AUTOMATIC CHLORINATOR FOR WATER STROGE RESERVOIR USING IOT

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Abstract

This abstract presents an innovative IoT-based solution for ensuring the safe and efficient addition of chlorine in water storage tanks, mitigating potential harmful effects associated with manual handling. The system employs ultrasonic sensors to continuously monitor the water level in the storage tank and utilizes this real-time data to intelligently control the chlorine dispensing process. The existing challenge of manually adding chlorine in fixed quantities, which can lead to over-chlorination or under chlorination, is addressed through this automated approach. The proposed system offers several advantages over conventional methods. Firstly, it eliminates the guesswork and potential errors associated with manual chlorine addition by adapting the dosage based on the actual water volume in the tank. Secondly, it ensures consistent water disinfection levels, reducing the risk of microbial contamination and the formation of harmful byproducts. Thirdly, it optimizes chlorine usage, leading to cost savings and environmental benefits. Key components of the IoT-based system include ultrasonic sensors for water level measurement, a control unit for data processing and decision-making, and a chlorine dispenser integrated with actuators. These components work in harmony to maintain an appropriate chlorine concentration in the water tank, safeguarding both water quality and public health. Furthermore, the system is designed with remote monitoring and control capabilities, allowing operators to access real-time data and make adjustments remotely. This feature enhances system management efficiency and responsiveness, reducing the need for on-site personnel involvement

Keywords: water tank, chlorination, chlorine dispenser

INTRODUCTION

An innovative IoT-based solution for ensuring the safe and efficient addition of chlorine in water storage tanks, mitigating potential harmful effects associated with manual handling. The system employs ultrasonic sensors to continuously monitor the water level in the storage tank and utilizes this real-time data to intelligently control the chlorine dispensing process. The existing challenge of manually adding chlorine in fixed quantities, which can lead to over-chlorination or under-chlorination, is addressed through this automated approach. The proposed system offers several advantages over conventional methods. Firstly, it eliminates the guesswork and potential errors associated with manual chlorine addition by adapting the dosage based on the actual water volume in the tank. Secondly, it ensures consistent water disinfection levels, reducing the risk of microbial contamination and the formation of harmful byproducts. Thirdly, it optimizes chlorine usage, leading to cost savings and environmental benefits. Key components of the IoT based system include ultrasonic sensors for water level measurement, a control unit for data processing and decision-making, and a chlorine dispenser integrated with actuators. These components work in harmony to maintain an appropriate chlorine concentration in the water tank, safeguarding both water quality and public health.

Furthermore, the system is designed with remote monitoring and control capabilities, allowing operators to access real-time data and make adjustments remotely. This feature enhances system management efficiency and responsiveness, reducing the need for on-site personnel involvement.

LITURATURE SURVEY

Gaetan Herold, ”Enhancing Water Safety in Decentralized Water Reuse Systems With Low-Cost Prussian Blue Amperometric Sensors for Free Chlorine Monitoring,”[1] 2023 - This paper examines The challenge of providing sustainable and safe water services in regions lacking centralized water infrastructure can be addressed through the utilization of on-site treatment and reuse of wastewater. However, the widespread implementation of decentralized water reuse systems is currently hindered by the considerable expenses associated with remote water quality monitoring. Specifically, when using chlorination for treatment, the fabrication and maintenance costs of free chlorine sensors pose significant drawbacks to their implementation. In this letter, we present an alternative solution by mitigating the sensor cost through the utilization of electrochemical sensing coupled with a cleanroom-free sensor fabrication process. We meticulously optimized the electrodeposition process to enhance sensor stability and ensure reproducibility, achieved through precise control of reactant concentrations.

Kunpot Mopoung, ”A Real-Time Free Chlorine Monitoring by Graphene Field-Effect Transistor,”[2] 2019 ˆa TWe have fabricated a real-time graphene field effect transistor (GFET) for monitoring free chlorine concentration. A monolayer graphene was grown by low-pressure chemical vapor deposition.

Xinnan Cai, ”A comparative study of machine vision-based rail foreign object intrusion detection models,”[3] 2023 - Due to the lack of track foreign body intrusion dataset, classical target detection models are rarely used in the field of foreign body intrusion on railway tracks, and model comparison experiments are also insufficient. Aiming at these problems, this paper makes a comparative study on the application of yolov5 and fast RCNN in railway foreign object intrusion detection. First, the train and test dataset was established by image preprocessing, data cleaning and data labeling of UAV aerial images. Second, the canny edge detection algorithm combined with Hough transform was used to extract the track features for delineating the detection area. Finally, Yolov5 and fast RCNN, two widely used models, were used to train and test respectively based on our dataset for comparative studies. Experiment results show that YOLOv5 has better comprehensive performance in detection rate and detection speed, and Faster RCNN model cannot meet the requirements of real-time detection of track foreign objects intrusion.

Summer Dalgamouni, ”Developing a Gold coated Fiber Brag Grating (FBG) sensor to monitor chlorine levels in water,”[4] 2022 - This paper Monitoring chlorine levels in water are crucial to prevent health risks in humans. This study investigated designing a sensitive FBG sensor to measure chlorine levels in water in ppm. The overall sensing mechanism provides advantages like; small features, high resolution, and sensing along the whole fiber length.

AIM & OBJECTIVES

1. Safety and Efficiency: The primary objective is to ensure the safe addition of chlorine to water storage tanks while mitigating potential harmful effects associated with manual handling. This is achieved through the use of automation and real-time monitoring.

2. Real-time Monitoring and Control: The system aims to continuously monitor the water level in the storage tank using ultrasonic sensors and use this real-time data to intelligently control the chlorine dispensing process.

3. Overcoming Manual Challenges: The system addresses the challenge of manually adding chlorine in fixed quantities, which can lead to over-chlorination or under-chlorination, by automating the process.

4. Eliminating Guesswork and Errors: The system seeks to eliminate guesswork and potential errors associated with manual chlorine addition by adapting the dosage based on the actual water volume in the tank.

5. Consistent Water Disinfection: The objective is to ensure consistent water disinfection levels, reducing the risk of microbial contamination and the formation of harmful byproducts.

6. Cost Savings and Environmental Benefits: The system aims to optimize chlorine usage, leading to cost savings and environmental benefits by reducing excess chlorine usage.

7. Key Components: The content highlights the key components of the IoT-based system, including ultrasonic sensors, a control unit, and a chlorine dispenser integrated with actuators, which work together to maintain an appropriate chlorine concentration in the water tank.

MOTIVATION

The motivation behind the innovative IoT-based solution for chlorine addition in water storage tanks is rooted in the urgent need to enhance public safety, water quality, and operational efficiency. Manual handling of chlorine poses significant risks to both human operators and the environment, and inaccuracies in dosing can lead to waterborne diseases or harmful byproducts. This system addresses these concerns by automating chlorine dosage based on real-time water volume data, ensuring consistent disinfection levels while minimizing costs and environmental impact. Furthermore, the integration of remote monitoring and control capabilities adds a layer of efficiency, reducing the need for onsite personnel involvement and enabling timely adjustments to maintain water quality and public health standards. This project is fundamentally motivated by a commitment to safeguarding water resources and public well-being through cutting-edge technology and sustainable practices

APPLICATION:

- Municipal Water Treatment: The system can be applied in municipal water treatment facilities to ensure safe and consistent drinking water for communities.
- Industrial Water Management: Industrial facilities that require precise control of water quality, such as manufacturing or food processing, can benefit from this technology.
- Agriculture: Agricultural operations, such as crop irrigation and livestock management, can use the system to maintain water quality for optimal yields and animal health.sHealthcare Industry

SYSTEM ARCHITECTURE

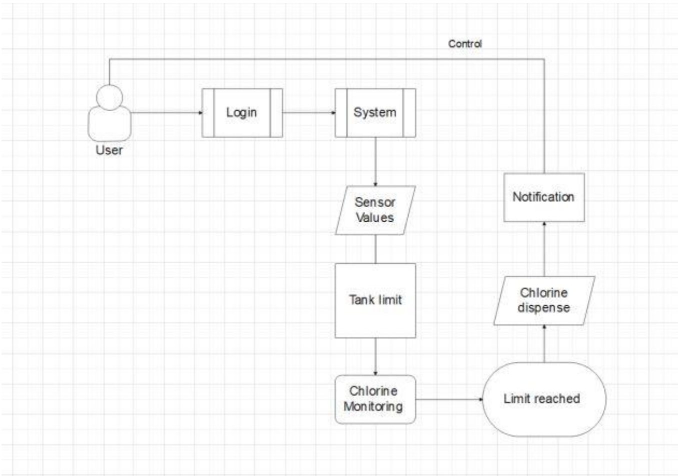

Fig -1: System Architecture Diagram

ADVANTAGES

- Improved Water Quality: The system ensures consistent and precise chlorine dosing, reducing the risk of waterborne diseases and improving water quality for consumption. Enhanced Public Health: By preventing over-chlorination or under-chlorination, the project safeguards public health and minimizes health risks associated with improper disinfection.
- Cost Savings: Optimizing chlorine usage leads to cost savings for water treatment facilities by reducing the amount of chlorine required, resulting in economic benefits.

FUNCTIONAL & NON-FUNCTIONAL REQUIREMENTS

Functional Requirement:

System Feature:

1**. Water Level Monitoring:**

The system must continuously monitor the water level in the storage tank using ultrasonic sensors to provide real-time data.

2**. Chlorine Dosing Control:**

The system should intelligently control the chlorine dosing process based on the actual water volume in the tank to ensure precise disinfection

3. Dosing Adjustments:

Operators and remote monitoring technicians must be able to adjust the chlorine dosing parameters, such as dosage rate and frequency, to accommodate varying water demand and quality requirements'.

4. Remote Monitoring:

It should provide remote access to real-time data and control functionalities, allowing operators to monitor and adjust the system remotely, and enhancing operational efficiency.

Nonfunctional Requirements

Security:

1. All sensitive data stored in the various components of the system must be encrypted before they are stored.

2. The system must be able to use facility of qualified electronic signature of all documents uploaded in the system.

3. System must support appropriate security controls, including user roles with predefined access rights which control the data and functionality each user has access to..

Auditability

1. For critical system events (e.g. tender bid submission, auction bid submission, etc.), System must support methods with which the sender of data can be provided with evidence of delivery. Such evidence will be implemented by means of e-Mail

2. System must be able to audit all system and user actions. System should ensure that all actions performed on received/stored data are recorded, keeping track of actors, date/time, input/output data and any other information necessary to allow specialized personnel to monitor and fully reconstruct a transaction.

Extendibility:

1. System must be built in a modular approach that will allow the addition of new functional modules without impacting the overall system functionality. The need

for this SW type of architecture is to allow the development of the system by different SW vendors, to avoid possible lock-downs or delays in system implementation and deployment cycle.

2. System must be based in an architecture that will allow the addition of extra HW resources to enhance the systems capabilities (e.g. performance, storage, bandwidth, etc.).

Portability:

1. System must be designed in a manner that will not be coupled to any hardware specific technologies.

2. System must be possible to be deployed on different HW and SW infrastructures and not dependent on the software technology used for implementation. However

Performance:

System must follow state-of-the-art interoperability standards so that its integration or communication with external systems can be achieved. System should be developed following Service Oriented Architecture (SOA) and Open standard architecture. System needs to be developed in a way that will allow the creation and support of a Web Services'ˆ to exchange information between the system and external systems

SYSTEM REQUIREMENTS

Software Used:
1. Operating System: Windows xp/7/8/10
2. Software Version: 3.1
3. Tools : Adriano IDE

Hardware Used:
1. Node MCU
2. Ultrasonic sensor

3. Connecting Wires
4. Tanks 5. Servo Motor
6. Relay
7. Motor Driver

CONCLUSION

In conclusion, the IoT-based Smart Chlorine Addition System represents a transformative approach to water treatment and storage, addressing the limitations of manual chlorine dosing and emphasizing precision, efficiency, and safety. By utilizing ultrasonic sensors and automation, this system ensures the maintenance of optimal water quality, significantly reducing the risks associated with over-chlorination, under-chlorination, and the formation of harmful disinfection byproducts. The integration of remote monitoring and control features enhances operational efficiency and responsiveness while minimizing the need for on-site personnel. This innovative project not only contributes to improved public health by delivering clean and safe water but also promotes cost savings, environmental sustainability, and regulatory compliance. Its scalability and adaptability make it a promising solution for diverse water storage facilities, with the potential to revolutionize water treatment practices and benefit communities worldwide

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