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IoT Based Water Level Monitoring and Control System

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Abstract: This project presents an IoT-based smart water level monitoring and control system using the ESP32 microcontroller. The system is designed to monitor the water levels in two tanks — a source tank and a main storage tank — using ultrasonic sensors.
The measured water levels are processed and displayed as percentage values on a 16x2 LCD as well as on a mobile application using Blynk.
The system automatically controls a water pump through a relay based on predefined conditions. The pump turns ON when the main tank level is low and turns OFF when the tank is full or when the source tank level is insufficient. Additional features such as LED indicators, buzzer alerts, and WiFi-based monitoring enhance usability and safety. The system ensures efficient water management, prevents overflow, and protects the pump from dry running.
Index Terms: ESP32 microcontroller, IoT-based smart water level monitoring, WiFi-based monitoring.

I. INTRODUCTION

The rapid advancement in Internet of Things (IoT) technology has enabled the development of smart systems that can monitor and control real-world parameters efficiently.
One such essential application is water level monitoring and management. In many residential, agricultural, and industrial areas, water wastage and overflow due to manual monitoring are common issues. Similarly, dry running of pumps due to empty source tanks can damage equipment and reduce efficiency.
This project, titled "IoT-Based Water Level Indicator and Controller using ESP32", aims to design an intelligent system that monitors water levels in real time and controls the pumping mechanism automatically. The system uses ultrasonic sensors to measure water levels in both source and main tanks and displays the information on an LCD as well as on a mobile application via IoT.
By integrating automation with wireless monitoring, this project ensures efficient water usage, prevents overflow, avoids pump damage, and reduces human intervention. It also provides a user-friendly interface for real-time monitoring and control, making it a practical and scalable solution.

II. LITERATURE SURVEY

Several research works have been carried out in the field of IoT-based water level monitoring systems. The paper *"IoT Water Level Monitoring System"* (2022) presents a smart solution for real-time monitoring and automatic control of water levels using IoT technology.
Another study, *"IoT-Based Water Monitoring Systems: A Systematic Review"* (2022), provides a comprehensive overview of different IoT techniques and technologies used in water monitoring applications. Furthermore, *"IoT-Based Water Level Monitoring and Flood Alert System"* (2025) focuses on real-time monitoring of water bodies and early flood warning systems using IoT and sensor networks.
In addition, the paper *"Secure IoT-Based Real-Time Water Level Monitoring System Using ESP32"* (2025) highlights the use of ESP32 for secure and efficient real-time monitoring of water levels, particularly in critical infrastructure. These studies collectively demonstrate the effectiveness of IoT in improving water management, automation, and safety systems.

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III. SYSTEM OVERVIEW

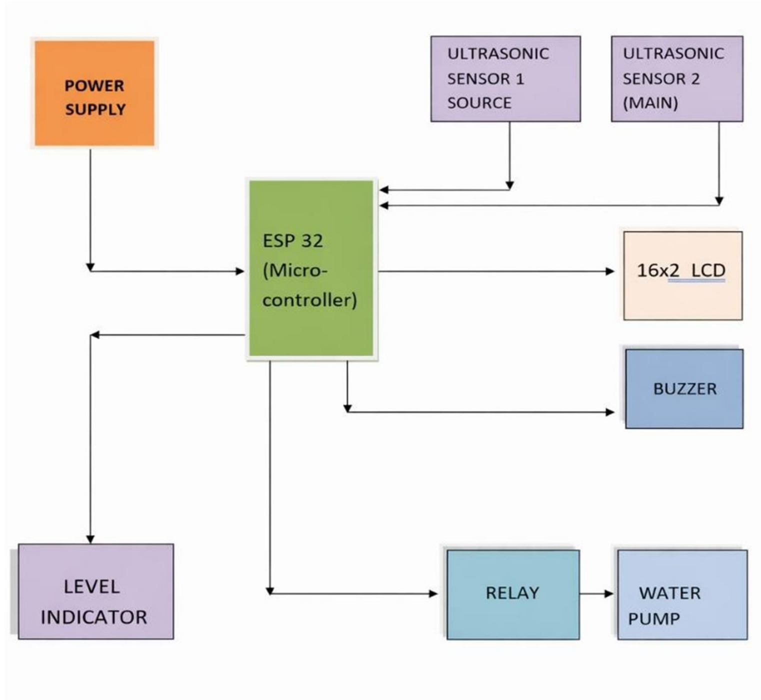

Fig 1: Block diagram

The block diagram of the system represents the overall architecture and interaction between different components used in the IoT-based water level monitoring and control system. At the input stage, two ultrasonic sensors are used to measure the water levels in the source tank and the main tank. These sensors send distance data to the ESP32 microcontroller.

The ESP32 acts as the central processing unit of the system. It receives input data from the sensors, processes it, and makes decisions based on programmed logic. The processed data is then used to control output devices and communicate with external platforms. The ESP32 is connected to a WiFi network, which enables communication with the Blynk mobile application. This allows real-time monitoring of water levels and remote control of the pump.

IV. METHODOLOGY

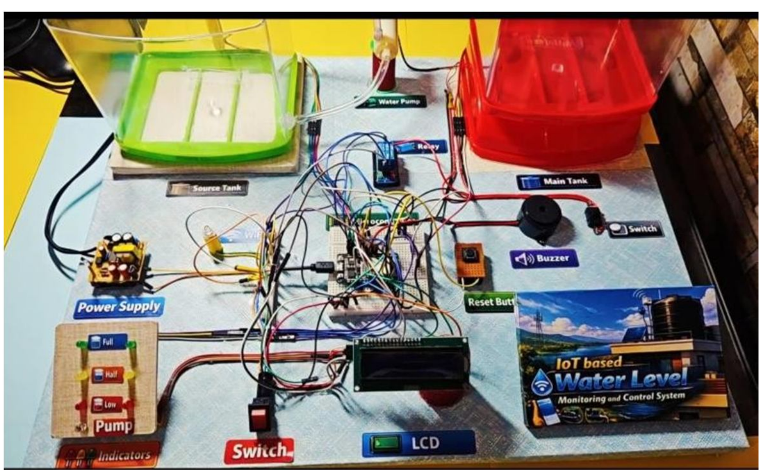

Fig. 2. System photo

1) ESP32: Main controller, processes data and controls system with WiFi support.
2) Ultrasonic Sensors: Measure water level in source and main tank.
3) Relay: Switches pump ON/OFF using ESP32 signal.
4) Water Pump: Transfers water automatically.
5) LCD (16×2): Displays water level and pump status.
6) LEDs: Indicate low, medium, high levels.
7) Buzzer: Alerts for low water level.
8) Push Button: Stops buzzer alert.
9) WiFi: Enables remote monitoring via app.
10) Power Supply: Provides stable power to system.

V. RESULT

The system showed reliable and accurate performance in all test conditions. The ultrasonic sensors measured water levels effectively, and the ESP32 processed the data correctly.

The pump control logic worked as expected:
1) Pump turned ON at low levels
2) Pump turned OFF at full level
3) Pump stopped during low source condition

The LCD displayed real-time data clearly, and the Blynk app successfully showed live updates and allowed remote control.

LED indicators provided quick visual feedback, and the buzzer alert system functioned properly for low water levels.

VI. CONCLUSION

From the above observations and test results, it can be concluded that the system operates efficiently and reliably. It successfully prevents water overflow, avoids dry running of the pump, and provides real-time monitoring through IoT.

The system is suitable for practical implementation in residential, agricultural, and industrial applications.

VII. ACKNOWLEDGMENT

We would like to express our sincere gratitude to Principal Mr. Vikrant Joshi and Head of Department Ms. Ashwini Khade for giving us the opportunity to present our project. Our heartfelt appreciation goes to our guide, Mr. Swapnil Jadhav for his invaluable. Guidance, continuous support, and constant motivation throughout this journey. We would also like to acknowledge the contributions of all the departmental faculty members and non-teaching staff for their unwavering support in our learning.

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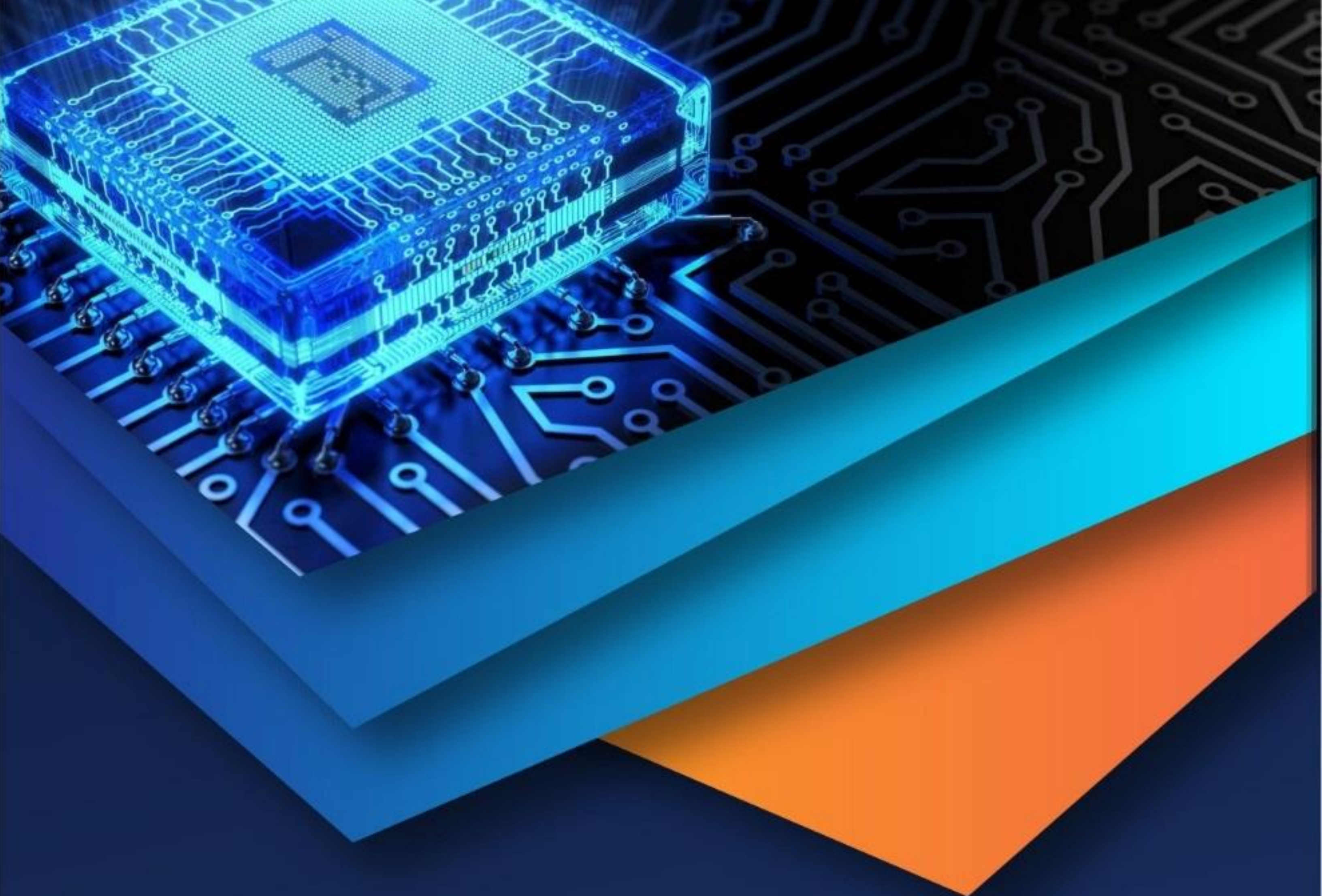

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