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IoT based Water Monitoring System

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Abstract: *An IOT gadget that will help analyze the water quality for various purposes that can be measured in real time. A low-cost system is proposed to monitor water quality using IOT. It includes several sensors for different parameters of the water sample. Temperature, pH, turbidity, and flow are some of the parameters that can be measured. These values from sensors can be further processed by a core controller, for instance Arduino. Finally, this data from the sensor can be viewed on internet through a WI-FI system. By embedding the devices in the environment for monitoring we can encourage a smart environment. This is implemented by collecting and analyzing the data received from the deployed devices. Through this we can bring the environment into real life i.e., using the data to make necessary decisions and bring about important changes for a a more sustainable future.*

Keywords: **MCU, Conductivity, pH sensors, Turbidity, Water Quality, Controller**

I. Introduction

In the past, water quality was determined manually by taking samples and sending them to labs for analysis. This method takes time, money, and human resources. water quality monitoring in real time faces challenges because of global warming limited water resources, growing population, etc. Therefore, we need to come up with better methods to monitor the water quality through various parameters in real time.

These methods do not deliver data instantly. The proposed water quality monitoring system, which consists of a microcontroller and simple sensors, is small and very useful for measuring the pH, turbidity, water level, temperature, and humidity of the surrounding environment. Continuous and real-time data are sent to the monitoring station via wireless technology.

II. Proposed Idea

Smart sensors network allows real-time measurement of water consumption and identifying excessive usage and wastage points as well as correct patterns for usage to reach sustainability and budgeting goals. Using data collected by various IoT sensors different points of water supply chain can get insights about the changing water resource conditions and equipment. One can thus take corrective measures for the same. Overall, they enhance the efficiency of industrial equipment like treatment plants, water collectors, distribution mains, and wastewater recycling centers.

The data parameters such as turbidity, temperature, pH and conductivity of a particular local body can be retrieved through these sensors in real-time on the application interface. The feature of Google Maps Interface can be efficiently used to find the most precise location of the water body. In this way, using low cost hardware and real-time data retrieval with user friendly interface makes this water monitoring system, the most efficient system model to get the data parameters within a friction of time. Main objectives focused on these studies are:

- To measure perilous quality metrics like physical, chemical, and microbial properties.
- To find the deviations in measured metrics and give timely warning in recognition threats or hazards.
- To provide real-time analysis of the sensor data and recommend appropriate corrective measures.
- To obtain quantitative information on the physical, chemical, and biological characteristics of water.
- Detection of drinking water standard violations to determination of the environmental state

III. Architecture

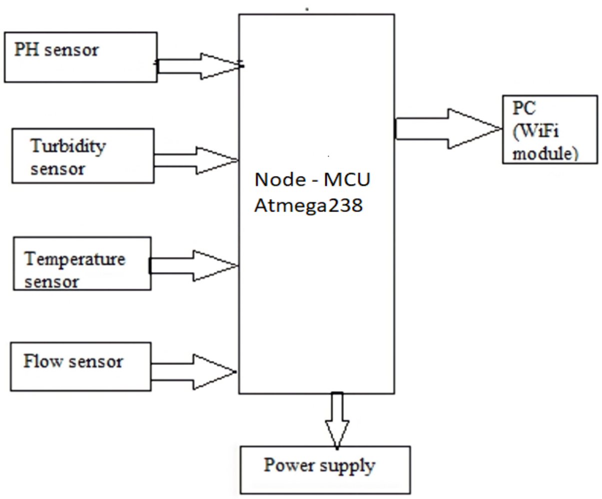

Figure 1. Basic Architecture of the Sensory System

1) Hardware

a) Sensors

pH sensor: A solution's pH serves as a gauge for its acidic or alkaline properties. The pH scale that is being used is a logarithmic scale with the neutral point being 7, and its range is 0 to 14. A basic or alkaline solution has a pH value over 7, while an acidic solution has a pH value below 7. It uses a 5V power supply and is simple to connect to an Arduino. pH levels should be between 6 and 8.5.

Turbidity sensor: It is a measure of the cloudiness present in water. It indicates the degree of loss of transparency of water. Turbidity is one of the important factors for defining the quality of water. It blocks out the sunlight that is needed by submerged aquatic vegetation. When sunlight strikes the colloidal particles near the surface of the water, the water temperature can be raised beyond the normal levels, hence harming the fauna present there.

Temperature sensor: Temperature of water can be determined with a temperature sensor. The DS18B20 temperature sensor has a range of -55 to +125 °C. This digital temperature sensor provides precise readings.

Flow sensor: It is mostly used to measure the water-flow going through the sensor. A Flow Sensor usually has a plastic valve body, a Hall Effect sensor and rotor. When water flows through the valve, the pinwheel rotates. The speed of this pinwheel will be directly proportional to the flow rate of the valve.

b) **Wi-Fi Module (NodeMCU):** NodeMCU is an open-source platform built on the ESP8266 that allows things to be connected and data to be transferred over wi-fi. The NodeMCU has a 4MB flash memory and an 80MHz clock speed. The NodeMCU has a WIFI connection and can access the internet through Wi-Fi. It functions best in IoT applications.

c) **Breadboard:** A solderless breadboard is used as an "electronic breadboard " (as opposed to the one used to makes sandwiches). They act as excellent prototyping and interim circuit building units the require no soldering. They can be used as an element for producing a prototype form that can be used to inspire or copy subsequent forms.

2) Software

a) When the registered user logs into the system using his credentials, he will be redirected to his User Profile, which will contain all his information such as his session timing, username, recent searches, etc. There will also be a Home Page where the user can avail the Google Maps feature for selecting his local water body. There will be a manual search or a location specific search engine option available to him.

b) When the user choses a specific location all the water bodies associated in that location will be highlighted with a red symbol or a specific symbol through which the user will have a precise choice to know data parameters about that local water body.

c) After selecting a particular local body, the data parameters such as turbidity, conductivity, pH and temperature will be known to the user, and will reflect the real time data into the system.

3) Algorithm

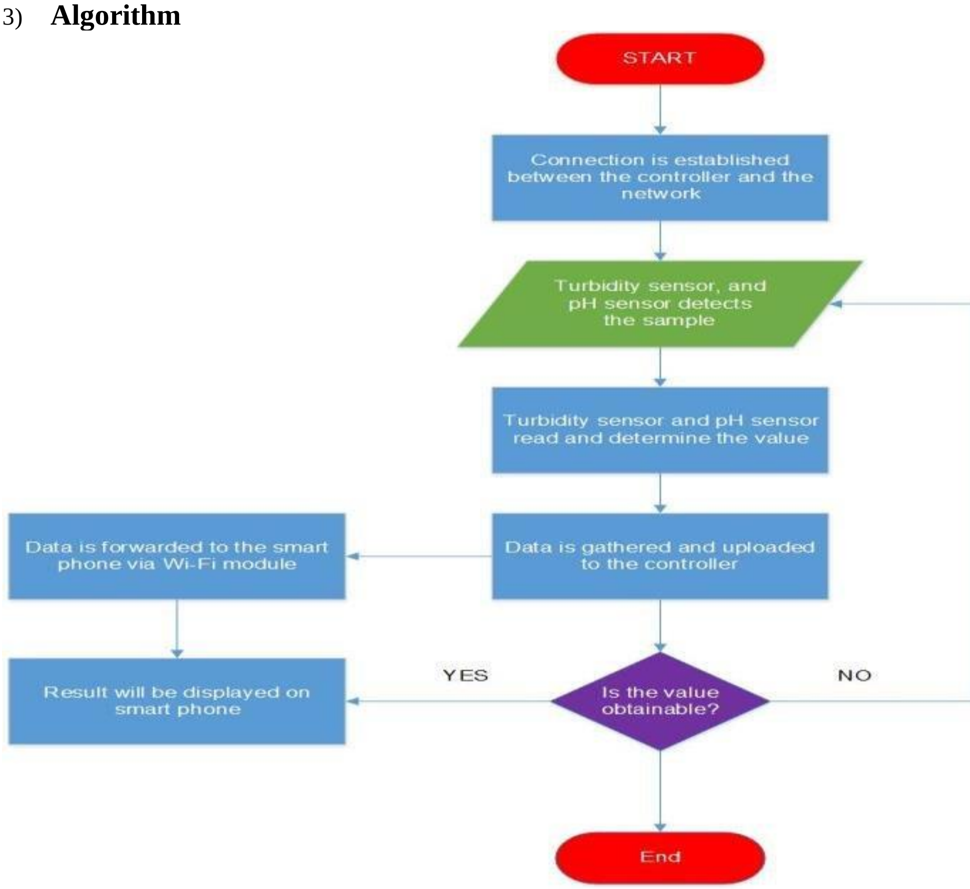

Figure 2. Algorithm for water monitoring

IV. Literature Review

Studies highlight various water quality monitoring methods, with efficient usage of available resources water quality and management can be improved drastically. From analysis of data, amount of memory allocated to functions interferes with deficiency minimally. Extensive case study using sensor network is made to perform level monitoring and shows the methods and ideas proposed.

Following are short summaries of some of the papers referred:

Table 1. Literature Survey on monitoring systems

Sr No.	Title	Author(s)	Description	Outcome
[1]	Internet of Water Things: A Remote Raw Water Monitoring and Control System.	Roberto Munoz, Maria De Los Angeles, Mohammad Mehedi Hassan.	This paper highlights the entire water quality monitoring methods, sensors, embedded design, and information dissipation procedure, role of government, network operator and villagers in ensuring proper information dissipation.	While automatically improving the water quality is not feasible at this point, efficient use of technology and economic practices can help improve water quality and awareness among people
[2]	IoT-Based Water Management Systems: Survey and Future Research Direction.	S. Ismail, D. W. Dawoud, N. Ismail, R. Marsh and A. S. Alshami.	In this paper, this work's primary goal is to develop a new online system to monitor and manage water resources, called Internet of Water Things (IoWT).	IoT, IoS, IoP and IoE can be considered as an element that can create a connection of the Smart City Initiative and Industry 4.0 – Industry 4.0 can be seen as a part of smart cities.
[3]	Connected Sensors, Innovative Sensor Deployment, and Intelligent Data Analysis for Online Water Quality Monitoring.	L. Manjakkal et al.	This paper holds an efficient energy management frame work to provide satisfactory QOI experience in IOT sensory environments is studied. The new concept of QOI-aware "sensor-to-task relevancy" to explicitly consider the sensing capabilities offered by an sensor to the IOT sensory environments, and QOI requirements required by a task. A novel concept of the "critical covering set" of any given task in selecting the sensors to service a task over time.	Extensive case study based on utilizing the sensor networks to perform water level monitoring is given to demonstrate the ideas and algorithms proposed in this paper, and a simulation is made to show the performance of the proposed algorithms.
[4]	A Complete Proposed Framework for	N. A. P. Rostam, N. H. A. H. Malim, R. Abdullah,	This paper presents the burst detection and localization scheme that combines lightweight	The approach not only significantly reduces the amount of communications

	Coastal Water Quality Monitoring System With Algae Predictive Model.	A. L. Ahmad, B. S. Ooi and D. J. C. Chan.	compression and anomaly detection with graph topology analytics for water distribution networks.	between sensor devices and the back end servers, but also can effectively localize water burst events by using the difference in the arrival times of the vibration variations detected at sensor locations.

V. Conclusion

This paper gives a thorough analysis of numerous research projects for developed and proposed IoT-based water management systems. Following a breakdown of the various applications connected to IoT-based water management systems by categorizing those systems into residential, industrial, and agricultural, it presents the overall architecture of smart water monitoring systems. This study examines the most recent research on the design of IoT-based water management systems as it relates to each application. It gives a thorough analysis of numerous research projects for developed and proposed IoT-based water management systems. Following a breakdown of the various applications connected to IoT-based water management systems by categorizing those systems into residential, industrial, and agricultural, it presents the overall architecture of smart water monitoring systems.

System can be used for both commercial and domestic purposes, for instance different water supply agencies and healthcare department for identification and spread of water diseases. Scope mainly covers evaluation, development, conservation, and control of water resources, planning and design of water resource systems; and operation, maintenance, and administration of water resource systems. Can be incorporated into smart irrigation as well as sensor-based leak detectors.

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