Smart Water Quality Monitoring System

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ABSTRACT—
The Water is a basic and important resource that is required for a variety of purposes including agriculture, industrial activities, and home use. Monitoring methods for water quality should be both cost-efficient and effective. As water utilities face more challenges, water is becoming increasingly valuable to all living beings. These issues arise as a result of rising population, dwindling water resources, deforestation, poor use, maintenance, and garbage disposal, among other factors. As a result, a variety of real-time water quality monitoring systems are employed. We must make certain that safe water distribution takes place, and that it is seen and noted in real time in order to project a new technique based on the "Internet of Things (IoT)" based water quality. This paper shows how to monitor water quality using a variety of sensors such as temperature and humidity, pH, turbidity, soil moisture, water leakage indication, and water level sensors are among the sensors available. The sensors are connected to the NodeMCU Microcontroller Unit (MCU), and then the computer (PC) does the rest of the work. Using the wifi module in the Blink application, the data is transferred to the cloud. In the application, We consider the water's standard before deciding whether to use it.

Key Words: Agriculture Automation, Safety, Security, Android, Blynk Cloud, leakage Detection.

INTRODUCTION

After air, water is the most important and essential for life-sustaining substance. Water is essential for the survival of all living things and for the proper functioning of the body's metabolism. For humans and to avoid disturbing existing ecosystems, conservation and quality preservation are vital. Water quantity and quality are currently tested and monitored manually using analogue and digital metres. Turbidity sensor, DHT sensor, pH sensor, water leakage sensor, and water level sensor were employed in our created system to determine the drinking water quality. The temperature and humidity in the environment were determined using the DHT sensor, while the acidic and basic material levels in water were determined using the pH sensor. The turbidity sensor determines whether the water is clear or cloudy. To determine the quantity of moisture in the soil, a soil moisture sensor is employed. The water level determines whether the water is low or high; and The water leakage sensor detects whether water is seeping from the pipe. NodeMCU collects data from the sensor and displays it on the LCD (Liquid crystal display).Additionally, this data is sent to the blink programme via the wifi module. Water monitoring is carried out in this application. If any data changes, a notification is delivered to both the client and the server.

This paper introduces a smart and secure automated system where physical security is provided, detect gas leakage and fire outbreak in the house. The system objective is to provide the facility through a cloud-based approach which helps user to access the data anywhere from globe and can be scaled up or down depending on the user requirement. The user can control the system using a user interface built in android.

RELATED WORK

The most reliable implementation of impure water is the cost-efficient and effective system of water quality monitoring. As water utilities face greater challenges, drinking water may become increasingly valuable to all people. These issues develop as a result of the high population, limited water resources, and other factors. As a result, a number of real-time water quality monitoring technologies have been created. To ensure that water is distributed safely, To monitor water quality in real time, a new technology based on the "Internet of Things (IoT)" has been proposed. With the expansion of the wireless device network approach in the IoT, real-time water quality observation is investigated through data collection, technique, and transmission. A microcontroller interfaces the measured values from the sensors, and the processed values are communicated to the core controller ARM over the WI-FI protocol. In this way, water quality monitoring interface sensors with quality monitoring and IoT settings were made available. WQM uses a network of device nodes to determine water parameters such as temperature, pH, water level, and CO_2. This is how the information is sent to the web server. The data on the server can be downloaded or viewed from anywhere in the globe, and it is updated on a regular basis. If the sensors do not work or are in abnormal conditions, a buzzer will ring.

Nowadays, Internet of Things (IoT) and Remote Sensing (RS) techniques are used to monitor [2], gather, and analyse data from remote sites in a variety of academic fields. The quality of water supplied to people has worsened dramatically as a result of massive increases in global industrial output, Overuse of land and sea resources, as well as migration from rural to urban areas. Fertilizers are widely used in agriculture.as well as other chemicals in industries such as mining and construction, has greatly impacted global water quality. Water is so important to human survival that systems must be in place to thoroughly check the quality of water made accessible for drinking in town and city-connected supplies. as well as the rivers, creeks, and seashore that surround our towns and cities. The availability of high-quality water is critical for reducing water-borne disease outbreaks and increasing overall quality of life. The Fiji Islands require a continuous data collecting network for water quality monitoring because to their remote location in the Pacific Ocean, which IoT and RS could help with. This study shows how IoT and remote sensing technology can be used to create a smart water quality monitoring system for Fiji.

Since drinking water has been poisoned and polluted [3], water pollution has become one of the most serious issues in recent years. Polluted water can cause a variety of diseases in humans and animals, affecting the ecosystem's life cycle. If water contamination is recognised early enough, appropriate steps can be done, and potentially dangerous situations can be averted. The quality of the water should be checked in real time to ensure a constant supply of fresh water. With advancements in sensor, communication, and Internet of Things (IoT) technologies, smart solutions for monitoring water contamination are becoming increasingly important. A complete review of the most recent research in the field of smart water pollution monitoring systems is offered in this paper. The study proposes a low-cost, high-efficiency IoT-based smart water quality monitoring system that checks quality parameters in real time. Three water samples are used to evaluate the constructed model, and the results are sent to a cloud server for further action.

Water is a basic and necessary resource that is required for all needs [4], including agriculture, industrial activities, and residential use. Despite the fact that numerous water monitoring systems have been installed, waste water disposal is barely managed, particularly in industrial regions. This project can be used not only to monitor water quality at the industrial level, but also anywhere else where water quality is important. Sensors are utilised to check the water quality in real time (PH, Temperature, Turbidity, conductivity, water level indicator). It also indicates the amount of water and, using the valve control system, checks the quality of the water before sending the water with pollutants to the filtering system. The IOT system is in charge of the entire system, which is constantly monitored by the module.

PROPOSED SYSTEM

We used six sensors in our proposed system: pH, turbidity, DHT-11, soil moisture, water level, water leakage, microcontroller unit as the main processing module, and ESP8266 Wi-Fi module as the data transmission module (NodeMCU). Because of its low power consumption and small size, the microcontroller unit is the most significant component of the system used for water quality testing. The proportions could be a suitable fit for an important point of sale technological criterion.

Three of the six sensors receive data in the form of analogue signals. The MCU includes an on-chip ADC that converts analogue sensor signals to digital format for further analysis. To obtain this analogue output from the sensor, the analogue output of the sensor will be connected to the analogue pins of the MCU. The remaining three sensors' digital outputs are connected to the MCU's digital pins. Using the Wi-Fi data connection module ESP8266 (NodeMCU) to the central server, all of the sensors' data processed by the MCU will be updated to the blink server.

The entire system is designed in Embedded-C++, with the written code being emulated using the Arduino IDE. Sensors are used by the water quality monitoring system to collect data on pH, turbidity, water level in tank, soil moisture, water leakage, temperature, and humidity of the surrounding atmosphere. Authorized users can log into their accounts and access this data using a user ID and password for accessing data on the Blink server. Data will be collected, analysed, and transmitted in real time.

M/S Espino's ESP8266 is a low-cost wi-fi module that includes a complete TCP/IP stack and a wi-fi chip. Because of their enhanced cache capacity, the code boots straight from external flash during programme execution, enhancing system performance and reducing storage requirements. To send and receive data, change wireless module settings, and change serial query commands, the ESP8266 uses Tx and Rx serial transceiver pins.

To communicate, Tx or Rx pins must be linked between a wi-fi module and a microcontroller that are connected in opposing directions. Setting up an IoT application with the Wi-Fi Module through SPI and UART is simple.

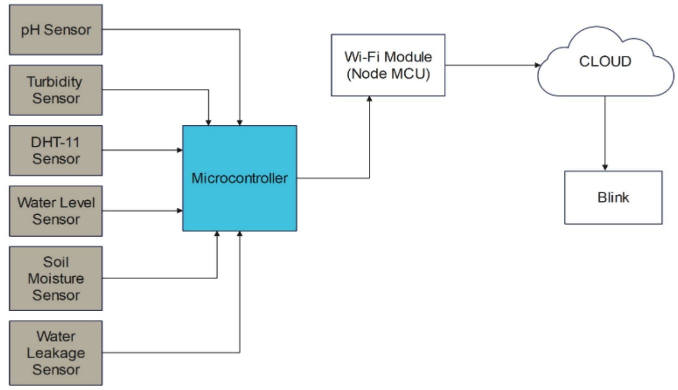


Figure 1. System Architecture

The Main components are:

1. NodeMCU

We use Esp8266 as a micro controller. It is a self-contained wi-fi module from micro controller to wi-fi and also it can run the application. It comes with built-in micro-USB connector.

Specification:

• Voltage:3.3V.
• Wi-Fi Direct (P2P), soft-AP.
• Current consumption: 10uA~170mA.
• Flash memory attachable: 16MB max (512K normal).
• Integrated TCP/IP protocol stack.
• Processor: Ten silica L106 32-bit.
• Processor speed: 80~160MHz.
• RAM: 32K + 80K.
• GPIOs: 17 (multiplexed with other functions).
• Analog to Digital: 1 input with 1024 step resolution.
• Maximum concurrent TCP connections: 5.
• We can program it using Arduino IDE

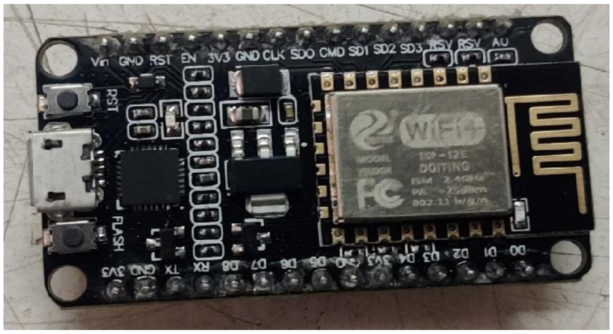


Figure 2: NodeMCU

2. Sensors

i) Ph sensor

The pH sensor is used to assess if the water is acidic or alkaline. It is designed to give a value between 0 and 14 based on the concentration of hydrogen ions using a negative logarithmic formula. The pH of the water is kept between 6 and 8.5 in this scenario, which is within permissible human consumption limits.

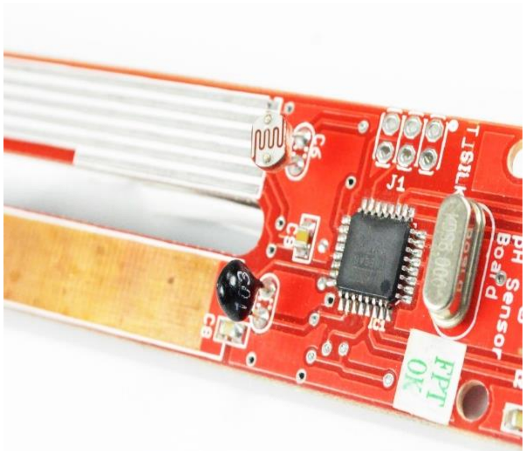


Figure 3: Ph sensor

ii) DTH-11

The DHT11 is a popular temperature and humidity sensor that features a dedicated NTC for temperature measurement and an 8-bit microprocessor that serially transmits temperature and humidity values.

DHT11 Specifications

Operating Voltage: 3.5V to 5.5

Operating current: 0.3mA (measuring) 60uA (standby)

Output: Serial data

Temperature Range: 0°C to 50°C

Humidity Range: 20% to 90%

Resolution: Temperature and Humidity both are 16-bit

Accuracy: ±1°C and ±1%

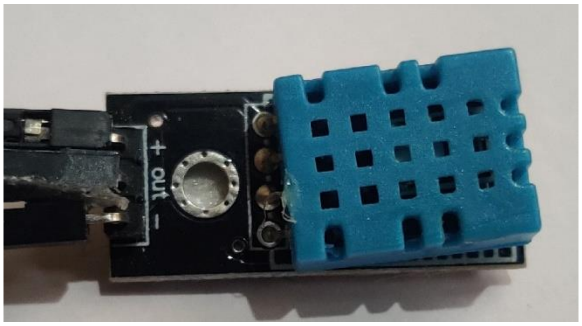


Figure 4: DHT11 sensor

iii) Turbidity

The Turbidity sensor measures the cloudiness or haziness of water caused by particles that aren't visible. The sensor detects suspended particles in water by calibrating the light transmittance and scattering rate, which varies depending on the water's total suspended solids quality.

Figure 5: Turbidity sensor

iv) Soil moisture

In the irrigation field as well as in plant gardens, soil moisture is critical. Plants require nutrients to thrive, which are provided by soil nutrients. In order to adjust the temperature of the plants, they must be given water. Water can be used to adjust the temperature of a plant through a process called as transpiration. When plants grow in damp soil, their root systems develop more quickly. Extreme soil moisture levels can lead to anaerobic conditions, which can promote plant growth and the spread of soil diseases.

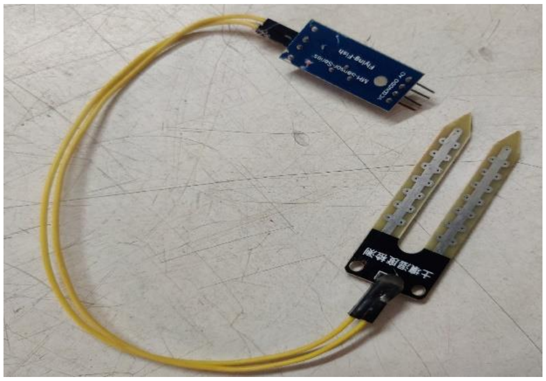
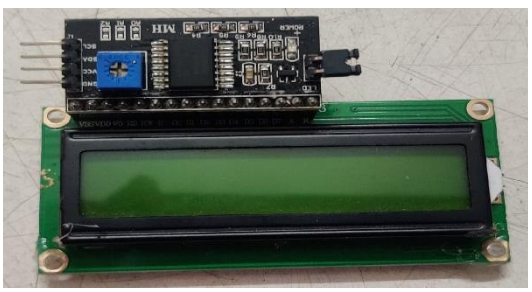


Figure 6: Soil moisture

3. Other components

- LCD
  LCD stands for liquid crystal display and is a flat-panel electronic display device with a wide range of applications. The most basic power is a 16x2 LCD display, which is extensively utilised in many devices and circuits. These modules outperform heptad segments and other multi-segment LEDs.

Figure 7: LCD



- Relay
  The relay is the device that opens or closes contacts to trigger the operation of other electric controls. It detects an undesirable circumstance in a selected area and instructs the circuit breaker to turn the affected area ON or OFF.

Figure 8: Relay

4. Blink Cloud

The Internet of Things was a driving force behind the development of Blink.. It can control hardware remotely, display sensor data, save and visualise data, and perform a variety of other tasks.

Features

- Similar API & UI for all supported hardware & devices
- Connection to the cloud using:
  - WiFi
  - Bluetooth and BLE
  - Ethernet
  - USB (Serial)
  - GSM
- Set of easy-to-use Widgets
- Direct pin manipulation with no code writing
- • Using virtual pins, it's simple to integrate and add new functionality.
- History data monitoring via Super-Chart widget
- Device-to-Device communication using Bridge Widget
- Sending emails, tweets, push notifications, etc.

METHODOLOGY

1. Interfacing NodeMCU board to Arduino IDE

- Install the ESP8266 Board Package
- Click on tools->Boards->Board Manager
- Scroll down to 'esp8266 by ESP8266 Community ' and click "Install" button to install the ESP8266 library package. Once installation completed, close and re-open Arduino IDE for ESP8266 library to take effect.
- Setup ESP8266 Support after restarted Arduino IDE, select 'Generic ESP8266 Module' from the 'Tools' -> 'Board:' dropdown menu.
- Select '115200' baud upload speed is a good place to start
- Go to Windows 'Device Manager' to find out which Com Port 'USB-Serial CH340' is assigned to.The matching COM/serial port is selected for CH340 USB-Serialinterface.
- Now the idle setup to the hardware is done and we can code for the board.
- After coding process, run and check any errors and then, upload code to the NodeMCU.

2. Interfacing NodeMCU to Blynk cloud

- Create a Blynk Account
- Create a New Project
- Decide on the project's hardware model.eg Arduino UNO,NodeMCU.
- Auth token gets generated after account creation
- Let's add a button to control our LED
- All the available widgets are located here. Now pick a button.
- Drag-n-Drop Tap and hold the Widget to drag it to the new position.
- Configuration of the Widget Each Widget has its own set of configuration settings. To access to them, tap on the widget.
- Run The Project
- A message will be popped up saying "Arduino UNO is offline" for example.To deal with this the later stepsshould be followed.
- The Blink Library must be installed on your computer.
- Add the auth token in the Arduino code along with the default code to connect to blink cloud.

- Launch Serial Terminal and transfer the sketch to the board.
- Wait until see something like this.
  Blink. X.X.X
  Your IP is 192.168.0.11
  Connecting...
  Blynk connected!
- Blynk is cloud is successfully connect to hardware.

CONCLUSION

The proposed system is an Internet of Things solution for real-time water quality monitoring that is low-cost and high-efficiency. This system is being developed with the help of a Micro Controller and NodeMCU target boards, which are connected to a variety of sensors. An efficient system will be constructed in real time to track water quality. After that, the pH value will be measured. The turbidity measurement value will be taken.

Through the webserver, a web-based application called Blink is utilised to monitor metrics such as pH, turbidity of the water, level of water in the tank, moisture in the soil, pipe leaks, temperature and humidity of the surrounding atmosphere. These measured parameters are also monitored via the Blink mobile app.

REFERENCES

[1] Nitin Kothari, Jitendra Shreemali, Prasun Chakrabarti, Sandeep Poddar: Design and implementation of IoT sensor-based drinking water quality measurement.

[2] IOT based water quality control and filteration system: G. Manoj Kumar, S.E. Gouthem, A. Srithar, V. Surya Prakash.

[3] IoT Based Real-time River Water Quality Monitoring System Mohammad Salah Uddin Chowdurya, Talha Bin Emranb, Subhasish Ghosha, Abhijit Pathaka, Mohd. Manjur Alama, Nurul Absara, Karl Anderssonc, Mohammad Shahadat Hossaind.

[4] Real Time Internet of Things (IoT) Based Water Quality Management System Saif Allah H. AlMetwally, Mohamed K. Hassan, Mohamed H. Mourad.

[5] Smart water quality monitoring system with cost-effective using IoT Sathish Pasika *, Sai Teja Gandla

[6] Smart Water Quality Monitoring System A.N.Prasad, K. A. Mamun, F. R. Islam, H. Haqva

[7] Smart Water Quality Monitoring System Using Iot Technology Vennam Madhavireddy1, B. Koteswarrao

[8] Smart Irrigation System Using IOT And Raspberry Pi Ms. Swapnali B.Pawar, Prof. Priti Rajput, Prof. Asif Shaikh

[9] https://stackoverflow.com/questions/29339565/how-do-i- call-rest-api-from-an-android-app

[10] https://en.wikipedia.org/wiki/Android_Studio

[11] https://docs.blynk.io/en/getting-started/what-do-i-need-to-blynk/quickstart-device-code-overview

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