UTILIZING THE MQTT PROTOCOL TO MONITOR WATER QUALITY IN AN IOT ENVIRONMENT

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ABSTRACT

Water resource degradation is now a prevalent issue. The traditional approaches to assessing water quality involve manually collecting water samples from various sites. These water samples underwent thorough testing in the lab. Such techniques are time-consuming and no longer viewed as successful.. The earlier method of determining the quality of the water was time-consuming, inaccurate, and expensive. By concentrating on the aforementioned problems, a low-cost water quality monitoring system that can use IoT to monitor water quality in real time is developed and designed. In the suggested system, water quality parameters including pH, temperature, and dissolved oxygen are detected by various sensors in order to transmit data onto a platform via a microcontroller system. All of these requirements can be satisfied by other technologies, such as MQTT (Message Queuing Telemetry Transport), which permits data posting and subscribing between the sensor and end device. Additionally, data will flow simultaneously between the servers and the sensors thanks to the MQTT algorithm.

Keywords: MQTT, Naive Bayes' Theorem, Internet Of Things (Iot), Arduino, Raspberry Pi, Ph Sensor, Wi-Fi(ESP8266).

I.   INTRODUCTION

Many issues have been resolved internationally since the introduction of the Internet of Things. It has helped with a number of challenges, including data collecting by physically visiting each lake or water source, communication (sending the water's qualities), data processing, and early water warnings. But in order to understand this, it is necessary to mix several technologies and protocol types. Here, the process is made quick and dependable thanks to the use of MQTT. The main goal of developing a system that offers the end user useful data is to monitor water quality using an IoT approach and the MQTT algorithm. Traditionally, water samples are gathered from various locations and subjected to a battery of rigorous laboratory tests by scientists to establish water quality. Because of this, traditional methods of producing water required a lot of time. Anyway, more of the same technology is connected to the internet. the Internet of Things (IoT) has the ability to modernize the process. This IOT strategy is far more effective than traditional approaches since it is less expensive, quicker, and simpler to use.

II.   METHODOLOGY

The main objective of this project is to create a wireless sensor network with a high detection accuracy, low power consumption, and low cost that can be used to continuously monitor water quality at remote locations.

• Finding a water parameter that would give a clear indicator of water pollution is the first challenge.

• The choice of locations that will produce meaningful data is the second phase. The area was reduced to industrial zones, sewage discharge entrances, and city lines, all of which have significant human intervention. At these places, many sensors were installed for testing.

• The data will be transferred from the sensor to the Arduino kit for additional processing in the third step.

• Next, the data is transmitted, which is where MQTT enters the picture. The information obtained is distributed to the server and the end user with the help of MQTT and the raspberry pi.

• Finally, data analysis using the Nave Bayes algorithm is carried out on the collected data set in order to retrieve the needed information.

MQTT ALGORITHM

The Client-server subscribes to the messaging transport protocol called MQTT. It is open, straightforward, lightweight, and created to be simple to use. These applications make it acceptable for use in a variety of scenarios by taking into account challenging situations like data transfer in Machine to Machine (M2M) and Internet of Things (IoT) settings where little code foot-mark is needed and/or network bandwidth is at a premium. MQTT is the abbreviation for Message Queuing Telemetry Transport. It is described as an Internet of Things (IoT)/M2M connectivity protocol.

The smallest measurement and observation devices can support this protocol, which can transfer data over vast, irregularly spaced networks. MQTT is a message transport protocol that is specifically designed to connect with enterprise servers, a variety of users, and real-world objects and events. Using dependable software distribution approaches, MQTT was created to take over the jobs of linking the quickly expanding physical construction of the sensors, actuators, phones, and tablets..
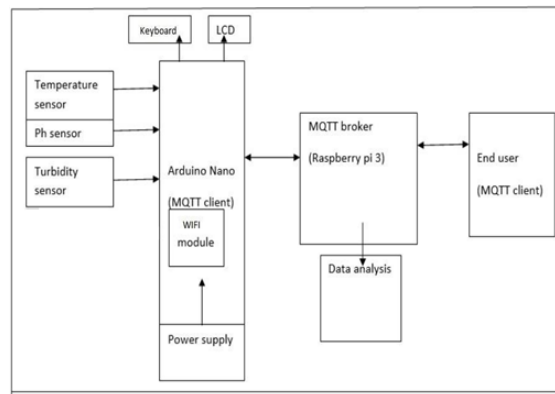

NAIVE BAYE'S THEOREM

The Naive Baye's theorem is used to examine data that is collected from sensors and sent through MQTT. In this, a specific or combination of parameters relating to the quality of the water are evaluated using this classifier without reference to the other attributes, or, to put it another way, each property is evaluated independently of the value of each and every other property. The naive Baye's theorem can be stated as follows in plain English:

$P(a/b) = P(b/a) P(a) /P(b)$

III. MODELING AND ANALYSIS

The combination of remote sensor institutions and cloud processing will bring about innovation in a number of areas, such as patient monitoring at low cost, a reduction in the number of safe beds in hospitals, and an improvement in the performance of the medical staff. The suggested framework can be set up inside of the clinics, and a significant amount of data can be collected and stored inside of the online records set. In fact, even the results can be made to be accessible from a portable device via an application. As the name implies, both patients and medical professionals will find little utility in the Smart Health Monitoring form's results. The patient can check their financial standing from the comfort of their homes and visit clinics only when they genuinely choose to. This should be possible by utilising our shape, the results of which are welcomed on the internet and are accessible from everywhere on the planet.
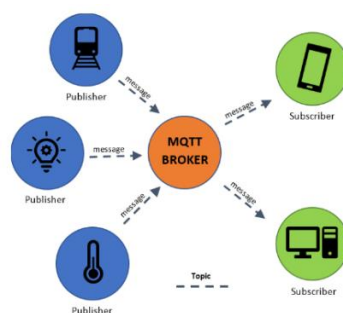
- Broker, create, and subscribe are the components of the MQTT protocol.
- The MQTT messages are sent over produce and subscribe in an asynchronous ("push") fashion.
- By exchanging MQTT control packets in a predefined sequence, the MQTT protocol functions. Each bit in a control data packet is selected with care to minimize the quantity of data carried across the network and serves a specific purpose.
- A MQTT server and an MQTT user are consumed by an MQTT topology. The user and server of MQTT communicate using this.

Following are the components used:-

A.   Arduino UNO

The ATmega328P serves as the foundation for the Arduino microcontroller board. It contains 6 analog inputs, a 16 MHz quartz crystal, 14 digital input, and output pins, a USB port, a power jack, an ICSP header, and a reset button. It has everything required to support the microcontroller.

B.   Wifi module

In order to establish a wireless internet connection, many goods require WiFi modules (wireless fidelity), often referred to as WLAN modules (wireless local area network) modules. It allows customers to either host the program or offload all WiFi networking functionality to another application processor, providing a comprehensive and self-contained WiFi networking solution.

C. pH Sensor

Most pH measurements are carried out using Ph-sensitive glass electrodes, which have generally shown to be successful in measuring pH. However, the behavior of pH-sensitive glass electrodes frequently lacks the necessary precision. The potential of cells with glass electrodes frequently drifts slowly over time after being placed in a new solution, despite the best care. In research that depends on accurate monitoring of minute pH variations, the drift of cell potentials is a particularly serious issue. The reliance of liquid junction potentials on the concentration and composition of the medium as well as variations in the system's pressure makes measurements involving cells with liquid junctions even more ambiguous.

IV.   RESULTS AND DISCUSSION

Finding the water characteristics that will be utilized to assess the water quality is the first stage. The parameters that were chosen in this instance are temperature, turbidity, and pH. Second, pond and lake water is gathered, and sensors are installed there for testing as part of the process of gathering data for analysis.

In order to transmit the information received from the sensors, a system is created that consists of an LCD display, a wifi router, and an Arduino Nano microcontroller. Every one of the gadgets is interconnected. Between the transmitter and receiver, the wifi module establishes a connection.

The raspberry pi functions as an MQTT broker in the following state, gathering data from the sensors and sending it to the server. The Raspberry pi functions like an open-source race message broker Mosquito, which uses the MQTT protocol. The entire procedure is instantaneous, rapid, and simultaneous. the connection between the server and the client.

The information is kept in a database, such as Microsoft Excel, for later study. The Naive Bayes algorithm is used to analyze the data. The values' upper limit is shown here, and whenever it is crossed, the graph will fluctuate. The maximum value for temperature is 40 degrees. For two hours, a sample is collected from three sources, which is then evaluated. The water is unfit for consumption if the temperature threshold value has crossed 40 degrees more than once. The same holds true with a different parameter.

V.   CONCLUSION

During transmission, the data is sent one by one, delaying transmission and causing a buzz. However, data transmission must be done simultaneously, more quickly, and securely. So, alternative technologies, like MQTT, can be used to satisfy all of these requirements (Message Queuing Telemetry Transport). The MQTT method will be used in place of the GSM network or any other technology to make the system workable, flexible, scalable, and affordable while also enabling simultaneous data exchange between sensors and servers.

There are no obstacles in the way of sending a lot of data. The technique can eventually be used on a bigger scale thanks to the resources that are now available. For the analysis of more precise and reliable data, additional sensors for assessing water quality might be utilized. Information to be provided to all users who depend on that plant. Detecting additional factors for the sake of security. Increasing the parameters by incorporating more sensors. The water supply is controlled by using a relay interface.

VI.   REFERENCES

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