Testing Water Quality by an efficient MQTT algorithm using an IOT approach

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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.

Index Terms—Internet of Things (IOT), MQTT, Raspberry Pi, 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, earlywarnings 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. Anything part of any device can be connected through any part of the world. It is very simple to be used by anyone. Easily anytime any context can be served or implemented on. IOT (internet of things) is the most used in this present era. Since it has helped resolve plenty of issues. We can use IOT anytime and anywhere we require.

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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 requirementsfor 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.

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

[2]High reliable communication will be required under the environment with lot of interfaces.

[3]Available spectrum resources will be very limited for new IOT wireless network.

[4]For harsh outdoor area, low power consumption and simple architecture will be required.

3 METHODOLOGY

[1]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.

[2]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.

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

[4]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.

[5]Finally data analysis is done on the acquired data set using Nave Bayes' algorithm with the help of which the desired information is obtained.

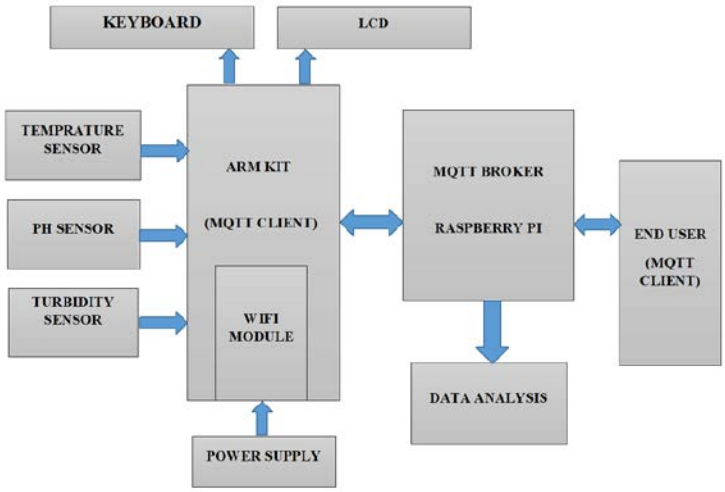

Fig -1: Architecture

4 LITERATURE SURVEY

Water quality monitoring can be used to protect source waters by identifying pollutant levels and locations in a source water. Water quality monitoring is commonly done multiple times a year because water quality may change with season and with weather events. Water quality can be monitored by measuring physical, chemical or biological characteristics of water.

Shruti Sridharan researched about developing an efficient wireless sensor network (WSN) based water quality monitoring system, that examines water quality, an important factor as far as, irrigation, domestic purposes, industries, etc are concerned.

R Karthik Kumar investigated about under water wireless sensor network to monitor the quality of water using wireless sensor network (WSN) technology powered by solar panel. Through WSN various data collected by various sensors at the node side such as pH, Turbidity and oxygen level are sent to base station. At the base station collected data is displayed as visual and is analyzed using different simulation tools.

Advantages of the proposed system is as follows:

- The low cost, efficient, real-time water quality monitoring system has been implemented and tested.
- This can help in preventing diseases caused due to polluted water and presence of metals.
- Quick actions can be taken to curb extreme levels of pollution like in the case of the water bodies and rivers.
- The system can be easily installed with the base station kept close to the target area, and the task of monitoring can be done by less-trained individuals.

The problems faced by the IOT based systems in this real world is given below:

- Compatibility: Now there is no standard for tagging and monitoring with sensors. Uniform concept like the USB or bluetooth is required which should not that difficult to do.
- Complexity: There are several opportunities for failure with complex systems.
- Privacy/Security: Privacy is a big issue with IOT.
- Safety: There is a chance that the software can be hacked and your personal information is misused. This possibilities are endless.

5 WORKING

5. Design and implementation

We evaluate the water quality by using the various sensors such as temperature sensor, pH sensor and turbidity sensor. Accurate values are displayed and are measured at every second interval.

5.1 Implementation and experimental setup

According to this paper we have written two programs that will allow the microcontroller to support the arm kit. Also each programs are written that will allow the temperature, pH and turbidity value to convert from analog to digital values through the convertor.

Specific sensors are used which are best in quality and are of low cost. These analog value after it gets converted to digital values they are passed through the GPRS to far away locations if needed. After these conversions the values are sent to the PC where the readings are displayed elaborately. Each parameters will be displayed in separate columns as shown below. This helps us to find out the water quality monitoring without using the manual method that was used earlier. The experimental setup is that the sensors are all connected to the microcontroller where the measurements are done.

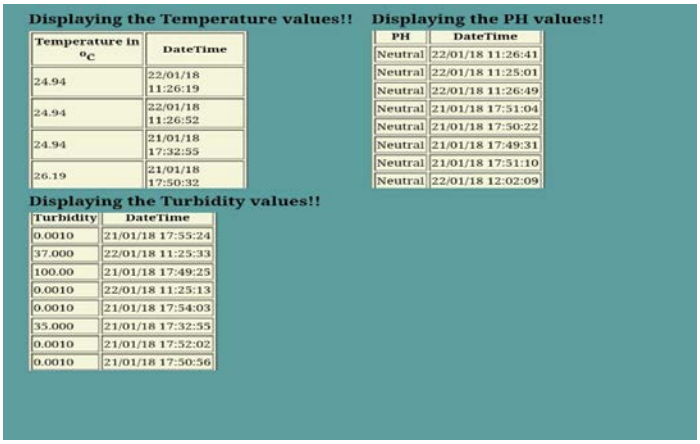

Fig-2: Reading of different parameters.

6 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.

7 REFERENCES

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