Towards Smart Water Quality Monitoring System for Urban Environment

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***Abstract*— The developing countries like India water is one of the most urgent concerns. In the current situation, people often place our healthcare in the hands of drinking water suppliers. Despite the fact that the water is purified and checked in central distribution stations, the manufacturer and people unaware the quality of water either in urban or rural areas.By focusing on the above problems, suggest a low-cost monitoring device that can use the Internet of Things to measure water quality such as pH (potential of Hydrogen) and conductivity in real-time. The water quality monitoring sensors detect the physical parameters that are needed. The microcontroller maps this value to the required water quality measure and stores it in a database through the Internet of Things. This allows providers to centralize routine water monitoring from various locations while still providing pure water to end users.**

Keywords—Water Quality, Sensors, IoT, Arduino UNO, cloud storage.

I. INTRODUCTION

Water contamination has become increasingly serious as the economy has grown and urbanization has increased [1]. Understanding the issues and patterns of water quality is also critical for water pollution reduction and regulation. Water covers 71% of the earth's surface and is essential for all known forms of life. Just 2% of this water is freshwater, and even then, only 0.036 percent is available. Due to the scarcity of water, it is important to make the best use of it by ensuring that all sources of water are pure. Water quality control is an important activity that ensures the water we drink meets the required standards. This involves measuring parameters including pH (potential of hydrogen), turbidity, hardness, and color, iron, and ammonia levels. Even though, in India, most of the population is depends on water pumps. The quality of the water changes from place to place i.e region to region. For example, most of the people living urban consume water from water plants situated in various parts of the city.

The physical, chemical, and biological parameters of water are used to assess its consistency. Water Quality Indices have been developed in order to provide an aggregate representation of water quality depending on all measurements [3]. As a result, it is important to assess water quality because it affects well-being. The current method of monitoring this issue in these supplies focuses on water collection, testing samples, and interpreting the results. [2]. Furthermore, emerging methodologies include measuring different types of consistency metrics. The conventional method of quality recognition is time-consuming, imprecise, and costly.

As a consequence, real-time monitoring of water and air quality parameters is needed indefinitely. In addition to the above problems, IoT is being used to build a low-cost monitoring device that can track air and water quality in real-time. Each computer is identified by a unique identifier and must be capable of capturing real-time data autonomously [4]. Sensors, processors, gateways, and software are the fundamental components of IoT. The parameters governing water quality The concentration of hydrogen ions is measured by pH. It indicates whether the water is acidic or alkaline. Pure water has a pH of 7, meaning it is acidic if it is less than 7pH and alkaline if it is greater than 7pH. The pH scale ranges from 0 to 14. For drinking, a pH should be between 6.5 and 8.5. Turbidity is an indicator of the amount of suspended molecules in water that are invisible to the human eye.

This work produces on testing the quality of water for different water plants in a region.. It includes a list of the necessary sensors as well as their specifications. The design and deployment of a rapidly deployable IoT network for surface water quality parameters is also defined.

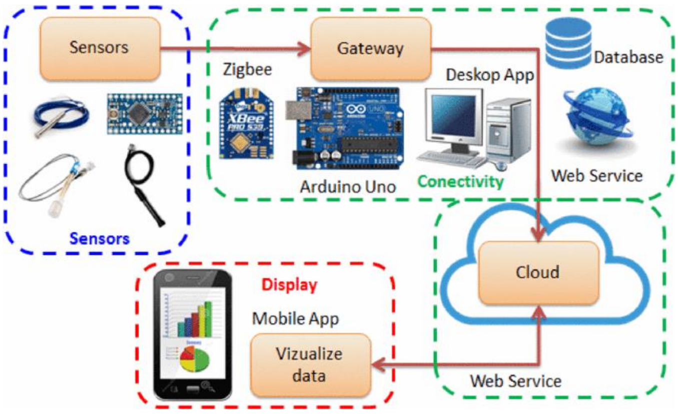

Fig1: General IoT Framework [12]

The rest of work structured as follows: Section II gives the state-of-the-art in this field, Section III focuses on the proposed smart water quality system, and Section IV describes the components and associated. In the end, section V gives the conclusion and future scope of this work.

II. LITERATURE SURVEY

In [5] implemented “IoT system for the monitoring of water quality in aquaculture”. The approach presented his work, tests water quality by using WSN and IoT. This knowledge is critical for the advancement of this field because it encourages multiple breeders and associations to share the various circumstances in the breeding of aquatic species. This knowledge helps determine the circumstances under which there is a better chance of success.

Jozsef Konyha[6] developed a "Grid-based wide-area water quality measurement system for surface water". The work is an essential component in the evaluation and conservation of water quality. Prototype of simple-to-implement technologies for measuring surface water quality metrics (e.g., rivers, lakes). The sensor-compact tube's configuration allows the equipment to measure from 1 to 7 indicators. The communication method of WAMS i.e wide are measurement system.

One of the author in [6] addressed the issue of the traditional spastically approach used in water quality measurement having a poor performance. This work is implemented as a novel type of water quality measurement for remote places with the help of WSN.

Another in [7] addressed "Reconfigurable Smart Water Quality Monitoring System in IoT Environment". In their work, they propose a smart sensor controller device that can be reconfigured for use with an IoT water quality monitoring framework setting. A FPGA architecture board, sensors, a ZigBee-based wireless networking module comprise the smart WQM system (PC). The proposed system's central component is the FPGA board, which is configured in very high speed integrator mode. Here, WQM system collects five parameters of water data in tandem and in real-time from multiple different sensors..

In paper [8,9,10,11] suggested simplified approach i.e connecting sensors to every taps and continuously monitor the water quality with help of RF module and IoT. Another demonstrated the water quality system using WSN for domestic purpose. One more performed the testing of water in laboratory and measure the parameters and developed smart system.An investigated four such factors that area unit pH scale, oxidisation and reduction potential (orp), physical phenomenon, and temperature employing a Remote Sensing (RS) technology solely by causation information just in case the values area unit simply a warning."

III. METHODOLOGY

The proposed approach is used to solve the shortcomings of the current method. In this case, we're using Arduino UNO board as the central controller and a variety of sensors to track the water quality. Figure 1 depicts the block diagram of our structure. These boards consist of microcontroller and also a facility to connect various sensors for monitor the water plant. In this experiment, various Raspberry Pi sensors are connected to track the water's conditions. The Raspberry Pi can read data from various sensors and then process it. ThingSpeak App can be used to display sensor data in the cloud.

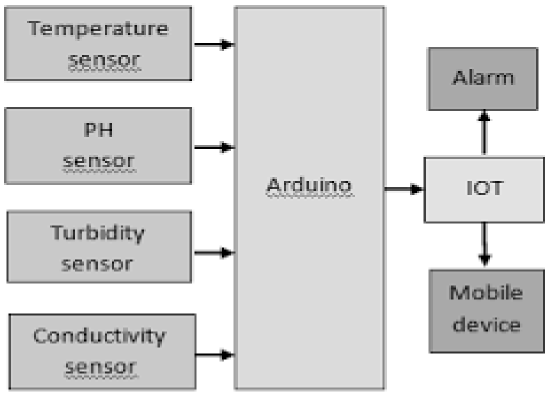

Fig2: IoT for Real time Scenario

As shown in Fig. 1, the above framework describes a smart and robust water quality monitoring system for an urban-friendly environment using the Internet of Things (IoT).

Task1: To measure water quality of different RO water plants, first, to know that which parameters measure from the water to monitor the quality of different water-plant in around region.

Task2: In this task, data sensed by the sensor is sent to the microcontroller unit which resides on the Arduino UNO board.

Task3: Most of the sensor data are analog and it will send to the ADC inboard for sending the digital data as packets to the cloud storage devices like ThingSpeak.

Task4: By using this framework, all users can easily track the water quality of specific sources and improve their healthy life.

IV. EXPERIMENTAL ANALYSIS

The following modules are used in this experiment to assess the consistency of water from various water plants.

1. **Arduino UNO:**"The Arduino Uno is a microcontroller board that is based on the 8-bit ATmega328P microcontroller. It includes other components to support the microcontroller, such as a crystal oscillator, serial communication, a voltage regulator, and so on, in addition to the ATmega328P. The Arduino Uno has 14 digital I/O pins (of which 6 can be used as PWM outputs), 6 analog I/O pins, a USB connection, a power barrel jack, and an ICSP header"[18].

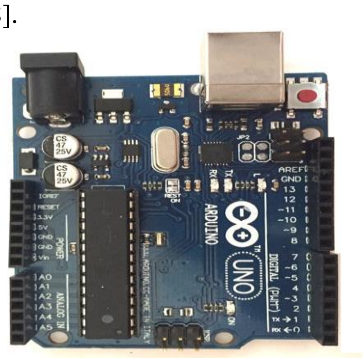

Fig3: Arduino UNO

2. pH Sensor: This sensor(Model: SKU: SEN0161) detects pH value of water. The range of scale is 0 to 14 and varies from different water sources.The

concentration of hydrogen [H] + ions in a solution is represented by its pH. It can be accurately measured using a sensor that detects the potential difference between two electrodes: a reference electrode (silver/silver chloride) and a glass electrode susceptible to hydrogen ion.

Fig4: pH Sensor

3. TDS Sensor: The volume of soluble solids dissolved in one litre of water is referred to as TDS (Total Dissolved Solids). The higher the TDS content, the more soluble solids dissolved in water, and the less pure the water. As a result,with refernce as water, the TDS value describes the TDS value which can be used in this analysis.

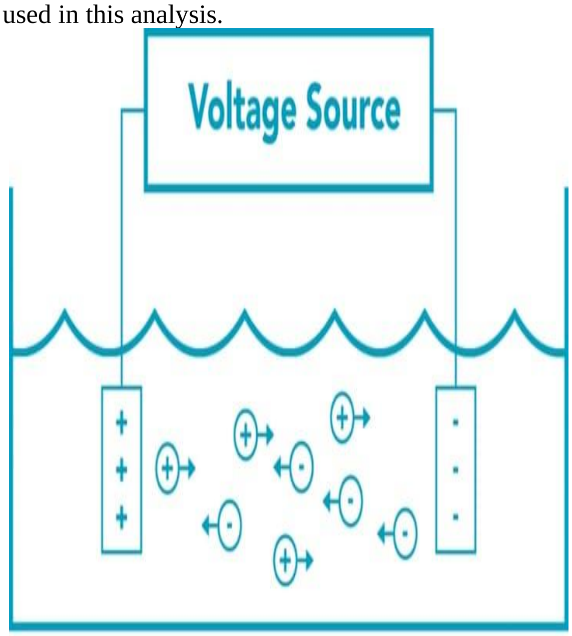

Fig5: TDS Sensor Flow

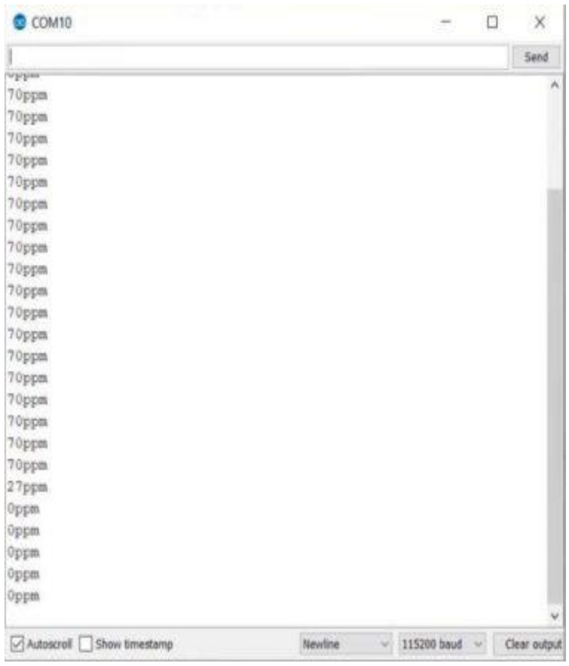

Fig6: TDS values displayed on Serial Monitor

4. Wifi module: This module contains SOC with TCP/IP protocol will provide the connectivity with microcontroller with WIFI network. “The ESP8266 will host an application or offload all Wi-Fi networking functions from another application processor. Each ESP8266 module includes an AT command set firmware pre-programmed. The ESP8266 board is relatively inexpensive”[17].
5. SCHEMATIC CIRCUIT

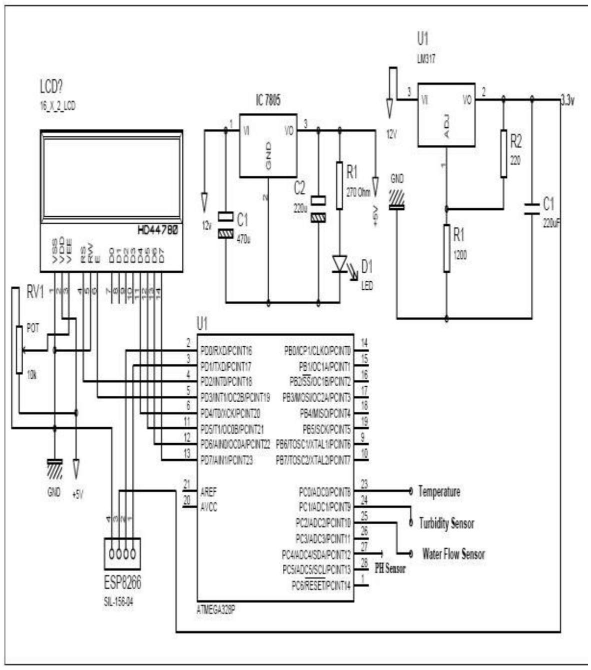

Fig 7: Schematic Circuit

6. Flow Chart

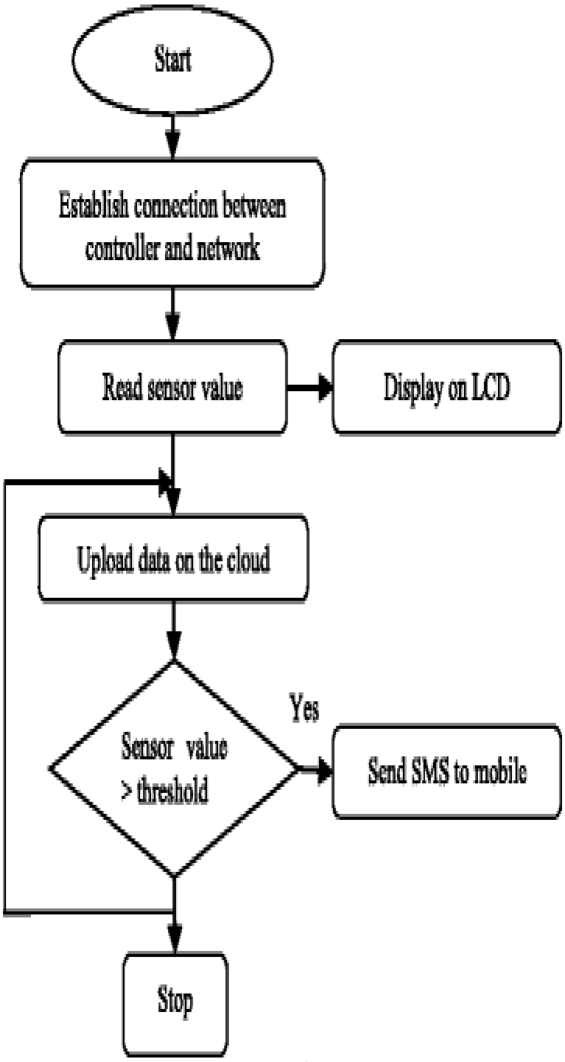

Fig8: Flow chart for Framework

A suitable implementation model is made up of different sensor devices and other elements, the functionalities of which are depicted in the diagram. The embedded computer is connected to the internet with an ADC and a Wi-Fi module. Sensors are linked to the Arduino UNO board for tracking, and the ADC can translate the corresponding sensor reading to its digital value. After collecting data from various sensor devices mounted in a specific area of interest. When a secure connection is established with the server computer, the sensed data is automatically sent to the web server. The data stored in Cloud Storage model like ThingSpeak and analysis the parameters using different plotting variants.

V. CONCLUSION AND FUTURE SCOPE

Finally, implemented smart water quality measurements for local water-plants and data from sensors was collected and stored in a cloud computing model similar to Thing Speak. Water level, pH level, turbidity, salinity, and other measuring criteria included in various water treatment schemes proposed in the literature have also been established. By using this data analyze the quality based on different parameters. Water quality in the delivery system is a significant issue that has an effect on public health, and smart water systems have a user-friendly platform for monitoring water quality in homes and taking corrective measures as required. To extend this work, the analytical device is embedded and validated in real-world environments using an Internet of Things computing interface. The developed systems best suited for quality of water monitoring system and gives healthier life to urban people.

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