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REVIEW ARTICLE OPEN ACCESS

Multi Tank Water Level Monitoring System Using ESP32 and Blynk

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Abstract:

Efficient monitoring of water levels in multiple storage tanks is essential to avoid overflow, water shortage, and manual supervision. This paper presents an IoT-based Multi Tank Water Level Monitoring System using ESP32 and ultrasonic sensors integrated with the Blynk platform. The system measures water levels of multiple tanks in real time and transmits the data through Wi-Fi to a mobile application. The proposed system is economical, accurate, and enables remote monitoring, ensuring proper water management and reducing human effort.

Keywords — ***ESP32, IoT, Multi Tank Monitoring, Ultrasonic Sensor, Blynk, Smart Water Management***

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I. INTRODUCTION

Water management has become a major concern in residential buildings, industries, and agricultural systems where multiple tanks are used for storage and distribution [4]. Conventional monitoring methods require manual checking, which is inefficient and may lead to overflow or insufficient supply [3].

With the development of Internet of Things (IoT) technology, it is possible to design smart systems that continuously monitor water levels and provide real-time updates [1], [2]. This project develops a Multi Tank Water Level Monitoring System using ESP32 that allows users to monitor several tanks remotely using a smartphone.

II. OBJECTIVES OF THE SYSTEM

The main objectives of the proposed system are:

To monitor water levels in multiple tanks simultaneously.

To reduce water wastage caused by overflow.

To eliminate manual inspection of tanks.

To provide real-time monitoring using a mobile application.

To develop a low-cost and reliable IoT-based solution.

III. LITERATURE REVIEW

Several researchers have explored the application of Internet of Things (IoT) technology for efficient water level monitoring and management. R. Buyya and A. V. Dastjerdi discussed the fundamental concepts of IoT and highlighted how interconnected

sensors and smart devices can be used for real-time monitoring and automation in various engineering applications [1].

L. Da Xu, W. He, and S. Li presented an overview of IoT in industrial environments, emphasizing the role of wireless communication and embedded systems in collecting and transmitting data for remote supervision and control [2]. Their work demonstrated that IoT-based monitoring systems improve operational efficiency and reduce manual intervention.

S. R. Patil and A. R. Kale developed an IoT-based water level monitoring system using sensors and microcontrollers to measure tank levels and send data to users through online platforms [3]. Their study showed that such systems effectively prevent overflow and ensure better utilization of water resources.

T. Perumal, M. N. Sulaiman, and C. Y. Leong proposed an IoT-enabled water monitoring solution that integrates sensing devices with cloud-based communication to provide continuous updates and alerts [4]. The research highlighted the advantages of remote accessibility and scalability in smart water management systems.

Based on the review of existing work, it is observed that most traditional systems monitor only a single tank or require complex infrastructure. Therefore, the proposed system focuses on a cost-effective multi tank monitoring solution using ESP32 with built-in Wi-Fi to achieve real-time, scalable, and user-friendly monitoring through the Blynk platform.

IV. METHODOLOGY

The proposed Multi Tank Water Level Monitoring System is designed using ESP32, ultrasonic sensors, and IoT-based communication to measure and monitor water levels in multiple tanks [3]. The methodology involves sensing, processing, data transmission, and visualization based on standard IoT architecture [1].

Initially, ultrasonic sensors are installed at the top of each tank to measure the distance between the sensor and the water surface. These sensors continuously emit ultrasonic waves and receive the reflected signals, allowing accurate calculation of the water level [3], [4].

The ESP32 microcontroller collects the distance data from all sensors through its GPIO pins. Using programmed algorithms, the controller converts the measured distance into water level values based on the known height of each tank [3].

The processed data is then transmitted through the built-in Wi-Fi module of ESP32 to the Blynk IoT platform. This enables real-time monitoring of all tanks on a mobile device or web interface [2], [4].

A regulated 5V DC power supply is used to ensure stable operation of the ESP32 and sensors. The system operates continuously, updating tank levels at regular intervals, thereby eliminating the need for manual inspection and enabling efficient water resource management [3].

This methodology provides a simple, scalable, and cost-effective solution that can be expanded to monitor additional tanks by integrating more sensors with the ESP32 [1].

V. COMPONENTS USED

The system consists of the following components:
ESP32 Microcontroller
Ultrasonic Sensors (for each tank)
Wi-Fi Connectivity (inbuilt in ESP32)
Blynk IoT Platform for monitoring
5V DC Power Supply
Jumper Wires and Connecting Cables

VI. WORKING PRINCIPLE

Each ultrasonic sensor is placed at the top of a tank to measure the distance between the sensor and the water surface. The sensor sends ultrasonic waves, which reflect from the water surface and return to the sensor, enabling accurate level measurement [3], [4]. The ESP32 calculates the distance using the time taken for the echo signal.

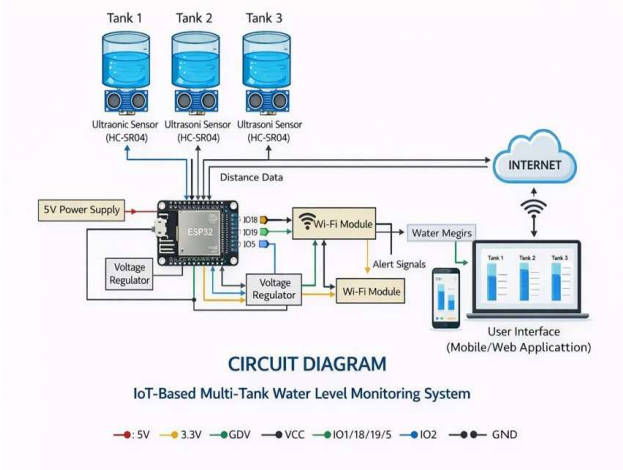
The water level is then determined using: Water Level = Tank Height − Measured Distance

The ESP32 processes the data from all sensors and sends it via Wi-Fi to the Blynk application, where users can monitor levels of multiple tanks in real time [2], [3].

VII. SYSTEM IMPLEMENTATION

The implementation includes hardware connection and software programming:

Ultrasonic sensors are mounted on each tank.
Sensors are connected to ESP32 GPIO pins.
ESP32 is powered using a 5V DC supply.
Program is written using Arduino IDE.
ESP32 connects to Wi-Fi network.
Data is transmitted to Blynk dashboard.
Mobile app displays live water levels of all tanks.



The complete hardware connection of the proposed system is shown in Fig. 1.

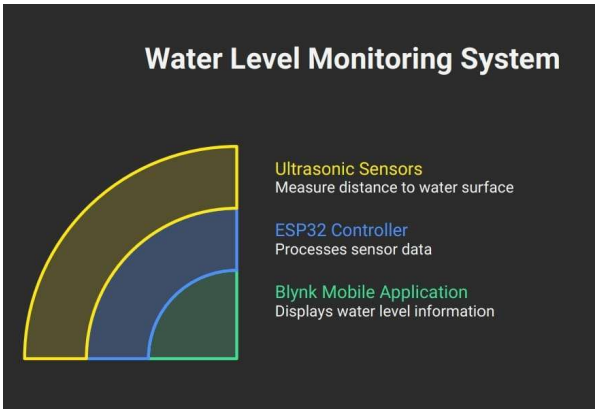
VIII. RESULTS AND DISCUSSION

RESULT

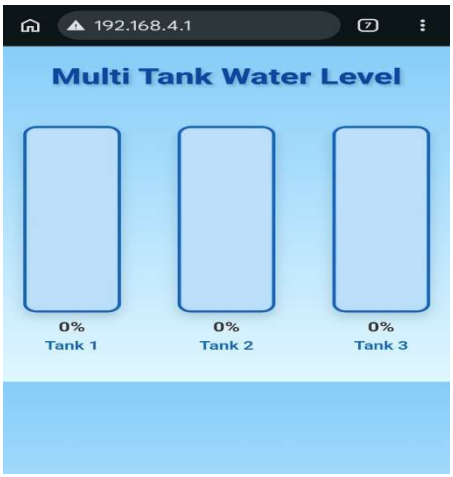
The developed system was tested on multiple water tanks under different level conditions.

Each ultrasonic sensor successfully measured the distance from the water surface and transmitted the data to the ESP32 controller. The ESP32 processed the readings and updated the water level information to the Blynk mobile application through Wi-Fi.

The system displayed real-time tank levels accurately on the smartphone dashboard. During testing, the response time was fast and stable, and continuous monitoring was achieved without signal loss. The prototype operated reliably using a 5V DC supply and showed consistent performance for all tanks.

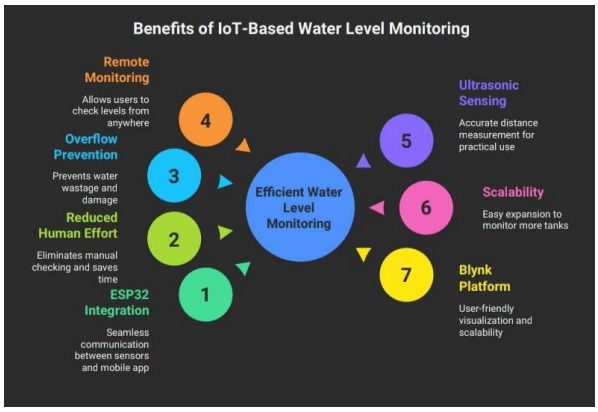


The real-time water level of multiple tanks is displayed on the monitoring dashboard, as shown below.



DISCUSSION

The experimental results show that the IoT-based monitoring system provides an efficient alternative to manual water level checking [3], [4]. The integration of ESP32 with Wi-Fi enables seamless communication between sensors and the mobile application, which is a key advantage of IoT-enabled systems [2]. Compared to conventional methods, this system reduces human effort, prevents overflow conditions, and allows users to monitor tanks remotely [3].



The accuracy of ultrasonic sensing was satisfactory for practical applications, and the system can be expanded to monitor additional tanks with minimal hardware modification, demonstrating the scalability typical of IoT architectures [1]. The use of the Blynk platform simplifies visualization and makes the solution user-friendly and scalable for residential and industrial environments [4]

IX. ADVANTAGES OF THE SYSTEM

Real-time monitoring of multiple tanks
Reduces water wastage
Low installation cost
Easy to operate and maintain
Scalable for additional

X. APPLICATIONS

Residential buildings with overhead tanks
Industrial water storage systems
Agricultural irrigation tanks
Hostels, hospitals, and campuses
Smart city water management system

XI. CONCLUSION

The Multi Tank Water Level Monitoring System using ESP32 and Blynk provides an effective and economical solution for monitoring water storage. The system enables real-time remote access, improves water utilization, and reduces manual effort. This project demonstrates how IoT technology can be applied for smart resource management [1], [2] and can be further enhanced with automatic pump control in future developments.

XII. FUTURE SCOPE

Automatic motor control based on water level
SMS/notification alerts
Cloud data storage and analysis
Integration with smart home systems

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