RESEARCH ARTICLE

SMART WATER MONITORING SYSTEM FOR REAL-TIME WATER QUALITY AND USAGE MONITORING

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Abstract:

The purpose of this work is to design a Smart Water Monitoring System (SWMS) for monitoring water quality and usage in real-time. An intelligent water quantity meter and an intelligent water quality meter make up this device. The Smart Water Quantity Meter was designed with the intention of promoting water conservation through the monitoring of residential water consumption and the subsequent notification of both the consumer and the authorities. Consumption bills are generated by a billing system based on the quantity consumed. By monitoring the five qualitative characteristics of water—pH, temperature, turbidity, dissolved oxygen, and conductivity—the Smart Water Quality meter verifies the purity of the water that is supplied to the customer. The system makes sure that any risks to public health or potential threats resulting from unintentional sewage seepage or agricultural discharge into the water container. These real-time cloud-based statistics are provided via an online monitoring system. The system generates an alert signal in the event that either the consumption limit or the water quality are violated, and the consumer and authority are promptly notified via SMS

Keywords — **SWMS, billing system, quality, usage, real-time monitoring, physical parameters**

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I. INTRODUCTION

Access to clean water and safe water is essential to the well being of communities, ecosystems, and the sustainability of our planet. In an era characterized by growing water scarcity and environmental challenges, ensuring the purity and availability of this vital resource is of paramount importance. The "Smart Water Monitoring System for Real-time Water Quality and Usage Monitoring" emerges as a pioneering solution designed to address these critical concerns by harnessing the power of advanced technology. Water quality and consumption are two key facets of water resource management, each playing a crucial role in shaping our world's health, environment, and future. The Smart Water

Monitoring System integrates data analytics with state-of the-art sensors., and real-time connectivity to offer a comprehensive and integrated solution for monitoring both water quality and usage. It is a transformative approach to ensuring that individuals, communities, and authorities have the tools needed to make informed decisions, optimize resource allocation, and protect public health. In this era of environmental uncertainty, water systems face multiple challenges, including pollution, contamination, climate change, and increased demand.The traditional methods of water quality and usage monitoring, often reliant on periodic sampling and manual data collection, are insufficient to address the rapid changes and risks that water sources face. This necessitates a more adaptive and real-time approach that empowers stakeholders with immediate insights and early warnings to respond effectively.

II. SYSTEM ARCHITECTURE

Fig shows the block diagram of the Smart Water Monitoring System for real-time water quality and usage monitoring.

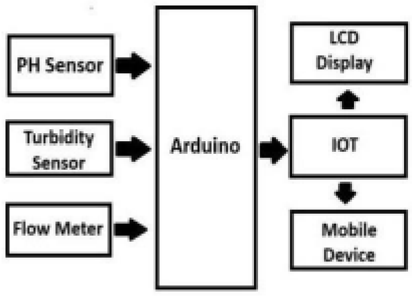

Fig-1 Block diagram of the Smart Water Monitoring System for real-time water quality and usage monitoring.

1. BLOCK DIAGRAM DESCRIPTION

A distinct user ID is issued and the system is installed at the user's home once the user submits an application for a new water supply connection. The household's water supply is turned on. The water's quality is examined at the house's entrance. The parameter readings are gathered by the Water Quality sensor and serially transmitted to the Arduino. The Arduino determines whether or not the water is portable and suitable for drinking according on 2 the usual quality factors. The water supply to the house is maintained if it is safe to drink. The three-slab system's foundation allows the water Consumption is monitored. Both the user and the authority keeping track of the amount of water used from the beginning of the month to that moment are notified when any limit is exceeded. The water flow keeps going until it reaches another barrier. The cycle is repeated for each of the three boundaries. The entire bill is created at the end of the month using the suggested three-slab technique. The readings are reset and the water supply for the following month starts after the bill is generated. A notification together with the physical parameter values of the water is delivered to the authorities and user in the event that the water is unfit for consumption. The water supply is cut off right away to avoid any unintentional ingestion of contaminated water, and the supply is shut off until the problem with the water quality is fixed.

2. ARDUINO UNO

A microcontroller board based on the ATmega328 is called the Arduino Uno. It features a 16 MHz ceramic resonator, 6 analog inputs, a 32k-byte in-system programmable flash, 14 digital I/O pins a USB port, a power jack, and a reset button. An open-source platform called Arduino is used to build and program circuits. Most gadgets can receive and send information from it, and it can even be used to control a particular electrical equipment via the internet. It makes use of a circuit board known as an Arduino Uno.. It comes with everything required to support the microcontroller; all you need to do is power it with a battery or an AC-to DC adapter or connect it to a computer via a USB cable to get going. "Uno" is an Italian word for one, and it was chosen to commemorate the impending introduction of Arduino 1.0. Going future the Arduino reference versions will be the Uno The most recent USB Arduino board is called the Uno.

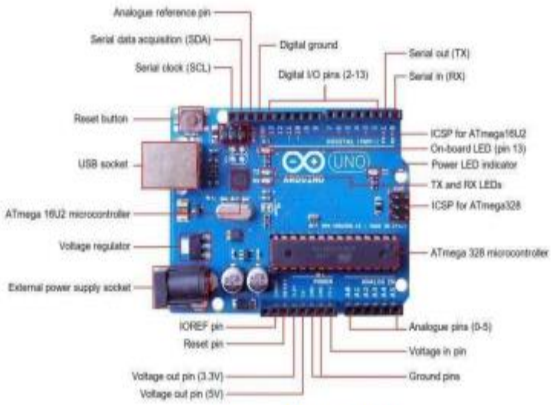

Fig -2: Arduino board

Table -1: Arduino board specifications

Input Voltage (recommended)	7- 12V
Input Voltage (limit)	6-20V
Digital I/O Pins	54 (of which 15 provide PWM output)
Operating Voltage	5V
Analog Input Pins	16
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32KB (ATmega328P)
SRAM	2 KB (ATmega338P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
Length	101.52 mm
Width	68.6 mm
Weight	25 g

3. Turbidity Sensor

An instrument called a turbidity sensor gauges how hazy or cloudy a liquid is when suspended particles like silt, sediment, or other pollutants are present. It is frequently used to measure water purity as part of water quality monitoring. Usually, the sensor detects the amount of scattered light by shining light through the liquid. More scattered light is produced by higher turbidity levels, which suggests that there are more particles in the water. Turbidity sensors are useful instruments for a number of industries, such as wastewater treatment, drinking water quality testing, and environmental monitoring

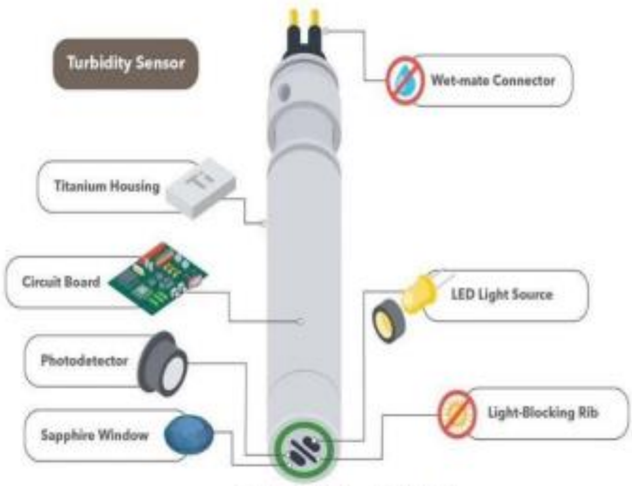

Fig – 3: Turbidity Sensor

4. PH Sensor

An instrument used to gauge a solution's acidity or alkalinity is called a pH sensor. It measures and expresses the concentration of hydrogen ions in the solution on a scale from 0 to 14, with 7 denoting neutrality (clean water). Alkalinity is indicated by a pH value above 7, whereas acidity is indicated by a value below 7. Usually, the sensor is made out of a glass electrode that senses changes in hydrogen ion concentration and produces a voltage proportionate to the solution's pH. In order to guarantee ideal circumstances for processes and reactions, pH sensors are extensively utilized in a variety of industries, including chemistry, biology, and environmental monitoring

Fig – 4 : PH Sensor

5. Flow Meter

A flow meter is a tool used to gauge how quickly liquid or gas moves through a conduit or pipe. It measures the displacement or movement of the fluid to determine the flow rate. To monitor and regulate the flow of substances in operations like manufacturing, water supply, and energy production, flow meters are essential in many different industries. There are various varieties of them, each with unique working principles, including as thermal, electromagnetic, ultrasonic, and mechanical. In many different applications, flow meters are essential for process optimization, efficiency, and accurate measurement maintenance.

Fig – 5: Flow Meter

III. FLOW CHART

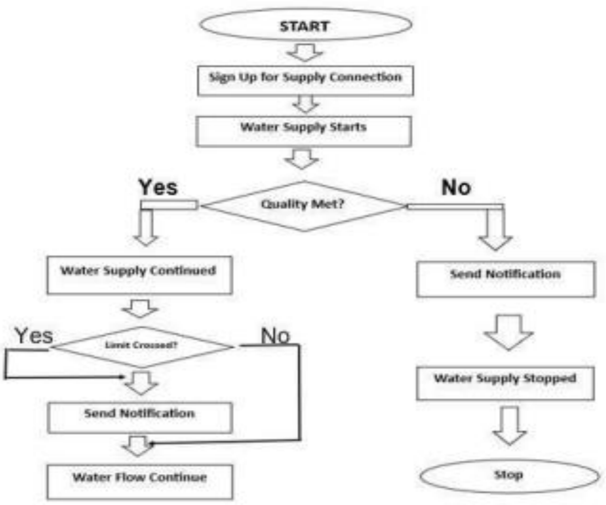

Fig 6: Flow Chart

IV. CONCLUSION

An important step forward in our joint efforts to guarantee the supply of clean and safe water is represented by the "smart Water Monitoring System for Real-time Water Quality and Usage Monitoring." This ground-breaking system uses technology to solve significant issues related to water quality and usage, providing a host of advantages for people, communities, and the environment This system equips stakeholders with the necessary tools to make well-informed decisions, maximize resource allocation, and safeguard public health by furnishing them with up-to-date data on water quality and usage. The benefits include lower operating costs environmental preservation, resource optimization, and early contamination identification. Furthermore, it is impossible to overstate how much the system can do to support sustainability objectives, build resilience in communities, and engage people. It serves as 4 the cornerstone of prudent water management. in a world when environmental issues and water scarcity are on the rise. The Smart Water Monitoring System will become even more important as it develops because it will guarantee that we have access to one of our most valuable resources, protect the environment, and advance community well -being. This cutting -edge technology is a proactive step toward a sustainable, safe, and universally available supply of clean water in the future.

V. References

[1] Taufik Ibnu Salim, Hilman S. Alam and Rian P. Pratama, Portable and online water quality monitoring system using wireless sensor network, 2nd International conference IEEE ICACOMIT 2017, Accession number: 17487078, January 2018.
[2] Arjun K, Latha C A, and Prithviraj, Detection of Water Level, Quality and Leakage using Raspberry Pi with Internet of Things, International Research Journal of Engineering and Technology (IRJET), Volume 04 Issue 06, June 2017, pp 2875 -2880.
[3] Shuang -Hua Yang, Xi Chen et.al., ”A case study of Internet of things: A wireless household water consumption monitoring system”, 2015 IEEE 2nd

World Forum on Internet of Things (WF -IoT), Accession Number: 15729217, December 2015

[4] Sajith Saseendran and V. Nithya, Automated Water Usage Monitoring System, 2016 IEEE International Conference on Communication and Signal Processing, April 6 -8, 2016.

[5]http:/www.groundwatertnpwd.org.in/wqlab2.htm

[6]https://bwssb.gov.in/content/prorata -and -water tariff

[7] Theofanis P. Lambrou, Christos C. Anastasiou, Christos G. Panayiotou, and Marios M. Polycarpou, A Low -Cost Sensor Network for Real -Time Monitoring and Contamination Detection in Drinking Water Distribution Systems, IEEE sensors journal, Volume 14, No. 8, August 2014, pp 2765 - 2772.

[8] Brinda Das and P.C. Jain, Real -Time Water Quality Monitoring System using Internet of Things, 2017 IEEE International Conference on Computer, Communications and Electronics (Comptelix), July 01 - 02, 2017.

[9] A. N. Prasad, K. A. Mamun and F. R. Islam, Smart water quality monitoring system, 2nd IEEE APWC on CSE 2015, Accession number: 16005040, May 2016.

[10] N.Suresh , E.Balaji , K.JeffryAnto , J.Jenith Sathyabama Raspberry pi based liquid flow monitoring and control Sathyabama University, Tamil Nadu, India, Volume: 03 Issue: 07 Jul -2014

