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IoT Based Water Quality Management System using ESP32

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Abstract: *Water pollution is one of the biggest fears for the green globalization. In order to ensure the safe supply of the drinking water the quality needs to be monitor in real time. In this paper we present a design and development of a low cost system for real time monitoring of the water quality in IOT(internet of things).The system consist of several sensors is used to measuring physical and chemical parameters of the water. The parameters such as temperature, PH, turbidity of the water can be measured. The measured values from the sensors can be processed by the core controller. The Arduino model can be used as a core controller. Finally, the sensor data can be viewed on internet using WI-FI system.*
The objective of this water quality monitoring system using internet of things is to find the quality of the water i.e. how the pH content varies and sending message to the corresponding authorities. We are going to implement this project at municipal water tanks and drinking water reservoir. For that we are using an Arduino board for finding pH value and GSM module for message technique. We use a led display to have continuous observation on water parameters. Finally the user gets message of pH value of water Further we extend this project by sending the sensor data to cloud for global monitoring of water quality.

Keywords: Water pollution

I. INTRODUCTION

According to the World Health Organization (WHO), 368 million people use unprotected well sand springs and 122 million people gather untreated surface water from lakes, ponds, rivers,and streams. This means in 2020, approximately 2 billion people were without access to safe water. Cholera, diarrhoea, dysentery, Hepatitis, typhoid, and polio are just a few of the diseases that can spread as a result of contaminated water and inadequate sanitation. People are exposedto avoidable health risks when water and sanitation infrastructure is inadequate, poorly maintained, or managed improperly. Poor income, technological advancements, internal community management, water contamination from agricultural chemicals, industries, and waste disposal all contribute to rural villagers limited access to clean drinking water. Since2000, more than 50% more city dwellers lack access to safely regulated drinking water. TDS and Turbidity are one the major qualities of water, as the drinking water should have a proper amount of TDS and turbidity in it[1].
In rural areas, the water quality of wells and ponds is assessed using two crucial parameters: pH and turbidity. The effectiveness of water treatment procedures, the taste and odour of drinking water, the corrosion of infrastructure, and the health and survival of aquatic species can all be impacted by the pH of water, which is a crucial parameter. Turbidity is a unit used to describe how cloudy or hazy a liquid, results suspended particles. Turbidity is a crucial metric that tells us about the transparency of the water. Turbidity can change the physical, chemical, and biological properties of water. The presence of suspended particles like silt, clay, andorganic matter can cause a variety of issues, including high levels of turbidity in water. A solution's acidity or alkalinity can be determined by its pH value, which ranges from 0 to 14,pH readings below 7 signifies acidity while above this value signifies alkalinity whereas pH 7is regarded as neutral. To guarantee that the water is safe and fit for use in rural regions where wells and ponds are frequently used as sources of drinking water, it is crucial to routinely test the pH and turbidity of the water. Indicators of the presence of pollutants or other contaminants in the water, which may have detrimental effects on both human health and the ecosystem, include high levels of turbidity or low or high pH. Frequent monitoring of these characteristics can aid in spotting possible issues before they become serious and enable the proper measures to be done

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to safeguard the water supplies in rural regions.A high TDS level in water can be an indication of dangerous pollutants or heavy metals, which can have an adverse effect on both human health and the environment.

II. LITERATURE SURVEY

A. Nikhil Kedia entitled "Water Quality Monitoring for Rural Areas-A Sensor Cloud Based Economical Project." Published in 2015 1st International Conference on Next Generation Computing Technologies (NGCT-2015) Dehradun, India. 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. It also explores the Sensor Cloud domain. 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.

B. Jayti Bhatt, Jignesh Patoliya, Iot Based Water Quality Monitoring System, IRFIC, 21 feb,2016. Jayti Bhatt, Jignesh Patoliya entitled "Real Time Water Quality Monitoring System". This paper describes to ensure the safe supply of drinking water the quality should be monitored in real time for that purpose new approach IOT (Internet of Things) based water quality monitoring has been proposed. In this paper, we present the design of IOT based water quality monitoring system that monitor the quality of water in real time. This system consists some sensors which measure the water quality parameter such as pH, turbidity, conductivity, dissolved oxygen, temperature. The measured values from the sensors are processed by microcontroller and this processed values are transmitted remotely to the core controller that is raspberry pi using Zigbee protocol. Finally, sensors data can view on internet browser application using cloud computing[4].

Internet of Things (IoT)

IoT stands for Internet of Things. It refers to the interconnectedness of physical devices, such as appliances and vehicles, that are embedded with software, sensors, and connectivity which enables these objects to connect and exchange data. This technology allows for the collection and sharing of data from a vast network of devices, creating opportunities for more efficient and automated systems. Internet of Things (IoT) is the networking of physical objects that contain electronics embedded within their architecture in order to communicate and sense interactions amongst each other or with respect to the external environment. In the upcoming years, IoT-based technology will offer advanced levels of services and practically change the way people lead their daily lives. Advancements in medicine, power, gene therapies, agriculture, smart cities, and smart homes are just a few of the categorical examples where IoT is strongly established. IOT is a system of interrelated things, computing devices, mechanical and digital machines, objects, animals, or people that are provided with unique identifiers. And the ability to transfer the data over a network requiring human-to-human or human-to-computer interaction.

Existing system

The existing systems of water quality management encompass a variety of methods and technologies designed to monitor, control, and improve the quality of water in both natural bodies of water and water distribution systems. Here's a broad overview of the key components typically involved:

- **Regulatory Frameworks**: National and international regulations play a crucial role in water quality management. These include standards and guidelines for allowable levels of pollutants, requirements for regular monitoring, and actions to be taken in case of non-compliance.
- **Monitoring and Testing**: Regular monitoring of water sources (like rivers, lakes, and groundwater) and water distribution systems is essential. This involves collecting water samples and testing them for various contaminants such as biological organisms, chemical compounds, and physical characteristics. Technologies such as remote sensing, in-situ sensors, and laboratory-based analyses are commonly used.
- **Water Treatment**: Water treatment facilities are critical for ensuring that water meets safety standards before it is distributed for public use or returned to the environment. Treatment methods can vary greatly depending on the source and intended use of water but generally include physical, chemical, and biological processes to remove contaminants.

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- **Source Protection**: Protecting water sources from contamination is a proactive approach to water quality management. This involves preserving watersheds, regulating industrial discharges, managing agricultural runoff, and preventing pollution through policy and community engagement.
- **Data Management and Technology**: Advanced technologies such as Geographic Information Systems (GIS), real-time data monitoring systems, and decision support tools are increasingly used to manage water quality. These technologies help in mapping, analyzing, and reporting data efficiently

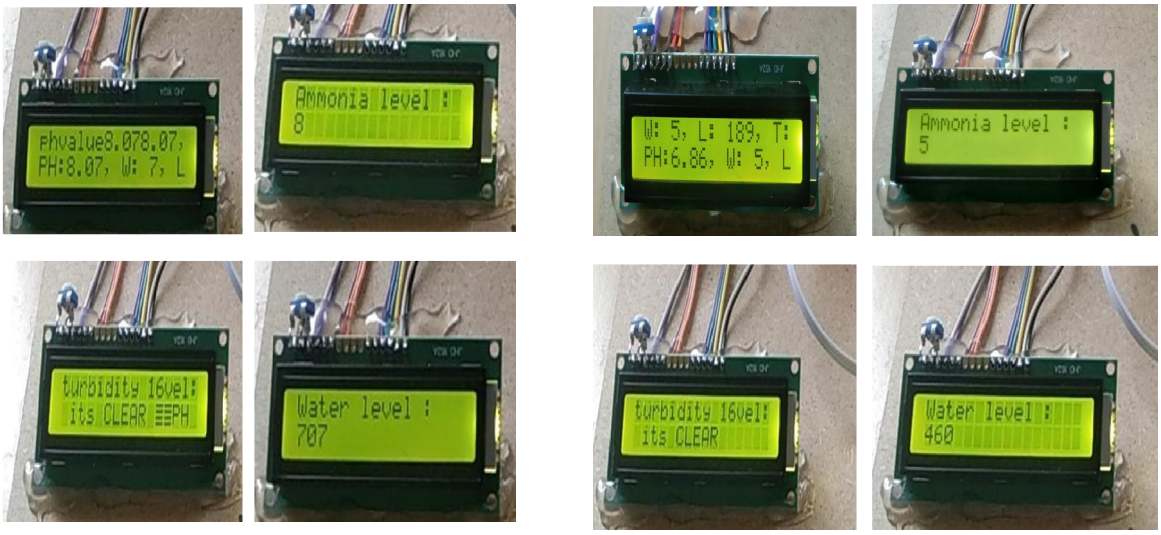
III. SOFTWARE USED

IoT software addresses its key areas of networking and action through platforms, embedded systems, partner systems, and middleware. These individual and master applications are responsible for data collection, device integration, real-time analytics, and application and process extension within the IoT network. They exploit integration with critical business systems (e.g., ordering systems, robotics, scheduling, and more) in the execution of related tasks. IoT systems allow users to achieve deeper automation, analysis, and integration within a system. They improve the reach of these areas and their accuracy. IoT utilizes existing and emerging technology for sensing, networking, and robotics. IoT exploits recent advances in software, falling hardware prices, and modern attitudes towards technology. Its new and advanced elements bring major changes in the delivery of products, goods, and services; and the social, economic, and political impact of those changes.

Data Collection: This software manages sensing, measurements, light data filtering, light data security, and aggregation of data. It uses certain protocols to aid sensors in connecting with real-time, machine-to-machine networks. Then it collects data from multiple devices and distributes it in accordance with settings. It also works in reverse by distributing data over devices. The system eventually transmits all collected data to a central server.

Software supporting integration binds (dependent relationships) all system devices to create the body of the IoT system. It ensures the necessary cooperation and stable networking between devices. These applications are the defining software technology of the IoT network because without them, it is not an IoT system. They manage the various applications, protocols, and limitations of each device to allow communication.

IV. RESULTS



Test results of outside water

Test results of drinking water

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Test results of mud water

V. CONCLUSION

IoT in water quality monitoring has definitely arrived, and it is only going to become more prevalent in the years to come. Due to the benefits that it offers, IoT can be used to improve water quality monitoring in communities and businesses. IoT offers a number of advantages when it comes to water quality monitoring. It can help to provide real-time data about water conditions. This is valuable information that can be used to make decisions about how to best manage water resources. IoT in water quality monitoring can help improve water quality in a number of ways. For example, IoT can be used to monitor water quality in real-time, which can help identify potential problems early on. Additionally, IoT can be used to track long-term trends in water quality, which can help identify larger problems that need to be addressed. Finally, IoT can be used to automatically collect data from a variety of sources, which can help provide a more complete picture of water quality.

There are a number of challenges that need to be addressed before IoT can truly revolutionize water quality monitoring. For example, the accuracy of sensors needs to be improved, and data needs to be properly standardized. Additionally, the costs associated with implementing IoT solutions need to be reduced. However, there is no doubt that IoT has the potential to transform water quality monitoring for the better[6].

The potential benefit of using IoT systems for measuring and monitoring water quality can be building social awareness of what IoT really is and investigating what the water quality is and what it really consists of. The term water quality itself is associated with many components that, thanks to IoT systems, can be measured in real time and observed by a larger group of recipients including people not technically related to both concepts.

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