International Journal of Advances in Engineering and Management (IJAEM)
Volume 5, Issue 9 Sep 2023, pp: 672-679 www.ijaem.net ISSN: 2395-5252

# Water Quality Monitoring System Using Iot

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Date of Submission: 01-10-2023 Date of Acceptance: 10-10-2023

**ABSTRACT :**
Water pollution has become a growing problem in recent years. Personal satisfaction with water can be exceptional among those primary variables with control well-being and disease status "around relatives, what more animals. Lakes and waterways would be the primary sources of drinking water that rely impressively on personal satisfaction with water (referring to the physical, chemical, and more living aspects of water). The goal of this water quality monitoring system using the Internet of Things is to detect the water quality, i.e. how the pH content changes, and send a report to the relevant authorities. We are going to implement this project at city water tanks and drinking water reservoir. For this we use an Arduino board to detect the pH value and a GSM module for the messaging technique. We use an LED display for continuous monitoring of water parameters. Finally, the user receives a report on the pH value of the water. We are further expanding this project by sending data from sensors to the cloud for global water quality monitoring. Water contamination will be those that pollute the water data (lakes, rivers, oceans, aquifers, what is more underground water). To ensure clean water for sea animals, the wireless oxygen sensor network system can detect water quality. In order to estimate the pollution content and the amount of oxygen in the water for future water purification. When oxygen centralization exceeds this common range, our convenient on-screen oxygen focus identification What's more, it will notify the client instantly. This plan is simple, you will also study to know the extent to which the oxygen centralization will be buzzing around.

**IndexTerms** - Wireless Sensor Network (WSN), Water parameters, Internet of things (IoT), Wi-Fi

## I. INTRODUCTION:

Wireless communication technologies are being expanded to assist individual and regular human duties. In recent years, many applications have been developed for building control, automation, data collection. There are many advantages such as low cost, easy installation and maintenance. The network of remote devices is applicable in several functions such as agriculture, traffic management, remote healthcare, forest management, security and surveillance. A "wireless sensor network" includes connectivity, computing and signal processing, and distributed nodes of sensing devices. This framework allows the user to view the devices that are connected from the down station through completely different communication principles such as "Bluetooth, Zigbee, WIFI, RFID and GPRS". IoT was established in parallel with WSN during which several things are connected with networks from one to different. Jing has developed a remote wireless monitoring system for water supply using a "PIC microcontroller" that relies on GPRS. The complexity of the microcontroller architecture is greater and the cost is high. Thus, a low-cost, low-power, and system-on-chip primarily based wireless device is needed to address these drawbacks. So I built a real time tracking system using GSM, Intel, sensors, ADC and LCD. These devices are limited because they are supported by advanced dedicated electronic boards. There are various web applications such as RFID tags, smart technology, sensor technology and mobile technologies.

## II. LITERATURE REVIEW:

Wireless sensor networks are also known as "wireless sensor and action networks (WSAN)", which is a network containing "distributed sensors" to monitor environmental or physical situations such as pressure, sound, temperature, etc. This system includes a gateway that offers connectivity into the world in use and distributed nodes that can transmit information across the network to the main location. Existing networks are bidirectional in nature and enable sensor operation. Jayti Bhatt Jignesh published "Real Time Water Quality Monitoring System". This research ensures a safe

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supply of drinking water. This system consists of different water parameters. The microcontroller processes the data. Finally, the data from the sensors is displayed on the web server. Ning designed a monitoring system for water quality

## III. EXISTING SYSTEM:

Today, water is polluted daily for many reasons. In this current system, equipment costs are high and processing takes a lot of time. Traditional methods have disadvantages such as long waiting time for results, high cost, low measurement accuracy and complicated methodology. So with the implementation in technology, we use different methods and techniques to control water quality. The disadvantage of the existing system is the high complexity of the system and low performance.

## IV. PROPOSED SYSTEM:

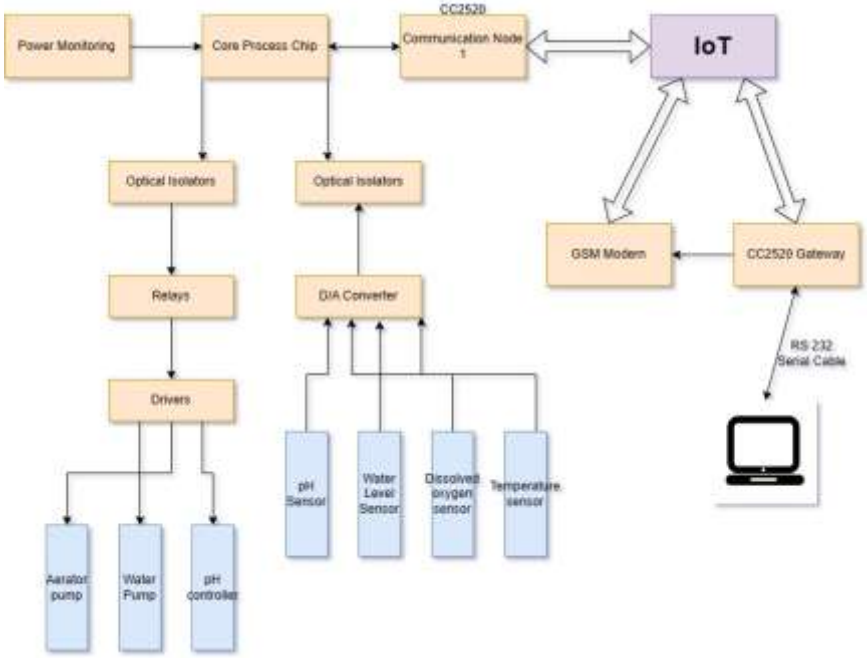
In this proposed system, complexity is reduced and performance is increased by collecting data on water parameters such as temperature, water level, CO2, ph. The collected information is updated on a web server that can be accessed from anywhere in the world.

**Components of a Water Quality Monitoring System using IoT:**

Sensors: Various sensors are used to measure different water quality parameters. These sensors can include:

pH sensors
Turbidity sensors
Dissolved oxygen sensors
Conductivity sensors
Temperature sensors
Chemical sensors for specific contaminants (e.g., heavy metals)

Figure 1:SystemBlockDiagram




## V. IMPLEMENTATION:

**a) Water Level Sensor:**

"The "Water Level Sensor" is designed to detect the water level in the tank and upper tanks. It is generally used in sensing water leakage, water level and rainfall. It mainly consists of three parts: a 1MΩ resistor, an electronic brick connector, and many rows of bare wires. It works by having a series of "exposed tracks" that are connected to the ground. It is also interspersed between "grounded footprints and sunstrokes". A weak 1MΩ pull-up resistor is present. The 1MΩ resistor increases the sensor value until the drop of water short-circuits the sensor trace to the grounded trace. This can measure water drops/water size using a series of "exposed parallel wires". It is characterized by high sensitivity and low power consumption.

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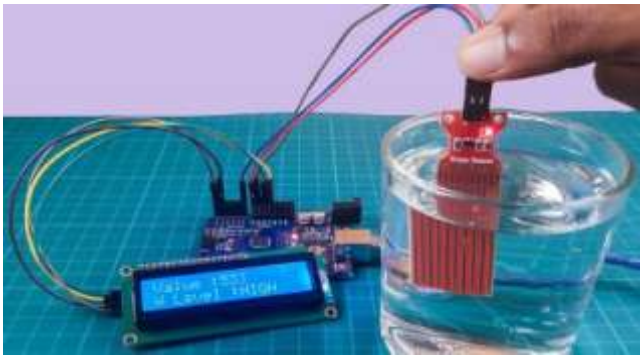
Figure 2: Water Level Sensor



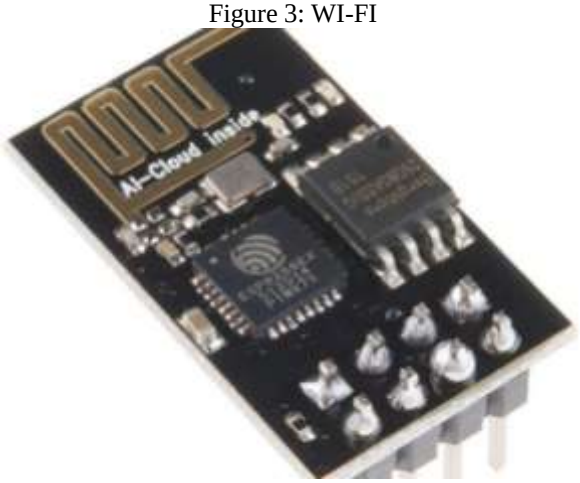
Features:

- Operatingvoltage:-3to5VDC
- Operatingtemperature:-10°cto30°c
- Measuring range: 0 to 15 feet's

**b) WI-FI:**

The WI-FI module used in this project is **ESP8266**. It follows the TCP/IP stack and is a microchip that is cheaper. This microchip allows the microcontroller to connect to a WI-FI network using Hayes-style commands that are executed or created over a TCP/IP connection. The ESP8266 has 1MB of built-in flash, a single-chip device capable of connecting to WI-FI. Espress if systems are the manufacturers of this module and it is a 32-bit microcontroller. There are 16 GPIO pins in this module. This module follows the RISC processor. It has a 10-bit DAC. Later, Espress if systems released a software development kit (SDK) that is used for on-chip programming, so no additional microcontroller is used. Some of the SDKs are Node MCU, Arduino, Micro Python, Zerynth and Mongoose OS. SPI, I2C, I2S, UART are used for communication between two sensors or modules. The IOT gateway is briefly described in the Results section.

Figure 3: WI-FI




**c) pH Sensor:**

A pH is an electronic device which is used for measuring the pH level in the water. It consists ofthree types of probes **(i) Glass electrode (ii) Reference electrode (iii) combination of gelelectrode.** pH is described as the "negative logarithm" of hydrogenion concentration in water.

- pH=-log[H+]

A pH meter consists of special probes which are connected to an electronic meter thatwould display the reading. If the pH level is greater than 7 then it is alkaline in nature, if thepH level isless than7thenitisacidicin nature,andgenerallytherange ofpH is0-14pH.

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Figure 4: pH Sensor

Features:

- Operatingrange:0-14
- Operatingtemperature:0-45°$c$
- Operatingvoltage:-5to5 v
- Outputvoltage:analog

**d) CO2 Sensor:**

A Co2 sensor is a device that is used to measure carbon dioxide in water. This system uses SKU: SEN0219 to measure concentration, which is an analog infrared CO2 sensor. Parts per million (ppm) is the unit used to measure co2 concentration. One "ppm (parts per million)" equals 1 milligram of something per liter of water. The characteristics of this type of co2 sensors are low power consumption, high sensitivity, waterproof and anti-corrosion protection, temperature compensation and stability.

Figure 5: CO2 Sensor

Features:

- Operatingvoltage:4.5to5.5vDC
- Outputsignal:Analogoutput(4-20mA)
- Digitaloutput:-150mA
- Measuringrange:0-5000ppm

**e) Temperature Sensor:**

xThe sensor is an "integrated circuit sensor". The tensile stress is linearly proportional to the temperature in Celsius. "LM35" sensor is used in this project because user cannot convert Kelvin to Celsius temperature. It is not suitable for remote applications and directly measures in degrees Celsius. The temperature sensor is used in microwave ovens, refrigerators, household appliances and air conditioners. It measures not only heat, but also cold. There are two categories of sensors; they are "contact temperature sensor" and "non-contact temperature sensor". The contact temperature sensor is again divided into three types; they are electromechanical, resistance resistance temperature detectors and semiconductor LM35, DS1820, etc.

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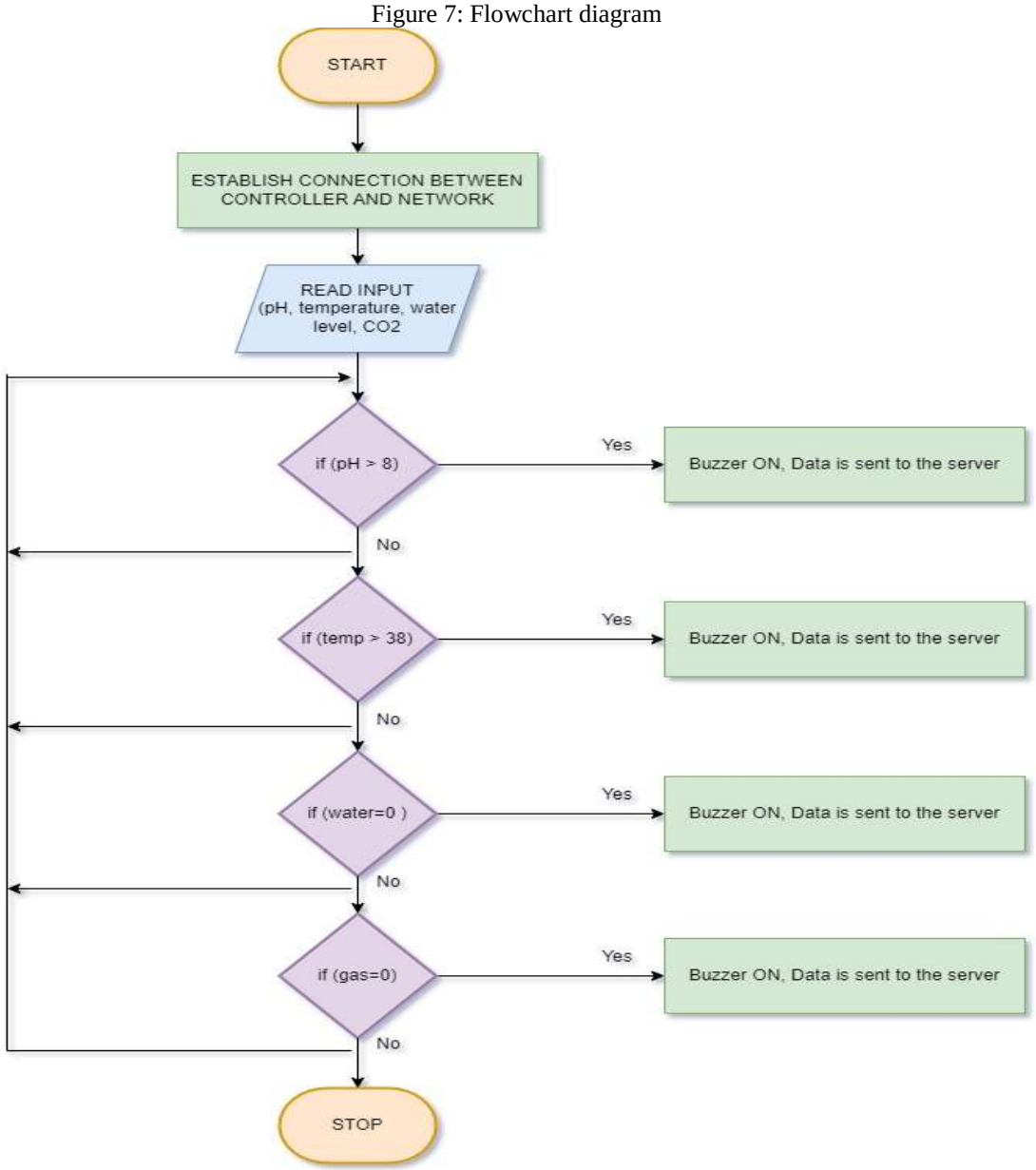
Figure 6: Temperature Sensor

## VI. FLOW CHART:

Figure 7: Flowchart diagram



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## VII. FORMULAS AND CALCULATIONS:

**pH Calculation:**

pH is a measure of the acidity or alkalinity of water. The formula to calculate pH is:

pH = -log10([H+])

Where [H+] is the concentration of hydrogen ions in the water.

**Dissolved Oxygen (DO) Calculation:**

Dissolved oxygen is important for aquatic life. The saturation concentration of DO depends on temperature and salinity. The formula for DO at saturation is:

DO (mg/L) = K * (P - 14.62) / (1 + 0.017 * (P - 14.62))

Where:

K is the solubility constant (mg/L per atm) at a given temperature and salinity.

P is the partial pressure of oxygen in the water.

**Turbidity Calculation:**

Turbidity measures the cloudiness or haziness of a fluid. It is typically measured in Nephelometric Turbidity Units (NTU).

The formula for turbidity measurement is complex and depends on the instrument used.

**Conductivity Calculation:**

Conductivity measures the ability of water to conduct an electrical current. The formula for electrical conductivity is:

Conductivity (µS/cm) = (Resistance (ohms) / Cell constant) * 10^6

Where the cell constant is specific to the conductivity sensor used.

**Temperature Measurement:**

Temperature is typically measured in degrees Celsius (°C) using a temperature sensor. No specific formula is needed for this parameter.

**Data Logging and Analysis:**

Data from the sensors is logged over time, and various statistical and analytical methods can be applied to assess water quality trends, detect anomalies, and trigger alerts if water quality parameters fall outside acceptable ranges.

These are just some of the common parameters and calculations involved in water quality monitoring. The specific formulas and sensors used can vary depending on the requirements of your monitoring system and the characteristics of the water body you are monitoring. Building a complete water quality monitoring system with IoT capabilities requires hardware, software development,
and integration skills.

## VIII. CHALLENGES AND CONSIDERATIONS:

- Sensor Accuracy: Ensuring the accuracy and reliability of sensors is crucial.
- Data Security: Protecting sensitive water quality data from unauthorized access is essential.
- Power Management: IoT devices in remote locations may require efficient power management solutions.
- Scalability: The system should be scalable to accommodate additional sensors or monitoring points as needed.
- Maintenance: Regular maintenance of sensors and equipment is necessary to ensure their proper functioning.
- Data Interoperability: Ensure that data from various sensors and sources can be integrated and analyzed effectively.

## IX. RESULT:

In this WQM framework, when the device board is switched ON, the devices get in to activated state and will discover the water parameters of individual sensors. Then, the composed data of water parameters are transmitted to the web server wirelesslyby using WI-FI module. The information is monitored frequently and presented in every action because the framework is set in a continuous mode. The information is refreshed for every 5 seconds. One hour is selected for the interval of sensing. It reduces power consumption.

Table 1: SensorDataAccessingintheWebthroughIoT

| S. No | S1 | S2 | S3 | S4 | Date |
|---|---|---|---|---|---|
| 301 | HIGH_PH | | | | 2023-04-08 13:07:45 |
| 302 | HIGH_TEMPERATURE | | | | 2023-04-08 13:07:17 |
| 303 | HIGH_PH | | | | 2023-04-08 13:06:49 |

| | | | | | |
|---|---|---|---|---|---|
| 304 | HIGH_TEMPERATURE | | | | 2023-04-08 13:06:20 |
| 305 | HIGH_PH | | | | 2023-04-08 13:05:52 |
| 306 | HIGH_TEMPERATURE | | | | 2023-04-08 13:05:54 |
| 307 | HIGH_PH | | | | 2023-04-08 12:57:12 |
| 308 | HIGH_PH | | | | 2023-04-08 12:56:18 |
| 309 | WATER_LOW | | | | 2023-04-08 12:55:52 |
| 310 | HIGH_PH | | | | 2023-04-08 12:55:25 |
| 311 | HIGH_PH | | | | 2023-04-08 12:54:54 |
| 312 | GAS_DETECTED | | | | 2023-04-08 12:54:12 |
| 313 | HIGH_PH | | | | 2023-04-08 12:54:45 |
| 314 | HIGH_PH | | | | 2023-04-08 12:51:08 |
| 315 | HIGH_PH | | | | 2023-04-08 12:50:55 |
| 316 | HIGH_PH | | | | 2023-04-08 12:47:32 |
| 317 | WATER_LOW | | | | 2023-04-08 12:47:02 |
| 318 | GAS_DETECTED | | | | 2023-04-08 12:44:48 |
| 319 | HIGH_PH | | | | 2023-04-08 12:44:11 |
| 320 | HIGH_PH | | | | 2023-04-08 12:43:46 |

## X. CONCLUSION:

By using a WI-FI module, the interfacing is done between transducers and the sensor network on a single chip solution wirelessly. For the monitoring process, the system is achieved with reliability and feasibility by verifying the four parameters ofwater.The time interval of monitoring might be changed depending upon thenecessity. Ecological environment of water resources is protected in this research. Thetimeisreduced, and the cost is low in this environmental management.

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