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IoT based Water Tank Cleaner using STM32

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Abstract - Water tanks are essential for storing and supplying clean water in both residential and industrial settings. However, over time, these tanks can accumulate sediment, algae, and other contaminants that can compromise water quality. Cleaning and maintaining water tanks is a critical task to ensure the supply of safe and clean water to consumers. The IoT-Based Water Tank Cleaner using STM32 project aims to address this issue by developing an innovative solution that automates the cleaning process of water tanks. This project leverages the power of the Internet of Things (IoT) and the capabilities of the STM32 microcontroller to create an intelligent and efficient water tank cleaning system. This project presents an innovative solution for water tank cleaning using the STM32 microcontroller and IoT (Internet of Things) technology. The proposed system automates the process of cleaning and monitoring water tanks, ensuring efficient operation and minimizing manual intervention. Water scarcity is a pressing global issue, necessitating efficient management of water resources. One significant aspect of water management is maintaining the cleanliness of water storage tanks, which often harbor contaminants due to neglect or inadequate cleaning procedures. This project introduces an IoT-based solution leveraging the STM32 microcontroller to automate the cleaning process of water tanks. The system employs sensors to monitor water quality, an actuator for tank cleaning, and IoT connectivity for remote monitoring and control.

***Key Words*:** Water tank cleaning, IoT-based solution, STM32, Water quality, Sediment removal

1.INTRODUCTION

Clean and safe drinking water is a fundamental necessity for human health. Water tanks are commonly used to store and supply water in many residential, commercial, and industrial settings. However, over time, these tanks can become contaminated with impurities, sediments, and microbial growth, posing a significant health risk. Regular cleaning and maintenance are essential to ensure the quality of the stored water. An Internet of Things (IoT) based water tank cleaner using the STM32 microcontroller is a modern and innovative solution for the efficient cleaning and maintenance of water storage tanks. This project combines IoT technology with a powerful microcontroller to create a smart and automated system that ensures the cleanliness and hygiene of water tanks. Traditional methods of cleaning water tanks are often labor-intensive, time-consuming, and may not be performed regularly. This can lead to water contamination and health hazards. The IoT-based water tank cleaner using STM32 aims to address this issue by providing an automated and efficient solution for tank cleaning. In an era where clean and accessible water is paramount, ensuring the quality and hygiene of water storage systems is of utmost importance. The project titled "Water Tank Cleaner using STM32" addresses this vital need by integrating cutting-edge technology to monitor and maintain water quality within tank. The project involves the use of an STM32 microcontroller, which is a powerful and energy-efficient microcontroller unit (MCU). The STM32 MCU is programmed to control the cleaning process of the water tank. It is equipped with sensors and actuators to perform the cleaning operation and monitor the tank's condition. IOT based water tank cleaner using STM32

This innovative system employs a turbidity sensor to continually assess the quality of water. If the sensor detects a decline in water quality below a predefined threshold, it triggers an automatic cleaning process. During this cleaning phase, the water outlet is securely closed while the cleaning outlet is activated, ensuring a thorough and effective cleaning operation. Furthermore, the system incorporates an ultrasonic sensor to monitor the water level within the tank. This data is crucial in managing water resources efficiently. The real-time information gathered by both sensors is transmitted to our dedicated website, providing users with immediate access to vital statistics regarding their water storage conditions. By combining sophisticated sensor technology with the powerful processing capabilities of the STM32 microcontroller, this project sets out to revolutionize the way we manage and maintain water quality in storage tanks. With a focus on automation and accessibility, this system promises to make a significant impact on water management practices, ultimately contributing to a healthier and more sustainable future. Various sensors, including pH, turbidity, temperature, and water level sensors, are deployed within the water tank to monitor key parameters. These sensors provide realtime data on water quality and tank conditions, enabling the system to determine the optimal timing and intensity of the cleaning process. Actuation mechanisms, such as motorized brushes or sprayers, are used to remove

sediments and contaminants from the interior surfaces of the water tank.

The STM32 microcontroller controls the operation of these actuators based on input from the sensors, ensuring thorough and efficient cleaning. The STM32 microcontroller serves as the brain of the system, responsible for processing sensor data, executing control algorithms, and managing communication with the IoT platform. Its low-power operation, multiple communication interfaces, and real-time processing capabilities make it well-suited for IoT applications. The IoT-based water tank cleaner leveraging the STM32 microcontroller presents a smart and efficient solution for addressing water hygiene challenges. By integrating sensors, actuators, and IoT connectivity, the system offers automated cleaning capabilities while providing remote monitoring and control functionalities.

2. LITERATURE SURVEY

The robot is equipped with a brush to clean the walls and bottom of the tank, and a turbidity sensor to detect the quality of water. The robot is controlled by an STM32 microcontroller, which is programmed to follow a predefined path inside the tank. The robot starts cleaning the tank when the turbidity sensor detects that the water quality is low. A ultrasonic sensor to measure the water level. The system is controlled by an STM32 microcontroller, which is programmed to clean the tank based on the water level. The system starts cleaning the tank when the water level falls below a certain threshold, and stops cleaning when the water level reaches a certain threshold.[1]

This paper presents a design of a water tank monitoring and cleaning system using STM32 and cloud computing. The system is equipped with a turbidity sensor to detect the quality of water and an ultrasonic sensor to measure the water level. The system is controlled by an STM32 microcontroller, which is programmed to monitor the water quality and level, and send the data to a cloud server. The cloud server can be used to view the data and control the cleaning system. [2]

This paper presents a design of a smart water tank cleaning system using STM32 and machine learning. The system is equipped with a turbidity sensor to detect the quality of water, an ultrasonic sensor to measure the water level, and a GSM module to send the data to a cloud server. The system is controlled by an STM32 microcontroller, which is programmed to monitor the water quality and level, send the data to the cloud server, and receive commands from the cloud server to control the cleaning system. The system also uses a machine learning algorithm to predict the water quality and cleaning schedule.[3] .

the paper emphasizes about the essentiality of water for human beings, plants and animals. The key aim of the paper is to reduce human intervention to reduce percentage water wastage in agricultural farms using a water level controller with wireless technology. The paper has said about the development of 4 stages of water pumping system. The paper has also compared between the wired and wireless Bluetooth based water level controller. They have used an Ultrasonic sensor, Arduino uno microcontroller, pump, relay and Bluetooth module HC-12.[4]

Water Tank Cleaning System Using Stm32 and Ultrasonic Sensor This paper presents a design of a water tank cleaning system using STM32 and ultrasonic sensor. The system is equipped with a brush to clean the walls and bottom of the tank, and an ultrasonic sensor to measure the water level. The system is controlled by an STM32 microcontroller, which is programmed to clean the tank based on the water level. The system starts cleaning the tank when the water level falls below a certain threshold, and stops cleaning when the water level reaches a certain threshold.[5]

Water Tank Cleaning Robot Using Stm32 and Turbidity Sensor This project paper presents a design of a water tank cleaning robot using STM32 and turbidity sensor. The robot is equipped with a brush to clean the walls and bottom of the tank, and a turbidity sensor to detect the quality of water. The robot is controlled by an STM32 microcontroller, which is programmed to follow a predefined path inside the tank. The robot starts cleaning the tank when the turbidity sensor detects that the water quality is low. [6]

They have developed a water level indicator based on IoT for smart villages. The proposed system consists of an IoT-based architecture including a presentation layer, service layer, and physical layers. Liquid level sensors, STM32, Internet, carriots.com and freeboard.io are included to acquire details of water level from any location. This paper also helps for the further development of the design by providing the basic and the technical information.[7]

3. REQUIREMENT AND ANALYSIS

Hardware Components:

- STM32 Microcontroller: Ensure compatibility, processing power, and energy efficiency.
- Turbidity Sensor: Detect water quality conditions.
- Ultrasonic Sensor: Monitor water level within the tank.
- Actuators: Mechanisms for cleaning operations.

Communication Modules:

- IoT Module: Facilitate data transmission for real-time monitoring.
- Cloud Connectivity: Enable cloud-based storage and analysis. Power Supply:
- Stable Power Source: Ensure uninterrupted operation.
- Power-efficient Components: Minimize energy consumption.

User Interface:

- Dedicated Website: Provide users with real-time access to water quality statistics.
- Mobile App (Optional): Enhance accessibility for remote monitoring.

Automation and Control:

- STM32 Programming: Develop algorithms for automated cleaning based on sensor inputs.
- Real-time Monitoring: Implement continuous monitoring of water quality and level.

Safety Features:

- Emergency Stop: Incorporate a mechanism to halt cleaning processes in emergencies.
- Secure Closure: Ensure water outlet closure during the cleaning phase.

Scalability:

- Design for Various Tank Sizes: Ensure adaptability to different residential, commercial, and industrial tanks.

Compatibility:

- Ensure Compatibility: Confirm compatibility with different water tank materials and structures. Analysis for IoT-Based Water Tank Cleaning System: Feasibility:
- Evaluate technical feasibility of integrating IoT and STM32 for water tank cleaning.

4. WORKING OF THE PROPOSED SYSTEM

An IoT-based water tank cleaner using an STM32 microcontroller can offer an efficient and automated solution
for maintaining water tank cleanliness. The system comprises multiple components, including water level sensors, ultrasonic sensors, a motor-driven cleaning mechanism, and an STM32 microcontroller equipped with Wi-Fi or cellular connectivity. The water level sensors detect the water level in the tank and send this information to the STM32.In an era where clean and accessible water is paramount, ensuring the quality and hygiene of water storage systems is of utmost importance. The project titled "Water Tank Cleaner using STM32" addresses this vital need by integrating cutting-edge technology to monitor and maintain water quality within tank.

This innovative system employs a turbidity sensor to continually assess the quality of water. If the sensor detects a
decline in water quality below a predefined threshold, it triggers an automatic cleaning process. During this cleaning phase, the water outlet is securely closed while the cleaning outlet is activated, ensuring a thorough and effective cleaning operation. Furthermore, the system incorporates an ultrasonic sensor to monitor the water level within the tank. This data is crucial in managing water resources efficiently. The real-time information gathered by both sensors is transmitted to our dedicated website, providing users with immediate access to vital statistics regarding their water storage conditions.

By combining sophisticated sensor technology with the powerful processing capabilities of the STM32 microcontroller, this project sets out to revolutionize the way we manage and maintain water quality in storage tanks. With a focus on automation and accessibility, this system promises to make a significant impact on water management practices, ultimately contributing to a healthier and more sustainable future.

5. HARDWARE MODULES

The IoT-Based Water Tank Cleaning System using STM32 integrates various components to automate and enhance the efficiency of water tank cleaning. The system's architecture combines the capabilities of the STM32 microcontroller, ESP32 for IoT connectivity, and sensors such as the turbidity sensor and ultrasonic sensor for monitoring water quality and level. Let's break down the working of the proposed system:

STM32 Microcontroller:

- The STM32 microcontroller serves as the central processing unit of the system, orchestrating the overall operation.
- It interfaces with sensors, actuators, and other peripherals to control and monitor the water tank cleaning process.

ESP32 for IoT Connectivity:

- The ESP32 module provides Wi-Fi connectivity, enabling the system to transmit real-time data to a dedicated website for remote monitoring.
- It facilitates communication between the water tank cleaning system and the user interface.

Turbidity Sensor:

- The turbidity sensor continuously assesses the quality of the water in the tank.
- If the sensor detects a decline in water quality below a predefined threshold, it triggers the cleaning process.

Relay Module:

- The relay module controls the activation of the DC motor responsible for the cleaning operation.
- The flow of water during the cleaning process, ensuring effective and controlled cleaning.

DC Motor:

- The DC motor drives the cleaning mechanism, which could involve brushes or other cleaning tools.
- Activated based on the signals from the microcontroller, it performs the cleaning operation.

Power Supply:

- The power supply, within the specified voltage range, provides the necessary power to the STM32 microcontroller and other components.
- A stable power source ensures continuous and reliable operation.

Proteus Simulation and EasyEDA for Design:

- The system's design and functionality can be simulated using Proteus, allowing for a virtual test of the circuitry and components.
- EasyEDA, as a web-based EDA tool, aids in the schematic capture and PCB design, facilitating the overall design process.

Real-time Monitoring:

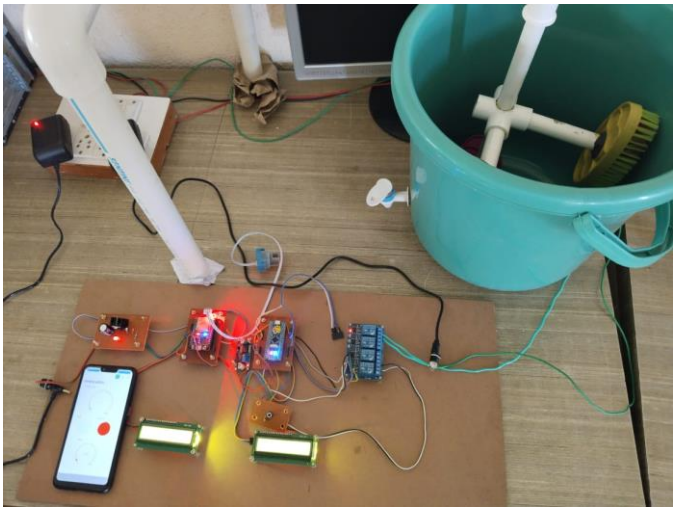
- Data from the sensors (turbidity and ultrasonic) is transmitted in real-time to a dedicated website through the ESP32 module.
- Users can access this website to monitor vital statistics regarding water quality and storage conditions.

Collaborative Development:

- Collaboration is facilitated through the use of EasyEDA, allowing multiple users to work on the electronic circuit design simultaneously.

6. RESULTS

The system's sensors, including turbidity sensors, allowed for real-time monitoring of water quality and tank conditions. When water quality declined, the system automatically activated motorized brushes and sprayers controlled by the STM32 microcontroller. Real-time data was transmitted to a dedicated website, enabling remote monitoring and management. Tests confirmed the system's reliability and adaptability, ensuring consistent maintenance of water hygiene in various settings.



CONCLUSION

The IoT-based water tank cleaner utilizing STM32 microcontrollers presents a robust and innovative solution for enhancing water quality management. By seamlessly integrating IoT capabilities with the efficiency of STM32, this technology revolutionizes the traditional approach to water tank maintenance. The system's ability to offer remote monitoring, automated cleaning, and real-time data analytics introduces a new level of efficiency and responsiveness in diverse applications. The energy-efficient nature of STM32 microcontrollers ensures sustainable operation, making the solution suitable for a wide range of scenarios, including off-grid locations and environments with limited power resources. The scalability and flexibility of the STM32 platform allow for easy adaptation to varying requirements and integration with evolving IoT ecosystems. Across residential, agricultural, industrial, and commercial sectors, the IoTbased water tank cleaner enhances water quality assurance, reduces maintenance costs, and promotes environmental sustainability

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