications so they access only the resources they need to do their jobs. If any component is compromised, access control ensures that the intruder has a minimal access to other parts of the system as possible.

c. Device authentication: When the device is plugged into the network, it should authenticate itself prior to receiving or transmitting data. Deeply embedded device often do not have users sitting behind keyboards, waiting to input the credentials required to access the network.

2.2 Sensor Network

A sensor network comprises of groups of tiny, typically battery powered devices and wireless infrastructure that monitor and record conditions in any number of environments from the factory floor to the data center to a hospital lab and even out in the wild. The sensor network connects to the internet, an enterprise WAN or LAN, or a specialized industrial network so that collected data can be transmitted to back end systems for analysis and used in applications.

2.3 Communication

Wireless communication system is the essential part of the IOT infrastructure, which acts as a bridge for dual directional communication for data collection and control message delivery. It can be applied to various IOT applications including mission critical industries, such as power grid, oil field and cases in our routine life like the smart city we summarize the common challenges and issues on wireless communication for IOT applications.

- Huge volume of sensors with varied types and distributed sites need to be connected, managed and maintained.

- High reliable communication will be required under the environment with lot of interfaces.

- Available spectrum resources will be very limited for new IOT wireless network.

- For harsh outdoor area, low power consumption and simple architecture will be required.

3. METHODOLGY

- The first task is to determine which water parameter would provide a close indication of water pollution. Through extensive research the parameter are chosen to be composed of pH, dissolved oxygen and temperature.

- The second step is selection of locales that will provide useful data. The location were narrowed down to industrial areas, sewer waste openings and city lines where human interference has a considerable impact. Various sensors were installed at such locations for testing.

- The third step is to transmit the data from the sensor on to the Arduino kit for further processing.

- The transmission of data obtained is done the next step, from where MQTT comes in the picture. With the help of MQTT along with raspberry pi, the information obtained is passed onto the server and the end user.

- Finally data analysis is done on the acquired data set using Nave Bayes' algorithm with the help of which the desired information is obtained
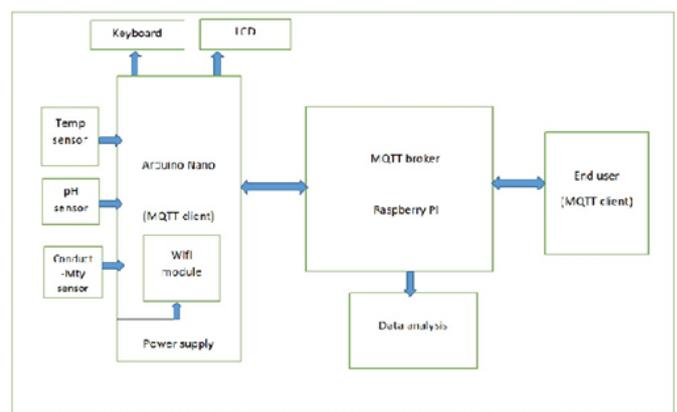
Fig -1: Block Diagram

4. NAIVE BAYES' THEOREM

In order to analyze the data obtained from the sensors to the MQTT, Naïve Bayes' theorem is used. Here with the help of this classifier, a particular or combined parameter of water quality is checked unrelated to the other attributes or it can be said that every feature being classified is

independent of the value of any other feature. In simpler word the Naïve Bayes' Theorem can be formulated as:

$$P(a/b) = \frac{P(b/a)P(a)}{P(b)}$$

5. CONCLUSION

During the transmission of data, it is sent one after another which creates a buzz and delay in transmission. However the data transmission should be simultaneous, faster and secure.

So in order to meet all these requirements, other technologies can be used such as MQTT (Message Queuing Telemetry Transport). Instead of using GSM network or any other technology, MQTT algorithm will be implemented to make the system feasible, modular, scalar and cost efficient along with this it makes communication of data between sensors and servers simultaneously flow. A large amount of data can be sent without facing any hurdle.

In future the system can be implemented on the larger scale with the help of availability of various resources. Other water quality determining sensors can be used for analysis of more precise and accurate data.

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