# Parameters Monitoring and Control of Industrial Tank Using Automation

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***ABSTRACT-***
To automate tank parameters using PLCs is important for ensuring safety, energy efficiency, and real-time monitoring in industries. Manual monitoring and control methods can cause errors, delays, and inefficiencies, leading to safety risks and higher costs. This project focuses on using PLC and SCADA to monitor and control industrial tank parameters, specifically water level and temperature regulation, which are crucial for safe and efficient tank operation. To ensure accurate monitoring, sensors were chosen based on factors like accuracy, cost, durability, and ease of integration. A level sensor is used for water level control due to its simplicity, low cost, and reliability. It provides an ON/OFF signal, which is easy to integrate with PLCs for precise monitoring for temperature measurement, the RTD PT100 sensor is selected for its accuracy, stability, and wide range, ensuring effective temperature regulation. A Programmable Logic Controller (PLC) automates decision-making using real-time sensor data, while SCADA allows for remote monitoring, data logging, and system visualization. This setup allows operators to manage tank parameters from a central interface, improving safety, efficiency, and maintenance This paper emphasizes the importance of sensor selection, automation, and communication technologies in optimizing tank operations. By using a PLC-SCADA system, industries can reduce human error, prevent failures, and boost overall productivity.

## 1. INTRODUCTION

Industrial tank is a critical component in manufacturing plants, power generation, chemical industries, and other sectors where steam and hot water are required for various processes. The safe and efficient operation of a tank depends on continuous monitoring and control of essential parameters such as water level and temperature. Improper regulation of these parameters can lead to serious operational risks, including tank dry run, overheating, reduced efficiency, increased fuel consumption, and catastrophic failures. Traditional manual monitoring methods are not only inefficient but also prone to human errors, which can compromise system safety to overcome these challenges, Supervisory Control and Data Acquisition systems, along with Programmable Logic Controllers, find widespread application in modern industrial automation. A PLC enables real-time monitoring and automatic control, reducing the need for human intervention. SCADA allows operators to remotely monitor, analyses, and control tank operations, ensuring better safety and efficiency through data visualization and logging. The success of a PLC-SCADA-based tank control system relies heavily on the choice of sensors used for data acquisition. Various level and temperature sensors have been reviewed, including ultrasonic sensors, resistive electrodes, pressure transducers, thermocouples, and RTDs.

Each sensor type has its advantages and limitations. Based on factors such as cost, reliability, precision, and ease of integration, the Ball Float Switch and RTD PT100 sensor The Ball Float Switch is selected for water level monitoring, as it is simple, cost-effective, and highly reliable in harsh industrial conditions. It provides a binary ON/OFF signal, making it ideal for direct PLC integration. Unlike electrode-based sensors, it does not suffer from corrosion or frequent maintenance issues. The RTD PT100 sensor is chosen for temperature monitoring due to its high accuracy, stability, and wide operating range. Unlike thermocouples, it offers linear and consistent temperature readings, ensuring precise boiler temperature regulation. By integrating PLC and SCADA with these sensors, this project aims to enhance the efficiency, reliability, and safety of boiler operations. The system will allow for automatic decision-making, remote monitoring, and data-driven analysis, leading to better process optimization, reduced operational costs, and improved system longevity. This paper explores the importance of automation, sensor selection, and industrial communication technologies in modern boiler management. The findings will contribute to the development of efficient and scalable boiler control solutions, helping industries achieve higher productivity and improved operational safety.

[1] Real- time monitoring and measurement of process parameters (temperature, level, and pressure) in an industrial pharmaceutical chemical reactor using PLC and SCADA system. IJERT July 2020.A Temperature detecting by using RTD technique for monitoring of temperature level in the tank is proposed in this paper. The paper insights into various sensors used for chemical reactor monitoring, including temperature, pressure, and level sensors, highlighting the integration of these sensors for effective process control. By employing a PLC (Programmable Logic Controller), the system ensures accurate measurement and seamless coordination of various parameters, leading to enhanced safety, efficiency, and consistency in reactor operations.
[2] Boiler Management System. UGC Care Group I Listed Journal January2020. This paper presents a solution using SCADA and PLC systems, along with a PID controller, to monitor and control critical boiler parameters. This approach

improves automation, enhances boiler efficiency, and minimizes financial losses by allowing operators to analyse and store data effectively UGC Care Group I Listed Journal January2020. In processing industries, especially chemical ones, boilers require precise control of temperature, pressure, steam, and water flow to avoid shutdowns. Traditional relay logic systems were complex and difficult to troubleshoot.

[3] design and implementation of boiler automation system using plc. ICASERT 2019. This paper presents the design and implementation of an automated boiler control system using PLCs to minimize errors. The system automatically starts and stops the boiler based on pre-set values, with sensors measuring temperature and sending data to the PLC for control. Additionally, the boiler can be operated for specific periods using an ON-OFF push button that is suggested in this research.

## 2. OBJECTIVES

- Develop a smart monitoring and control system that eliminates human error and significantly strengthens safety protocols.

- Implement real-time data collection and automated control strategies to mitigate the risk of critical failures and enhance tank efficiency.

- Improve operational effectiveness by integrating a PLC-SCADA system that supports predictive maintenance, reduces downtime, and ensures compliance with industry regulations.

- Prevent equipment malfunctions and expensive repairs by making real-time adjustments based on precise sensor data, thereby prolonging the lifespan of industrial tank systems.

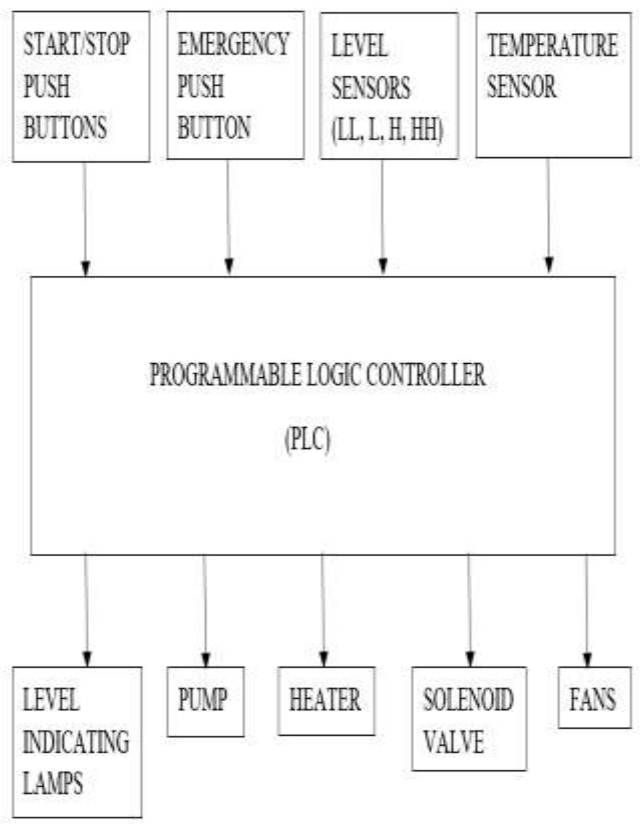
- Minimize excessive energy usage and operational expenses by employing advanced automation and intelligent control techniques.

- Establish a resilient system capable of managing unexpected deviations and maintaining an uninterrupted industrial workflow with minimal human oversight.

A highly efficient and intelligent control mechanism, this project redefines industrial automation by seamlessly integrating precision, reliability, and safety. It serves as an essential asset in modern industrial applications where operational efficiency is critical.

## 3. PROBLEM STATEMENT

Industrial tank plays a vital role in modern manufacturing and energy production, yet they operate in high-risk environments that require continuous monitoring. These systems function under intense pressures and temperatures, presenting substantial safety hazards such as explosions, system breakdowns, and severe inefficiencies. Despite advancements in industrial automation, many facilities continue to depend on outdated, manually operated methods that are susceptible to human error, potentially resulting in catastrophic failures and financial setbacks Furthermore, inadequate monitoring of tank parameters such as temperature, and water levels can lead to hazardous operating conditions, excessive fuel usage, and expensive downtime. Traditional methods lack real-time adaptability, resulting in delays in corrective measures, which can amplify minor issues into serious failures. Hence, an advanced automated control system is not merely beneficial but essential for ensuring the smooth, safe, and efficient operation of industrial tank.

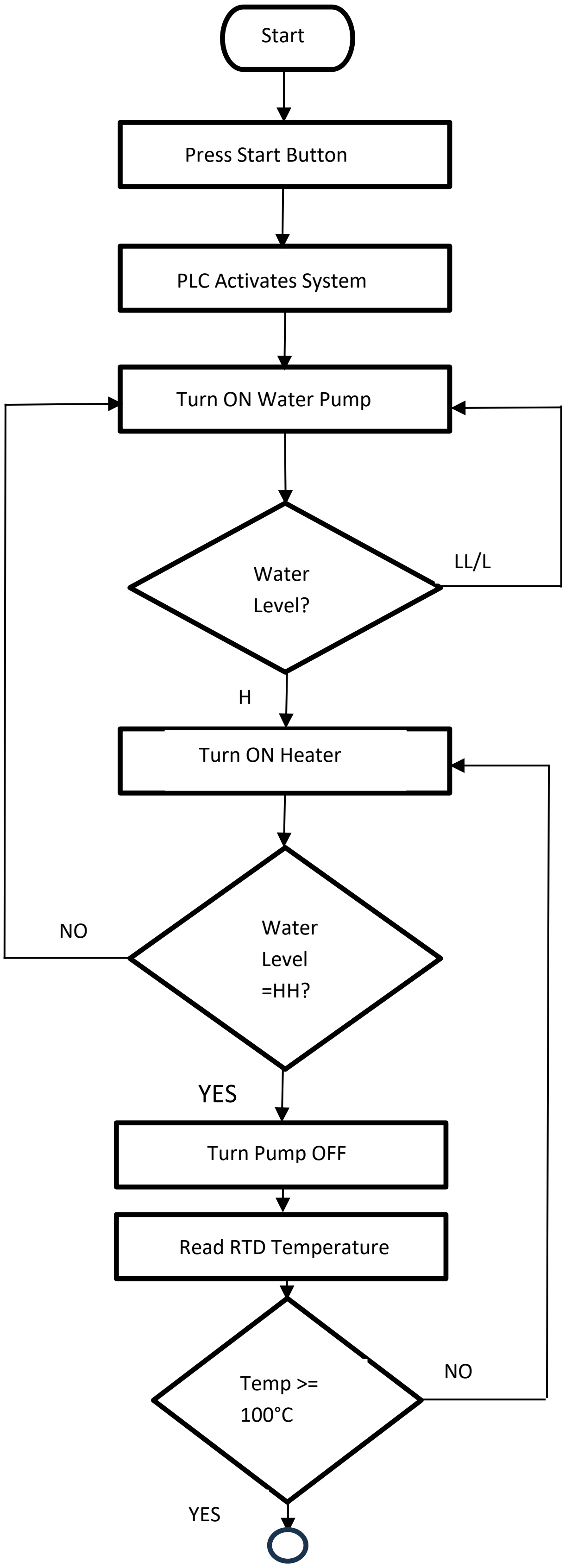



The given block diagram represents the control system of an automated boiler project using a Programmable Logic Controller (PLC). The system is designed to manage the water level, temperature, and various actuators involved in the boiler operation. The major components are described below:
Start/Stop Push Buttons: These push buttons are used to initiate or terminate the system operation manually. When the start push button is pressed, the system begins its process cycle. The stop button is used to halt the process under normal operating conditions. Emergency Push Button: This button is used in critical or hazardous situations to stop all operations immediately. It bypasses the regular shutdown procedure and cuts off all output signals from the PLC. Temperature Sensor (RTD): The RTD sensor measures the temperature inside the b. An anaog-to-digital converter (ADC) is used to convert the analoge temperature into a digit format, which is hen relayed to the PLC. The PLC interprets this data to control the operation

of heaters and fans. Programmable Logic Controller (PLC): Serving as the primary control unit, the PLC collects input signal from multiple sensors and push buttons. It evaluates this signal using pre-defined logic and produces corresponding outputs to operate various actuators. It ensures the boiler operates safely and efficiently.

Our project introduces a sophisticated PLC-based tank automation system engineered to enhance efficiency, safety, and precision in industrial operations. At the core of this system is a Programmable Logic Controller (PLC), functioning as the central automation unit, continuously analyzing real-time data from multiple sensors and executing control actions with exceptional accuracy. The input module collects crucial data from a temperature sensor, pressure sensor, and level sensor, each playing a key role in sustaining optimal operating conditions. The temperature sensor maintains safe thermal limits, the pressure sensor safeguards against hazardous pressure buildup, and the level sensor precisely monitors water levels to prevent overfilling or dry-run scenarios. Additionally, start and stop push buttons enable operators to effortlessly manage system functions. Once the PLC processes this data, it communicates with the output module, which comprises key actuators essential for efficient tank operation. A high-capacity water pump maintains a steady and controlled water supply, while a precision-engineered solenoid valve precisely regulates steam flow. To further improve safety, a pressure relief valve functions as a failsafe, instantly releasing excess pressure when required. The powerful heating rod activates with controlled intensity, ensuring the water reaches the optimal temperature for steam generation. Additionally, a multi-stage level indication system (LL, L, H, HH) provides operators with real-time visual feedback on water levels. This advanced automation system is carefully designed to minimize human error, maximize energy efficiency, and improve operational safety. By leveraging cutting-edge automation technology, our PLC-based setup revolutionizes tank management, ensuring a seamless, this system doesn't stop at just monitoring water levels—it takes automation to unparalleled heights with the integration of a highly sensitive Resistance Temperature Detector (RTD) sensor. This sensor operates with pinpoint accuracy, continuously tracking the temperature to guarantee optimal thermal efficiency. The moment the water temperature crosses 150°C, the system instantly deactivates the heater, preventing hazardous overheating and ensuring maximum energy conservation. This real-time, self-regulating mechanism eliminates the risk of human error, ensuring the highest level of reliability and performance. By incorporating cutting-edge industrial automation, our project doesn't just improve tank management—it revolutionizes it. This next-generation system provides a seamless, ultra-efficient, and highly secure operational framework, reducing manual workload to near zero while skyrocketing productivity to unprecedented levels. This innovative approach makes our automated tank management system an indispensable asset, setting a new gold standard for industrial efficiency, safety, and energy optimization.

## 4. FLOW CHART



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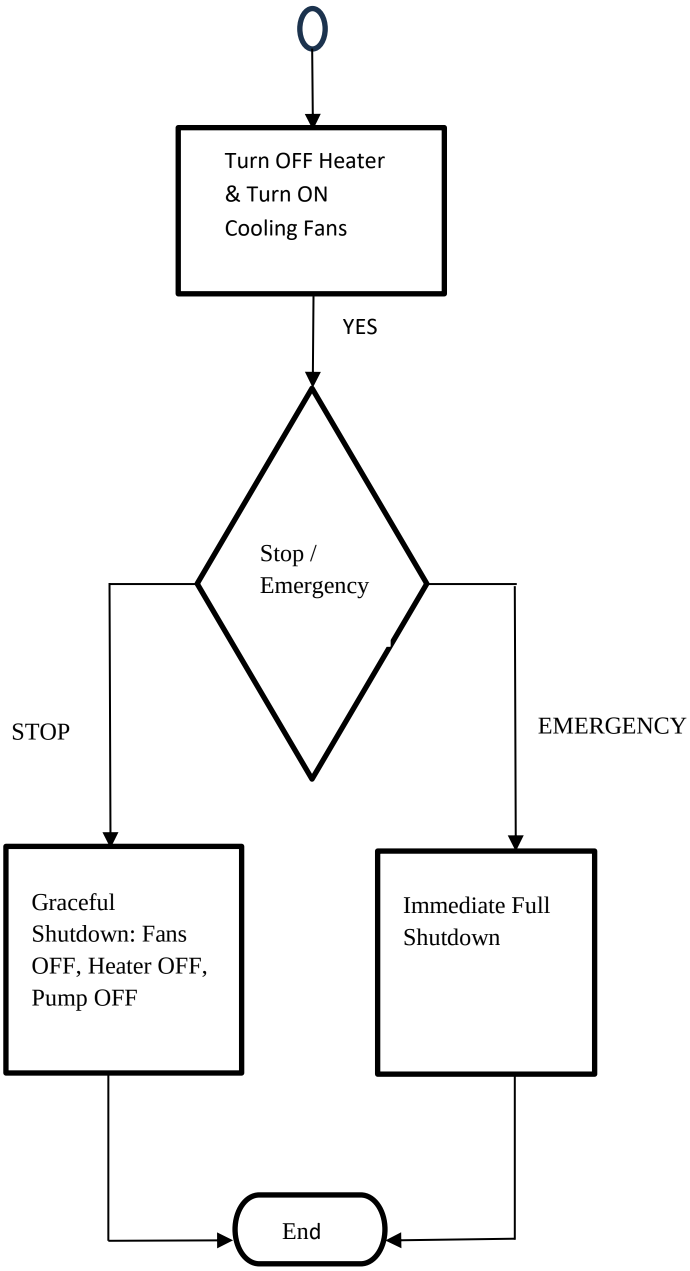



Our project presents an innovative, fully automated tank control system, designed to enhance efficiency, safety, and precision in industrial applications. Utilizing state-of-the-art automation technology, this system operates with exceptional intelligence, minimizing the need for manual intervention while guaranteeing seamless performance. At the heart of this advanced system is a highly responsive level sensor that continuously and precisely monitors the water level within the tank. The moment the system detects the water level falling within the critical range of 0% to 80%, it promptly activates the high-powered motor and inlet valve, ensuring a controlled water inflow. Once the water level reaches 80% or higher, the system immediately stops the motor and inlet valve, preventing any risk of overfilling that could lead to severe operational failures. As soon as the level stabilizes at 60%, the powerful the heating system is then activated, ensuring rapid and highly efficient steam generation.

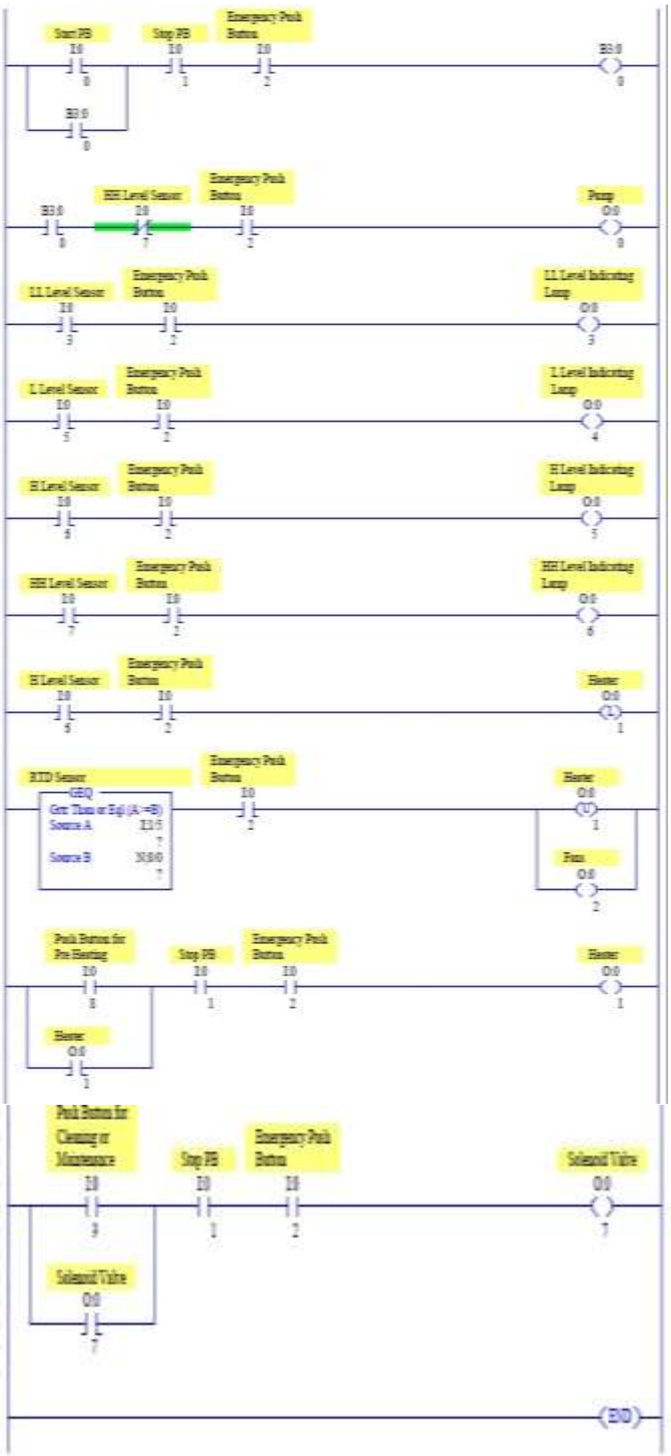
## 5. HARDWARE IMPLEMENTATION & RESULT

The system has been successfully designed and implemented for the automation of a water tank, with continuous monitoring and measurement of parameters such as temperature and level. The entire reactor water tank process is managed by a Programmable Logic Controller (PLC), which converts analog signals into the necessary digital format. Real-time temperature and level data are visually represented in the SCADA system through graphical displays.

## 6. CONCLUSIONS

An industrial tank automation system was designed and implemented using a PLC. Sensors were employed to monitor and maintain both temperature and water level. When the temperature exceeds a predefined threshold, the heater is turned off to allow the temperature to decrease. Conversely, if the temperature falls below the set limit, the heater is activated to raise the temperature and maintain it. In the future, the system can be further enhanced by integrating application-oriented features such as remote monitoring of the tank through SCADA with internet connectivity.

## 7. PROGRAMMING



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