Section A-Research paper
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INTERNET-BASED, WIRELESS SENSOR-BASED SYSTEM FOR MONITORING WATER QUALITY

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ABSTRACT
This project presents the development and design of a low-cost system for real-time monitoring of water quality in IOT (the Internet of Things), a solution to the problems of poor real-time performance, secondary contamination, excessive cost, and other factors. The water's physical and chemical characteristics may be determined with the help of the system's many sensors. It is possible to gauge water characteristics including temperature, acidity, and clarity. The sensor readings are sent to the central controller for analysis. As a central controller, the Arduino model is a viable option. The system effectively monitors water quality data, lessens the effects of contamination, and satisfies smart and efficient water quality standards.

INTRODUCTION

In terms of raw materials, nothing is more essential to human existence than water. Water is essential for everything, from human industry to basic survival. Water is in high demand for urban living, agricultural irrigation, and industrial output. As wireless sensor network technology has advanced, it has become ubiquitous in modern society. Since ZigBee-based wireless sensor networks are extensively used due to their cheap cost, low use of energy, and efficient ad hoc network administration function, we suggest using such networks for water quality monitoring. The PH scale in water indicates how many hydrogen ions are present. If the solution of water is either alkaline or acidic, this will reveal it. If the pH of your water is below 7, it is considered acidic, and if it is over 7, it is considered alkaline. The pH scale runs from 0 to 14. The optimal range for pH in drinking water is 6.5 to 8.5. Turbidity is a measurement of the huge number of invisible suspended particles in water. The potential for unseen particles floating in water increases as turbidity rises. If the turbidity is reduced, the water becomes clear. A sensor detects how hot or cold the water is.

As wireless sensor network technology has advanced, it has become ubiquitous in modern society. Because of its inexpensive price, low power consumption, strong ad hoc network features, and

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network administration function, wireless sensor networks powered by ZigBee technology are becoming more popular. In light of these considerations, this research presents a wireless sensor network for water quality monitoring.

LITERATURE SURVEY

Water Quality Monitoring Using Internet of Things

AUTHORS: Hafiz Kamaludin, Ismail Widad

This study proposes integrating the Radio Radio Identification (RFID) system, a Wireless Sensor Network, or WSN, platform, and Internet Protocol, or IP, based connection into a unified platform for monitoring the quality of water (WQM) as part of an IoT-based system implementation. For the planned WSN connectivity to be implemented in a forested region, a radio frequency of 920MHz is recommended. In this suggested system, the pH level in the water is monitored via an analogue pH sensor.

Design and implementation of the monitoring and control systems for distribution transformer by using GSM network,

In this study, a GSM (global smartphone mobile) network is used to monitor and operate the tap changer of distribution transformers. The suggested approach uses an embedded system that monitors and analyses data on a variety of transformer characteristics, including but not limited to: ambient temperature and humidity; silicone gel colour; Buchholz relay status; input and output phase status; current flow; and power output per phase. The system transmits all parameters through the GSM modem across the network used by GSM to the control centre, where they are received, processed, and displayed on a computer if they are found to be outside of acceptable ranges. In addition, the tap shifter position, the transformer indication, and the transformer parameters report are all subject to orders issued from a central location. The technology eliminates the need for an operator, makes troubleshooting the distribution network easier, helps keep loads balanced, and ensures adequate service to clients, just to name a few of its many benefits.

Dataset For A Wireless Sensor Network Based Drinking-Water Quality Monitoring And Notification System

AUTHORS: Sithole Mhambi PHila PHiladePHian, Nwulu Nnamdi

In this study, we provide the results of 10 separate tests designed to assess water quality and in which we used dirt, salt, washing powder, chlorine, and vinegar as pollutants. Sensor that measure pH, contamination, ow rate, and resistivity in water were used to gather the data throughout the daytime hours in a chamber with constant temperature and humidity. The CR was determined by comparing the measured values from the sensors to the requirements for water quality parameters provided by the WHO by the South African Department od Waterways (DWA). While the predicted parameter measurements were taken for each experiment and used to determine the error measurements, which were then repeated 26 times. The standard for potable water was defined as water from the tap. In the first five tests, one pollutant at a time was introduced to the water supply; in the sixth experiment, two contaminants were introduced, and so on, until all possible contaminants were tested at once in the final experiment.

Design of Water Resources Remote Monitoring System Based On AT89S52 Single Chip Computer

AUTHORS: C.L. Liu, M. Chen, T. Chi

The likelihood of survival of cultured species relies heavily on the water quality of the fish pond, which is monitored and maintained by a large number of people in the conventional aquaculture business. The automatic water quality checking system is a great tool for relieving farmers of the strain of constant water quality checks. There are challenges with several automated monitoring of water's quality systems used in large-scale sh farms, including as a lack of monitoring capability for low-power, distant water quality monitoring and a restricted communication range between equipment. Therefore, a LoRa based Drinking Water Monitoring Service (LWMS) is developed in this study by combining a large number of water quality sensors with LoRa long-range wireless communication technology and open-source cloud services. Experiments with the

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LWMS on the ph lagoon showed that the suggested technology may be used to keep tabs on the pond's water quality from afar.

Block diagram:

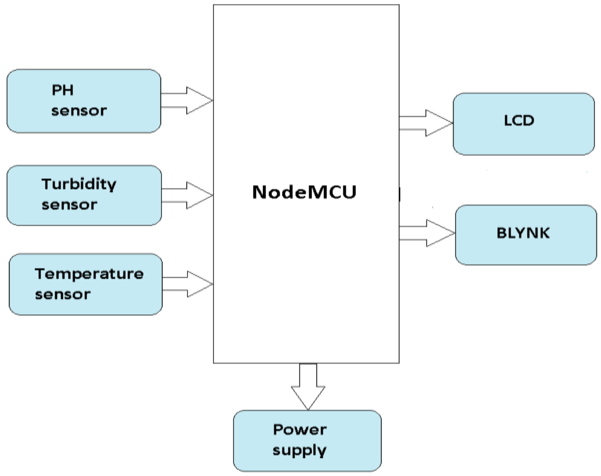

Figure 5.1 System Architecture

The system's five components are as follows: data collector, coordinator, host computer, global system for mobile communications (GSM), and mobile terminal. The data collecting system is comprised of a piece of equipment and a microprocessor. Multiple ZigBee acquisition nodes comprise the information gathering component of the system. Each node has sensors attached to it that measure and transmit things like temperature, pH, and turbidity. The ZigBee receiver and integrated microcontroller make up the coordination module. The ZigBee receiver gathers information about the surrounding environment and transfers it to the machine that hosts it via serial port so that it may be analysed. Data processed on a host computer may be sent to a mobile terminal using a GSM module. The water excellence parameter data is sent back to the remote terminal module via short message.

NoDeMCU

Based on the ESP8266 chips WiFi module, NodeMCU is a developer board with open-source firmware. Its goal is to streamline the process through which programmers build internet-enabled IoT applications. Many Internet of Things (IoT) projects rely on NodeMCU.

Figure Node MCU

PH SENSOR

The alkaline or acidic status of a substance is quantified by its pH value. The pH scale acts as a logarithmic scale, with 7 representing neutrality. If the pH of a solution is more than 7, it is basic or alkaline, and if it is less than 7, it is acidic. It's simple to connect to an Arduino and runs on 5V electricity. The pH scale typically runs from 6 to 8.5..

Figure- PH Sensor

TURBIDITY SENSOR

The haziness of water may be quantified by its turbidity. The level of turbidity measured has shown how much visibility has been lost in the water. It's a reliable indicator of water quality that's widely used. Turbidity prevents sunlight from reaching aquatic plants that are submerged. As a result of suspended particles at the surface absorbing heat from sunlight, surface water temperatures may rise beyond usual.

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Figure-Turbidity Sensor

TEMPERATURE SENSOR

The DHTI1 digital climate and moisture sensor is a simple, low-cost option. A capacitive dampness gauge and a thermistor take readings from the air and convert them into a digital signal that can be read directly from the information on a pin (no analogue input connections are required). It's not hard to figure out how to use, but you have to time your data captures just so.

Figure-Temperature Sensor

LCD (Liquid Crystal Display)

LCD screens are used to show live information from Internet of Things gadgets like sensors and cameras. They may be altered to show whatever kind of data the user or programme requires.

Figure- LCD Display

Blynk IOT

Using Blynk, you can make apps for your smartphone that facilitate communication with microprocessors or even entire computers like the Raspberry Pi.

Figure-Blynk IoT

DATA FLOW DIAGRAM

1.A bubble chart is another name for the DFD. It's a straightforward graphical formalism for representing an appliance in terms of the data it takes in, the information it processes, and the output it produces.

Two of the greatest important modelling tools are data flow diagrams (DFDs). The system's constituent parts are modelled with its help. A system is made up of its process, the data utilised by that process, any external entities with which the system interacts, and what information flows inside the system.

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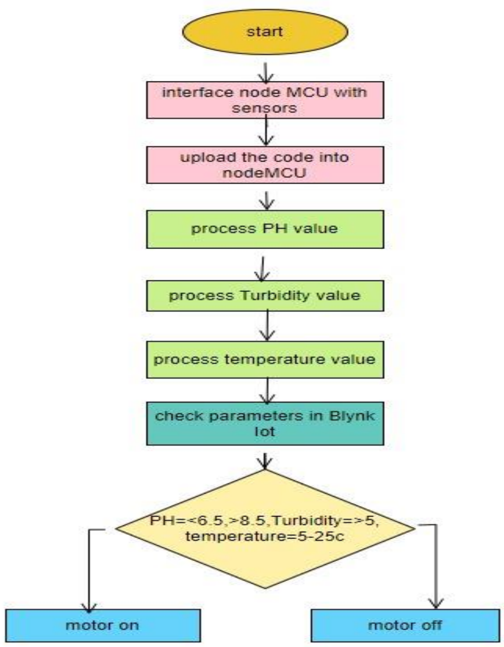
Third, DFD illustrates the information's journey in the system and the alterations it undergoes along the way. It's a visual representation of how data goes from input to output, including with the modifications that occur along the way.

Any degree of abstraction may be utilised to portray a system using a DFD. The transfer of information and functional granularity may be reflected in DFD's potential partitioning into levels.



IMPLEMENTATION

IOT

The term "Internet of Things" (IoT) is used to refer to the interconnected network of gadgets, computers, and other "things" that are outfitted with sensors, wireless connectivity, and other types of technology for the sole purpose of sharing and receiving data. These gadgets vary from the commonplace to the highly specialised. Experts predict that by 2025, there will be 22 billion IoT devices, up from the current 10 billion. Oracle's device partnerships are extensive.

Importance of IoT

In recent years, the Internet of Things (IoT) has emerged as one about the most revolutionary innovations of our century. Because of embedded devices, commonplace items like refrigerators, autos, thermostats, and baby monitors may now communicate with one another and with us through the internet.

With the use of low-cost computers, the internet, big data, analytics, as well as smartphones and other inanimate objects may communicate and gather data with one another with little to no human interaction. Each contact between interconnected items in today's hyperconnected environment may be recorded, monitored, and adjusted by digital systems. The analogue and digital spheres interact, and find common ground.

The Internet of Things (IoT) is not a new concept; but, recent advancements in a variety of technologies have made it a viable one.

RESULTS

Appstore or Playstore**- Signup/Login page**

To join up, just click the registration button, enter your email address, and choose a password. And then, of course, you need to log in. **Circuit connection:**

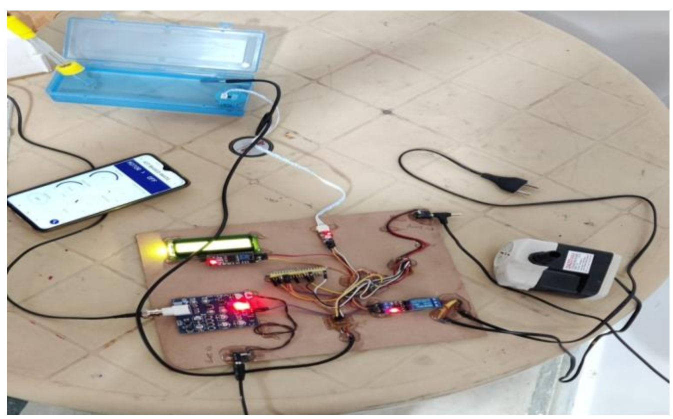


Figure Circuit connection

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This complete package includes the Node MCU, LCD Display, motor, and three sensors (pH instrument, turbidity sensor, temperature sensor).

Water quality checking

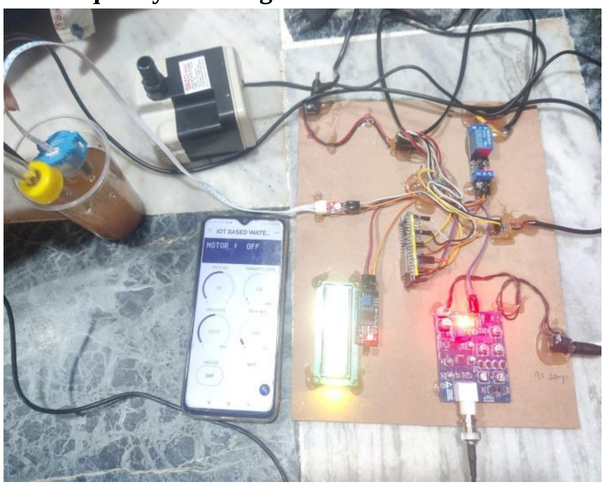

Figure Water quality checking

Blynk Interface

The Blynk IoT app interface displaying sensor data and the on/off switch for the pump used to drain water from storage tanks, basements, and elsewhere.

Water Quality parameters in real time

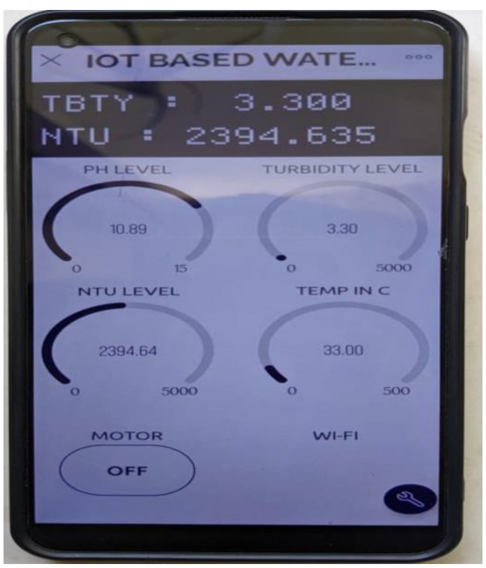

Figure BlynkIoT Water Parameter Readings

We saw considerable improvements in water quality after using the Blynk IoT software. We measured a pH of 10.89 in the water, making it far more alkaline than we were anticipating. The turbidity rating of 3.30 NTU shown by the app indicates a considerable amount of visibility or particles in the water. An exceptionally elevated turbidity score of 2394.64 NTU, indicating the presence of many particles or contaminants, was the most worrisome observation. And the water was a comfortable 33 degrees C.

CONCLUSION

Water turbidity, pH, and temperature may be tracked using a water detection sensor and the already-established GSM network. Automatic, low-cost, and requiring no human monitoring, the device is ideal for keeping tabs on water quality. As a result, it's more practical, quick, and cheap to check the water quality. The mechanism may be adjusted easily. This system may be adapted to monitor other aspects of water quality by swapping out the sensors and updating the appropriate software. It's a straightforward process. Deployment gadgets that sense in the environment allows us to make the environment more lifelike, allowing it to communicate with other things across a network. The user will thereafter be able to access the gathered data and the findings of the analysis through Wi-Fi.

FUTURE ENHANCEMENT

The long-term goals of this research include deploying cutting-edge sensors to detect new quality metrics, using machine learning to anticipate when water will become contaminated, identifying the illnesses brought on by those metrics, and determining the best way for disinfecting the tank. To further improve water quality, biosensors may be employed to detect the presence of macrobacteria.

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