



WATER LEVEL & TEMPERATURE MONITOR WITH TFT GRAPHICS

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Abstract:

This project presents the design and implementation of a Water Level and Temperature Monitoring System using ESP32 with a TFT Graphical Display. The main objective of this system is to monitor the water level and water temperature continuously and display the information in a clear and easy-to-understand graphical format. The system helps reduce manual monitoring and improves the efficiency of water management.

The system also includes LED indicators and a buzzer to provide instant alerts based on the water level. A green LED indicates a normal water level, a yellow LED indicates a medium level, and a red LED along with a buzzer warns the user when the water level is very low or reaches a critical condition. These visual and audio alerts help users take quick action and prevent water-related problems.

An ultrasonic sensor is used to measure the water level in the tank, while a temperature sensor measures the water temperature. The ESP32 microcontroller collects data from these sensors, processes it, and displays the results on a TFT display using graphical indicators such as water level bars, numerical values, and temperature readings. This graphical interface allows users to understand the tank status quickly and accurately.

The system provides real-time monitoring, making it easier to detect conditions such as low water level, full tank, water overflow, or abnormal temperature. By providing continuous updates, the system minimizes human effort, reduces water wastage, and improves the overall reliability of



water storage management.

The proposed system is low-cost, energy-efficient, user-friendly, and easy to install. It can be expanded in the future by adding IoT technology for remote monitoring through a mobile application, cloud data storage, automatic pump control, and alert notifications.

A prototype of the system was successfully developed and tested, demonstrating accurate and reliable performance under different water levels and temperature conditions. This project is suitable for residential water tanks, industrial storage tanks, agricultural irrigation systems, laboratories, and other water management applications, where continuous monitoring is essential for efficient operation and resource conservation.

Keywords: - ESP32, Water Level Sensor, Temperature Sensor, TFT Display, Buzzer, IOT Water Monitoring.

1. INTRODUCTION

Water is one of the most valuable natural resources and plays an important role in daily life, agriculture, industries, and commercial applications. Proper management of water is essential to ensure its efficient use and to avoid problems such as water wastage, overflow, dry running of pumps, and unnecessary energy consumption. As urbanization and industrialization continue to grow, the demand for smart and automated water management systems is also increasing.

Traditional methods of checking water level and temperature require manual inspection, which is time-consuming, less accurate, and may lead to human errors. In many cases, tanks overflow because the motor is not switched off at the right time, or pumps get damaged due to running without sufficient water. These issues increase maintenance costs and waste both water and electricity. Therefore, there is a need for an automatic, reliable, and cost-effective system that can continuously monitor water level and temperature.

Recent developments in embedded systems, microcontrollers, and sensor technology have made it possible to design intelligent monitoring systems that provide accurate real-time information. This project presents a Water Level and Temperature Monitoring System with a TFT Graphical Display using an Arduino. The system continuously measures the water level using an ultrasonic sensor and the water temperature using a temperature sensor. The collected sensor data is processed by the Arduino microcontroller and displayed on a TFT screen in the form of graphical indicators, numerical values, and status messages.

The TFT graphical display provides a user-friendly interface that allows users to easily understand the condition of the water tank. Unlike conventional LED indicators or simple displays, the TFT screen presents information using colorful graphics, water level bars, percentage indicators, and temperature readings. This improves visualization and makes monitoring more effective.

The system also includes automatic motor control to reduce manual effort. When the water level falls below the minimum limit, the motor automatically starts filling the tank. Once the tank



reaches the maximum level, the motor automatically stops. This prevents water overflow, avoids dry running of the pump, and increases the life of the motor. In addition, a buzzer is used to provide warning alerts whenever abnormal conditions such as very low water level, full tank, or high temperature are detected.

The proposed system offers several advantages, including continuous real-time monitoring, improved accuracy, reduced human intervention, lower maintenance costs, water conservation, and energy savings. The system is economical, easy to install, and suitable for both indoor and outdoor environments.

Furthermore, the project can be enhanced in the future by integrating IoT technology. By using Wi-Fi modules such as ESP32, users can monitor water level and temperature remotely through a mobile application or web dashboard. Features such as cloud data storage, automatic notifications, historical data analysis, and smart control can make the system even more efficient and intelligent.

In addition to monitoring and automation, the system provides a simple and user-friendly interface that allows users to view real-time water level and temperature information at a glance. The combination of the TFT graphical display, ultrasonic sensor, temperature sensor, LED indicators, and buzzer alerts ensures quick response to changing conditions. Due to its low cost, reliability, and ease of maintenance, the system is suitable for homes, industries, agricultural fields, educational institutions, and commercial buildings. It also provides a strong foundation for future smart water management systems with advanced IoT and cloud-based technologies.

2. LITERATURE SURVEY

Gupta et al. (2025)[1] created a smart water monitoring system using IoT technology with a graphical TFT interface and the ability to access data from the cloud. This system used sensors connected to cloud platforms for real-time tracking and predictive analysis, helping manage water resources more effectively.

Mahajan et al. (2024)[2] built a smart embedded system that included water level sensing, temperature protection, motor control, and a TFT graphical display. This helped reduce water wastage and made home water systems more automated.

Roy et al. (2024)[3] introduced a system that monitored multiple water parameters like level, temperature, and turbidity. The TFT graphics module showed dynamic charts for better understanding and analysis of data.

Verma and Gupta (2023)[4] developed a water tank monitoring system that used GSM alerts and a TFT display. It sent automated alerts and made it easier to access data from a distance.

Joshi and Kulkarni (2023)[5] designed an automatic water level and temperature monitoring system using Arduino and a TFT LCD screen. The display showed waveform charts and numbers for more accurate readings.



Reddy and Kumar (2022)[6] created a microcontroller-based water monitoring system with real-time TFT graphics. This ensured accurate measurements and made the data easier to understand for users.

Nair et al. (2022)[7] presented a smart irrigation system that used water level and temperature sensors. The TFT display gave clear visual updates for farmers and agricultural use.

Bhosale and Patankar (2022)[8] developed a low-cost embedded system for monitoring water tanks with real-time TFT display. The system was made for practical use in homes.

Patil and Deshmukh (2021)[9] made a smart water tank monitoring system with temperature sensing and a TFT display to make data easier to read and interpret.

Mehta and Joshi (2021)[10] proposed a smart water management system using ultrasonic and temperature sensors. The TFT screen displayed graphical trends to make monitoring more efficient.

Khan and Ahmed (2021)[11] introduced an IoT-based water level system with cloud access and a TFT interface to improve remote monitoring.

Kumar et al. (2020)[12] designed an Arduino-based water level system using ultrasonic sensors with automatic motor control.

Singh et al. (2020)[13] introduced a system that controlled water pumps automatically and monitored temperature to avoid motor overheating and save energy.

Chaudhary et al. (2020)[14] created a digital water monitoring system using Arduino and temperature sensors with a TFT display for better usability.

Sharma et al. (2019)[15] presented an IoT-based system for real-time monitoring of water level and temperature using Node MCU and cloud-based access.

Desai et al. (2019)[16] developed a system that automatically filled water tanks and used a graphical display and buzzer to prevent overflow and dry running.

Ali et al. (2018)[17] made a cost-effective real-time system for water level monitoring using capacitive sensors and a graphical interface.

Thomas and Kumar (2017)[18] built a system using float and temperature sensors with a microcontroller and LCD display. It had automatic motor control to prevent overflow and improve system reliability at home.

Rao et al. (2016)[19] created an embedded system with ultrasonic sensors and GSM communication to send SMS alerts for water level changes. Their work focused on automating and remotely managing water.

Patel and Shah (2015)[20] developed a low-cost system using Arduino for real-time water level and temperature monitoring. It used a display to show readings and helped manage motor control

efficiently.

Karthik et al. (2014)[21] designed a real-time system that used temperature sensors with a microcontroller. Data was shown digitally, making manual monitoring easier. Their work focused on affordability and practical use at home.

3. PROPOSED METHODOLOGY

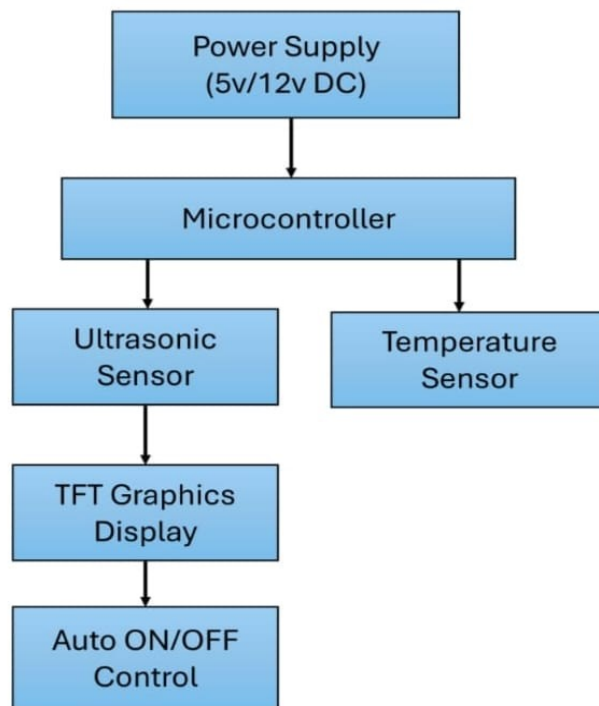


Fig. 1 Water level & Temperature Monitor With TFT Graphics

The Water Level and Temperature Monitoring System with TFT Graphics is designed to continuously monitor the water level in a tank and measure the surrounding temperature in real time. The system is built using an ESP32 microcontroller, HC-SR04 ultrasonic sensor, DHT11 temperature and humidity sensor, TFT display, LED indicators, and a buzzer. The ESP32 acts as the main controller, collecting data from all the sensors and controlling the display and alert devices.

When the system is powered on, the ESP32 initializes the ultrasonic sensor, DHT11 sensor, TFT display, LEDs, and buzzer. The HC-SR04 ultrasonic sensor is mounted at the top of the water tank to measure the distance between the sensor and the water surface. Based on this distance, the ESP32 calculates the water level and classifies it into different stages such as Empty, Low, Medium, and Full.

At the same time, the DHT11 sensor measures the surrounding temperature and sends the digital

data to the ESP32. The microcontroller processes both the water level and temperature readings and converts them into meaningful values such as water level percentage and temperature in degrees Celsius.

The processed information is displayed on the ILI9341 TFT display in a graphical format. The display shows the water level using a graphical bar, numerical percentage, and status messages such as Empty, Low, Medium, or Full. It also displays the current temperature, making the information easy to understand at a glance.

To provide instant alerts, the system uses LED indicators and a buzzer. The Red LED glows and the buzzer sounds when the water level is critically low, warning the user to refill the tank. The Green LED indicates a normal or medium water level, while the Yellow LED turns on when the tank reaches the full level. These visual and audio indications help users monitor the tank without continuously checking the display.

The system performs continuous real-time monitoring by repeatedly reading sensor values and updating the TFT display. This ensures that any change in the water level or temperature is reflected immediately. The graphical interface improves readability and allows users to understand the tank status quickly.

4. RESULT AND DISCUSSION

Result:-

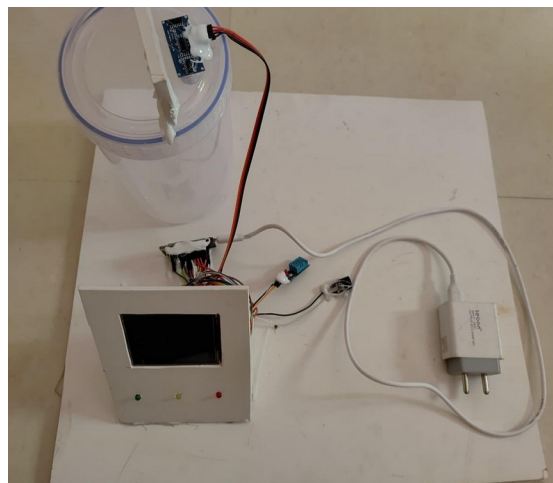


Figure 1

Discussion:-

The Water Level and Monitoring System with successfully designed, tested under different water hardware prototype consists



Temperature TFT Graphics was implemented, and level conditions. The of an ESP32



microcontroller, an ultrasonic sensor for water level measurement, a DHT11 sensor for temperature monitoring, a TFT display, LEDs, a buzzer, and a Blynk IoT interface.

The first result image shows the complete hardware setup before operation. All components were connected successfully, and the system was powered through an adapter. The ultrasonic sensor was positioned above the water tank to measure the distance between the sensor and the water surface, while the DHT11 sensor measured the surrounding temperature. The ESP32 processed the sensor readings and controlled the display and alert system.

The second result image shows the system during operation. The TFT display continuously showed the current water level percentage, temperature, and a graphical tank indicator, making it easy for users to understand the tank status. At the same time, the measured data was transmitted to the Blynk IoT application, allowing remote monitoring through a smartphone. The LEDs changed according to the water level, and the buzzer provided an audible warning when the water level reached a critical condition.

The experimental results demonstrated that the ultrasonic sensor accurately detected changes in the water level, while the DHT11 sensor provided stable temperature readings. The TFT display updated the information in real time without noticeable delay, and the IoT platform successfully synchronized the data with the mobile application. The system responded quickly to variations in water level and generated alerts whenever required.

Overall, the developed system achieved reliable real-time monitoring of both water level and temperature. The graphical TFT display, visual indicators, buzzer alerts, and IoT connectivity improved the usability of the system and enabled efficient water tank monitoring. The results confirm that the proposed system is suitable for domestic, agricultural, and industrial applications where continuous monitoring and timely alerts are essential.

5. CONCLUSION

The proposed Water Level and Temperature Monitoring System with TFT Graphics was successfully designed, developed, and tested. The system effectively measures the water level using an ultrasonic sensor and monitors the surrounding temperature using a DHT11 sensor. The ESP32 microcontroller processes the sensor data and displays the information on a TFT display in both numerical and graphical formats, making it easy for users to understand the tank status.

The integration of the Blynk IoT platform enables remote monitoring through a smartphone, allowing users to access real-time water level and temperature information from anywhere with an internet connection. The LED indicators and buzzer provide instant visual and audible alerts whenever the water level reaches predefined conditions, improving the safety and reliability of the system.

Experimental testing demonstrated that the system provides accurate measurements, fast response, and stable performance under different operating conditions. The graphical display and IoT



connectivity enhance the overall user experience and reduce the need for manual inspection of water tanks.

In conclusion, the proposed system is a low-cost, reliable, and efficient solution for real-time water level and temperature monitoring. It can be successfully used in homes, farms, schools, and small industrial applications to improve water management and prevent water overflow or shortage. The system also provides a foundation for future enhancements such as automatic pump control, cloud data storage, and advanced data analysis.

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