Cloud Based Water Quality Monitoring System

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ABSTRACT

The traditional technique of assessing temperature, turbidity, and pH is to collect samples by hand and send them to a laboratory for testing. Today, however, it was unable to reach the water quality testing. Temperature, turbidity, and pH sensors, as well as a single board computer module, internet, and other peripherals, make up the suggested system. The single board computer detects temperature, turbidity, and pH of water automatically. We know Raspberry Pi is a small computer. The data from the sensors is sent into the single board computer, and that data is then processed and will be transferred through the internet to the web server.So it is easier for the management to take appropriate actions in a timely manner and to be able to detect the current state of water quality remotely. The system has achieved water quality monitoring automation, data analysis intelligence, and information transmission networking.

Keywords-Raspberry Pi, Real-Time, Water Quality, Cloud, Data Visualization, ADC, Cost Effective

INTRODUCTION

With the increasing growth of the economy, more and more serious environmental issues arise. One of these issues is water contamination. Temperature, pH, turbidity, and humidity are all water quality factors that are routinely measured. The most frequent way of detecting these factors is to collect samples manually and then submit them to a lab for detection and analysis. This method is inefficient in terms of labour and material resources, and it has drawbacks such as sample collection, long-term analysis, ageing experiment equipment, and other concerns. A sensor is an excellent detecting instrument for these issues. It has the ability to convert non-power data into electrical impulses. It can readily transport, process, transform, and control signals and it has a number of unique features, including high selectivity, sensitivity, and response speed etc. The autonomous measuring and reporting system for water quality is created and developed based on these properties and advantages of sensors. The data is send to Raspberry Pi and process it and the result will transferred to web server through internet. The system uses little human, material, and financial resources while implementing automation, intelligence, and a network of water quality monitoring.

EXISTING SYSTEM

The Central Water Commission collects samples from representative points acrossthe distribution system to monitor the quality of the water. At the modern laboratories, these samples are examined. In these labs, raw water samples, filtered water samples analysis are conducted. Calculating water characteristics including turbidity, pH, and temperature etc. are carried out with the use of sensors. The drawbacks of the current system therefore include the fact that there is monitoring is not done at the site continuously, requires human resources and is less reliable. Due to the shortcomings of the current system, it is necessary to create a system that will allow real-time and continual evaluation of the water's quality.

LITERATURE SURVEY

[2] ***"Water Quality Monitoring for Rural Areas-A Sensor Cloud Based Economical Project," by Nikhil Kedia. Printed at the 2015 Dehradun, India, First International Conference on Next Generation Computing Technologies (NGCT-2015).***The whole water quality monitoring method, sensors, embedded design, and information dissipation mechanism, as well as the responsibilities of the government, network operator, and villages in guaranteeing adequate

International Journal of Enhanced Research in Science, Technology & Engineering
ISSN: 2319-7463, Vol. 11 Issue 7, July-2022, Impact Factor: 7.957

information dissipation, are highlighted in this study. It also looks into the Sensor Cloud. While it is not possible to automatically increase water quality at this time, smart use of technology and cost-effective procedures can help improve water quality and public awareness.

[3] ***"Real Time Water Quality Monitoring System," by Jayti Bhatt and JigneshPatoliya***. This study explains a way to maintain a secure method for monitoring water by watching its quality in real time. For this goal, new IOT (Internet of Things)-based water quality testing approach has been developed. We tend to discuss the architecture of associate IoT-based water quality monitoring system that monitors water quality in real time during this study. The sensors during this system measure water parameters like pH scale, turbidity, conductivity and temperature. The measured values from the sensors are processed by the microcontroller, and also the processed values are sent through Zigbee protocol to the core controller, that is the Raspberry Pi. Finally, by cloud computing, sensors data may be viewed on a web browser application.

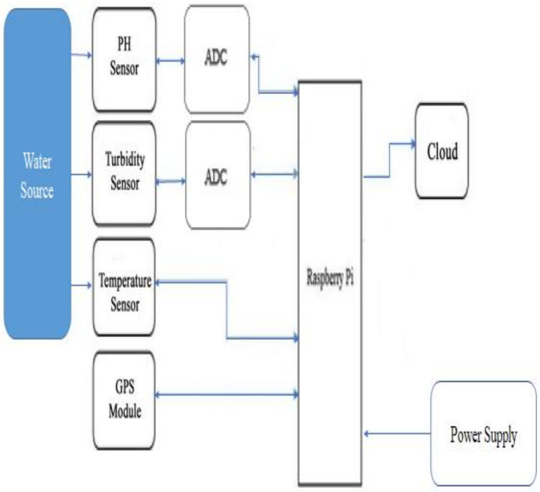
[4] ***Sokratis Kartakis, Weiren Yu, Reza Akhavan, and Julie A. McCann entitled "Adaptive Edge Analytics for Distributed Networked Control of Water Systems".***This analysis describes a burst detection and localization strategy for water distribution networks that mixes lightweight compression and anomaly detection with graph topology analytics. We show that our technique not solely minimises the number of communication between devices and back-end servers, however conjointly expeditiously localises water burst occurrences by scrutiny the arrival times of vibration variations detected at different device locations

[5] ***"Design of Smart Sensors" by Niel Andre Cloete, Reza Malekian, and Lakshmi Nair.*** The sensors area unit coupled to a microcontroller-based activity node that processes and analyses the information. For communication between the activity and notification nodes, ZigBee receiver and transmitter modules are utilized in this system. Once the water quality parameters approach harmful levels, the notification node displays the device readings associated and generates an audio alert. To validate every part of the system, numerous qualification tests are performed. The activity node will send data to the notification node through ZigBee for audio and visual display. The results show that the system is capable of reading physiochemical parameters and processing, transmission, and displaying the data.

[6] ***"IoT based Real-time River Water Quality Monitoring System" by Mohammad Salah Uddin Chowdurya, Talha Bin Emran, SubhasishGhosha, AbhijitPathak, NurulAbsara, Karl Andersson, and Mohammad Shahadat.***
A sensor-based water quality monitoring system is proposed in this research. A microprocessor for system processing, a communication device for inter and intra node communication, and multiple sensors are the essential components of a Wireless Sensor Network (WSN). Remote monitoring and Internet of Things (IoT) technology can provide real-time data access. With the help of Spark streaming analysis via Spark MLlib, Deep learning neural network models, and the Belief Rule Based (BRB) system, data may be shown in a visual way on a server PC. If the obtained amount exceeds the threshold value, the agent will receive an automated warning SMS message.

[7] ***"Water Quality Monitoring System Based on IOT," by Vaishnavi V. Daigavane and Dr. M.A. Gaikwad.*** This study proposes the design and construction of a low-cost system for real-time water quality monitoring (internet of things). The system consists of multiple sensors that measure the water's physical and chemical characteristics. Temperature, PH, turbidity, and the flow sensor of the water can all be measured. The core controller can process the measured values from the sensors. As a core controller, the Arduino model might be used. Finally, utilising a WI-FI system, the sensor data may be seen on the internet.

PROPOSED SYSTEM



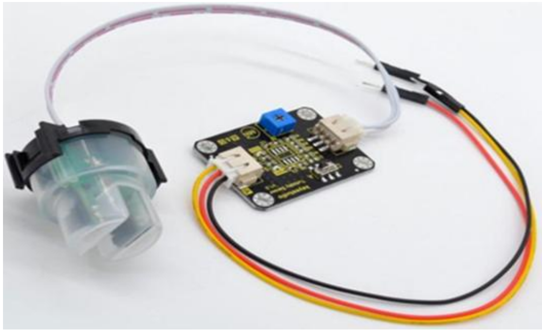
Our objective is to use Raspberry Pi to create a system for real-time water quality evaluation in residential areas. Sensors for pH, turbidity, and temperature are utilised to collect the data needed to monitor water in real-time health

The following are the goals of the system that is planned:
(a)To determine the chemical and physical properties such aspH, temperature, and turbidity of water.
(b)Send the data to a Raspberry Pi and display the data on the screen and transfer it to a cloud-based service using a Wired/Wireless Channel
(c) When any differences are discoveredin the quality of the water, set off an alarm.
(d)Cloud-based data visualisation and analysistools for visualising.

The Raspberry Pi 3 Model B+: a single-board computer that perform all of the tasks typically performed by a desktop. Including spreadsheets, word processing, the internet, programming, games, and more. The newest item in the Raspberry Pi 3 line, the Model B+, features a 64-bit quad core Bluetooth 4.2/BLE, a 1.4GHz processor, dual-band 2.4GHz and 5GHz wireless LAN, faster Ethernet and PoE functionality with a different PoE HAT.

PH Sensor: It is a scientific tool used to precisely determine how acidic or alkaline water and other liquids are. The hydrogen power is represented by the pH. Testing water quality and aquaculture both use this. The overall pH scale has a range of 1 to 14, with 7 being regarded as neutral. Acidic solutions are those with a pH below 7, and basic or alkaline solutions are those with a pH above 7. The pH electrode features a single cylinder that enables direct connection to any pH device with a BNC input terminal, including controllers, metres, and other pH devices.

Turbidity Sensor: It determines the quality of the water by measuring the The amount of total suspended solids (TSS) in the water affects the light transmittance and scattering rate. The level of turbidity increases as the TTS increases. River and stream gauging, wastewater and effluent measurements, control equipment for settling ponds, sediment transport research, and laboratory measurements all use turbidity sensors.



Temperature Sensor (DS18B20): This waterproof SMD DS18B20 temperature sensor measures temperature with 9 to 12 bits and communicates over a 1-Wire bus, which means only one data line needed to connect to a central microcontroller. It measures the water's temperature with exceptional accuracy and operates between 3 and 5.5 volts.

GPS Module: Small processors and antennas found in GPS modules are used to directly receive data from satellites using specific RF frequencies. From there, it will get data from various sources, including timestamps from all visible satellites.

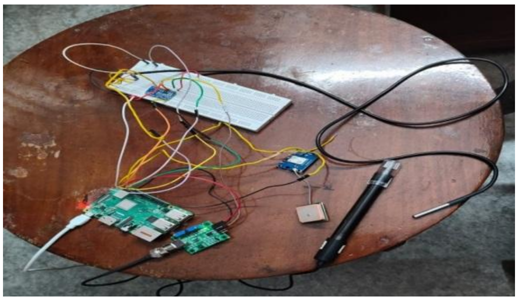
ADS1015 ADC: The analogue signal is transformed into a digital signal by this analogue to digital converter (ADC). In comparison to an I2C protocol, this specific ADC type offers a greater precision rate of 3000 samples per second. This ADC has the additional benefit of operating between 2V and 5V.

Thing Speak: It is an online tool that allows users to collaborate with web services, social networks, and other APIs by building plugins and apps, collecting data in real-time, and visualising it in the form of charts.

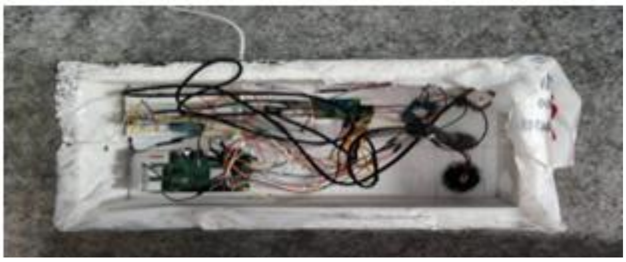
A "Thing Speak Channel" is the essential component of Thing Speak. The following components make up a channel, which is where data that we provide to Thingspeak is stored:

•8 fields for storing data of any kind. These fields can be used to store data from embedded devices or from sensors.
•3 location fields: Latitude, longitude, and elevation can all be stored in these fields. These are excellent for following a moving object.
• One status field, which contains a short statement outlining the channel's data.

DESIGN OF MODEL



Hardware Setup

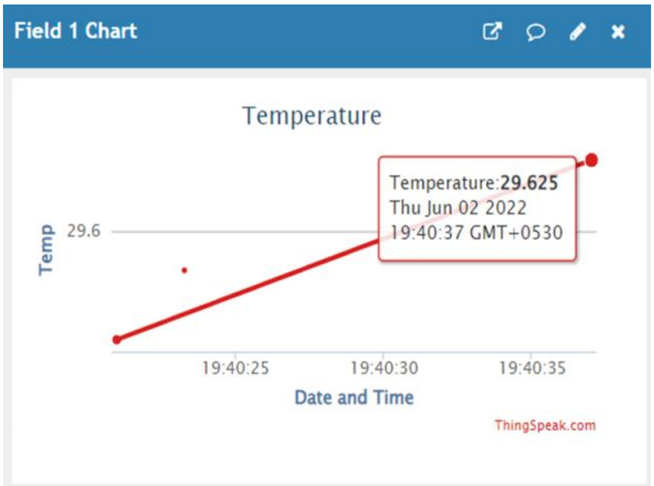


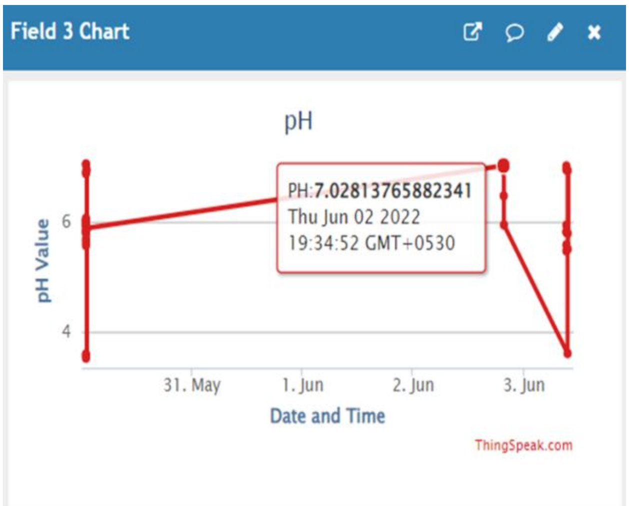
Prototype model

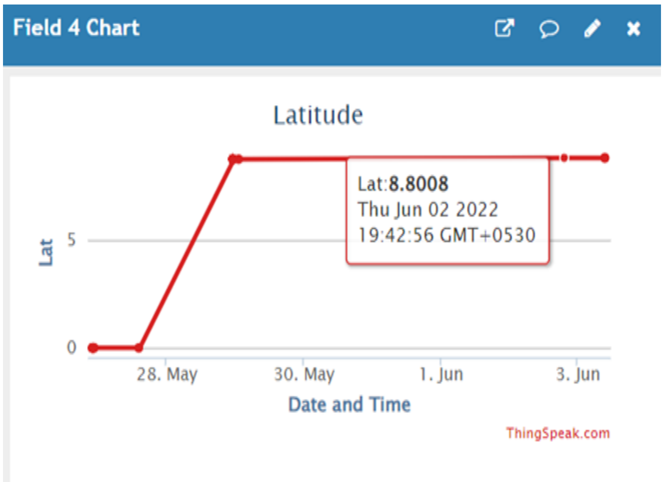
International Journal of Enhanced Research in Science, Technology & Engineering
ISSN: 2319-7463, Vol. 11 Issue 7, July-2022, Impact Factor: 7.957

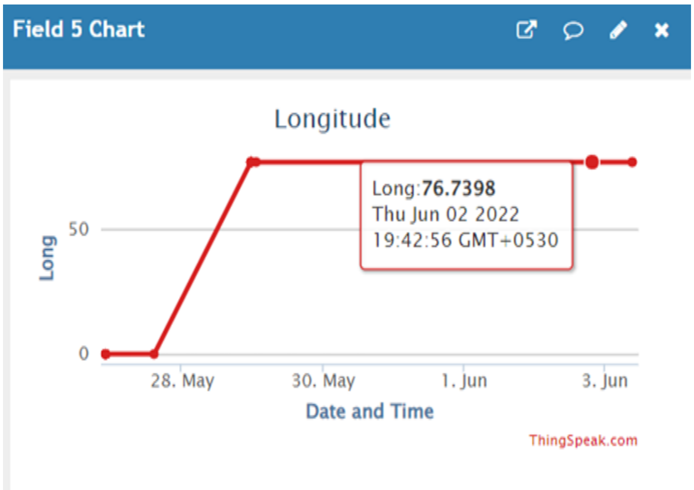
RESULT

The Cloud-based Smart Water monitoring system is a project made to gather information about the water sample that it is placed in and the result is uploaded to the cloud. Here we use a Raspberry Pi which is combined with some analogue sensors that can give information about the quality or purity of the water sample. The Raspberry Pi is coded to understand the data from the respective analogue sensor such as ph, turbidity, temperature and GPS data. This analogue data is converted to digital and given to Raspberry Pi. This is done by using Analog to Digital Converters and also with the help of Python Libraries. The data retrieved from the sensors are uploaded to a cloud platform (here we are using ThingSpeak). The ThingSpeak has a Write API Key through which the data can be sent to ThingSpeak either by an HTTP link or can be uploaded in a .csv file. So we can increase the usability of this project by uploading data that are taken before by a means of the traditional lab method can also be uploaded to the cloud. This can help in further improving the accuracy and reliability of the Project. The uploaded data to the cloud can be seen by anyone with internet access if the data is made public by the cloud controller. The data is accessed by opening a URL which shows these data.









CONCLUSION

Real-time monitoring of the quality of Water uses a Raspberry Pi and an existing Cloud system to analyse data using PH, turbidity, and temperature sensors. The device can automatically check water quality and activate warnings to prevent any health dangers. It does not require personnel to be on duty as a result the system is likely to be more cost-effective, easy, and quick. The method is very adaptable. This system may be used to monitor different water quality metrics by simply replacing the sensors and modifying the required software packages. The approach is simple and the system is very customizable. The system's applicability can be broadened further by tracking hydrologic, air pollution, industrial, and agricultural production.

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