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Display Tank Level Using PLC

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Abstract:This project presents the design and implementation of a PLC-based tank level monitoring and display system. The system is developed to measure the liquid level inside a tank using a suitable level sensor and process the sensor signal through a Programmable Logic Controller (PLC). The measured level is displayed on an HMI or digital display in real time, allowing the operator to monitor the tank status easily. Based on predefined level limits, the PLC can control the operation of a pump, such as switching it ON when the level is low and OFF when the tank is full. The system can also provide high-level and low-level alarms to prevent overflow, dry running, and wastage of liquid. This PLC-based method improves monitoring accuracy, reduces manual supervision, and increases the safety and efficiency of industrial tank-level control applications.

Keywords: PLC, tank level monitoring, level sensor, HMI, pump control, automation, liquid level display

1.INTRODUCTION

Water and other liquid storage tanks are widely used in domestic, commercial, agricultural, and industrial applications. In many processes, maintaining the correct liquid level inside a tank is very important for the safe and continuous operation of the system. Traditionally, tank levels are monitored manually by observing the tank or using a simple indicator. Although this method is easy to implement, it requires continuous human supervision and may not provide accurate or real-time information. Manual monitoring can also result in tank overflow, liquid wastage, pump damage, and interruption of the industrial process.

With the development of industrial automation, Programmable Logic Controllers (PLCs) are increasingly used for monitoring and controlling different industrial operations. A PLC is a digital control device that receives signals from input devices, processes them according to a programmed logic, and provides appropriate outputs to control machines or equipment. PLCs are reliable, flexible, easy to program, and suitable for both simple and complex automation systems. These features make PLCs useful for controlling pumps, motors, valves, conveyor systems, temperature systems, and liquid-level applications.

The project "Tank Level Display Using PLC" is designed to monitor the level of liquid inside a tank and display the level to the operator in real time. The system uses a level sensor to detect the quantity of liquid in the tank. The output signal from the sensor is connected to the input section of the PLC. The PLC processes this signal and determines the present condition of the tank. The tank level can then be displayed using an HMI, LCD, LED indicators, digital display, or SCADA-based monitoring screen.

The main purpose of the system is to provide a clear and reliable indication of the liquid level without requiring the operator to physically inspect the tank. The level can be divided into different conditions such as low level, medium level, high level, and full level. Each condition can be represented through a display or indicator. For example, a green indication may represent a normal level, a yellow indication may represent a warning level, and a red indication may represent a high or critical level. This makes the system easy to understand and operate.

In addition to displaying the tank level, the PLC can also be programmed to control the pump automatically. When the liquid level falls below the lower limit, the PLC can send an output signal to start the pump. The pump continues to fill the tank until the liquid reaches the upper limit. When the tank becomes full, the PLC sends another signal to stop the pump. This automatic operation reduces the need for manual control and prevents the pump from running unnecessarily.

An important advantage of this system is the prevention of tank overflow. Overflow may lead to wastage of water or chemicals, damage to nearby equipment, and unsafe working conditions. By setting a maximum level in the PLC program, the pump can be stopped automatically when the tank reaches its full capacity. Similarly, a low-level alarm can be used to warn the operator when the liquid level becomes too low. This helps prevent dry running of the pump, which may cause overheating or mechanical damage.

The proposed system consists of several important components, including a storage tank, level sensor, PLC, input-output modules, pump, relay or contactor, display unit, and alarm indicators. The level sensor may be selected according to the type of liquid, tank size, required accuracy, and application conditions. Depending on the design, float sensors, conductive probes, ultrasonic sensors, pressure sensors, or analog level transmitters can be used. The sensor provides either digital or analog information to the PLC.

When a digital sensor system is used, the PLC receives ON or OFF signals corresponding to predefined liquid levels. In an analog system, the sensor provides a variable signal related to the actual liquid level. The PLC

converts and processes this signal and displays the level in percentage, height, or other suitable units. An analog system can provide more detailed level information, while a digital system is simpler and more economical for basic applications.

The PLC program contains the control logic required for tank-level monitoring and pump operation. It may include start and stop conditions, interlocking logic, alarm conditions, delay timers, and emergency stop functions. Interlocking is important because it prevents the pump from operating under unsafe conditions. For example, the pump can be prevented from starting when the source tank is empty or when a fault condition is detected. The control program can also be modified according to the requirements of different industrial processes.

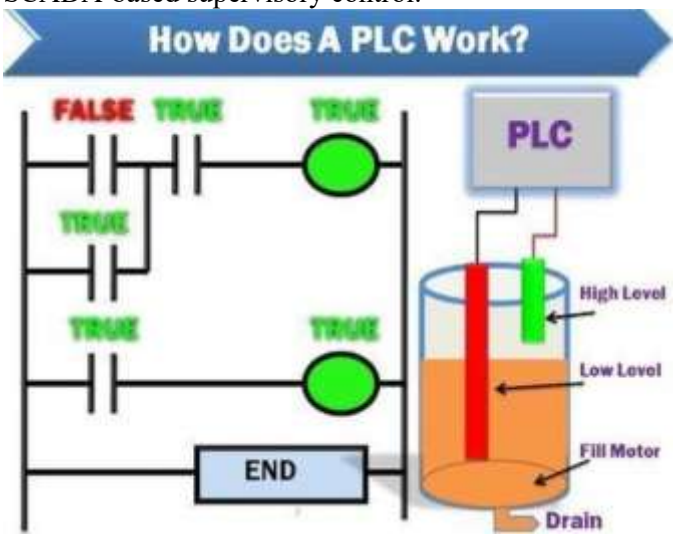
The display unit is another important part of the project. It provides the operator with visual information about the current condition of the tank. An HMI can display the actual tank level, pump status, alarm messages, and operating conditions. A simple LED display can be used for small and low-cost applications, while an HMI or SCADA system is more suitable for large industrial plants. By using a display system, the operator can quickly identify whether the tank is empty, filling, normal, nearly full, or completely full.

The implementation of a PLC-based tank-level display system offers several benefits. It improves the accuracy of level monitoring, reduces human effort, saves water and energy, and improves the safety of the overall process. It also reduces the possibility of errors caused by manual observation. Since PLC systems are programmable, changes can be made easily without replacing the complete control system. Additional sensors, alarms, displays, and control functions can also be added when required.

This project is useful in industries such as water treatment plants, chemical industries, food-processing plants, pharmaceutical industries, agriculture, cooling systems, and manufacturing units. In these applications, correct tank-level control is necessary for maintaining product quality, process continuity, and equipment safety. The same basic control concept can be adapted for different tank capacities and liquid materials.

The main objectives of this project are to measure the liquid level accurately, display the level in real time, control the pump automatically, prevent overflow and dry running, and provide warning signals during abnormal conditions. The project also demonstrates how PLC technology can be applied to solve a practical industrial automation problem.

In conclusion, the Tank Level Display Using PLC system is an efficient and reliable solution for automatic liquid-level monitoring and control. It combines sensor technology, PLC programming, display systems, and pump control to provide a safe and user-friendly automation system. The project represents an important application of PLCs in industrial automation and can be further developed by adding remote monitoring, data logging, IoT connectivity, mobile notifications, and SCADA-based supervisory control.



2. *Literature Survey*

Tank-level monitoring and control is an important part of industrial automation. Liquid tanks are used in water treatment plants, chemical industries, food-processing units, pharmaceutical industries, agricultural systems, and manufacturing plants. Maintaining the correct liquid level is necessary to avoid overflow, shortage of material, pump damage, and interruption of the production process. Various methods have been developed for measuring and controlling tank levels, ranging from simple manual methods to advanced PLC, SCADA, IoT, and sensor-based systems.

2.1 Manual Tank-Level Monitoring

In conventional systems, the liquid level is monitored manually by inspecting the tank or using a graduated scale, sight glass, or mechanical float indicator. This method requires continuous attention from an operator. It may be suitable for small tanks and simple applications, but it is not reliable for large industrial processes.Manual monitoring has several disadvantages. The operator may not always be present near the tank, and the level reading may not be accurate. Delayed observation can cause overflow or emptying of the tank. In addition, manually operating the pump increases the possibility of human error. These limitations created the need for an automatic and reliable tank-level monitoring system.

2.2 Float-Based Level Measurement

Float-based systems are among the simplest methods used for detecting liquid levels. A float moves up and down according to the liquid level. This movement can operate a switch or provide a mechanical indication. In automatic systems, float switches are connected to relays or PLC inputs.

The main advantages of float sensors are their low cost, simple construction, and easy installation. They are suitable for water tanks and other liquids that do not

contain excessive solid particles. However, float sensors have mechanical moving parts that may wear out over time. They may also become stuck due to dirt, chemical deposits, or damage. In addition, a float switch generally provides level information only at fixed points, such as low level or high level, instead of continuous level measurement.

2.*3 Conductive and Electrode-Based Level Sensors*

Conductive level sensors use electrodes placed at different heights inside the tank. When a conductive liquid touches an electrode, an electrical path is formed between the electrodes. This signal is used to detect whether the liquid has reached a particular level.These sensors are commonly used for water-level applications because they are economical and easy to interface with control circuits. Multiple electrodes can be installed to indicate low, medium, high, and full levels. However, this method is not suitable for non-conductive liquids. Electrode corrosion and material deposits can also affect the performance of the system. Therefore, proper selection of electrode material and regular maintenance are required.

2.4 ***Ultrasonic Level Measurement***

Ultrasonic sensors measure the distance between the sensor and the liquid surface by transmitting ultrasonic waves and measuring the time taken for the waves to return. The distance is then converted into the liquid level. Since the sensor does not come into direct contact with the liquid, it is useful for applications involving corrosive or contaminated liquids.Ultrasonic measurement can provide continuous level information and can be connected to a PLC through digital or analog signals. However, its accuracy may be affected by foam, vapour, temperature variations, tank shape, and surface turbulence. The sensor also requires proper positioning to avoid interference from tank walls or internal equipment.

2.5 ***Pressure-Based Level Measurement***

Pressure sensors and differential-pressure transmitters can be used to determine liquid level by measuring the pressure produced by the liquid column. The pressure increases as the liquid height increases. This pressure signal is converted into an electrical output and supplied to the control system.Pressure-based systems are suitable for industrial tanks and can provide continuous measurement. They are often used where the tank is closed or where direct visual inspection is not possible. However, the accuracy depends on liquid density, sensor calibration, and installation conditions. Corrosive liquids may also require special sensor materials and protective arrangements.

2.6 ***PLC-Based Tank-Level Control***

Programmable Logic Controllers are widely used for industrial control because of their reliability, flexibi-lity, and fast response. A PLC-based tank-level syst-em normally consists of a level sensor, PLC, pump,r-elay or contactor, display unit, and alarm circuit.The sensor sends an input signal to the PLC. The PLC co-mpare the measured level with predefined limits and executes the programmed logic. If the liqu-id level is low, the PLC can start the pump.When the liquid re-aches the high-level limit, the PLC can stop the pump . The PLC can also activate alarms during low-level, high-level, or fault conditions.Compared with relay-based control systems, PLCs require less wiring and are easier to modify. Changes in the control sequence can be made through programming instead of chang-ing the complete hardware circuit. PLC systems also provide better possibilities for diagnostics,expansion , interlocking, and communication with HMI or SC-ADA systems.

2.7 HMI and SCADA-Based Monitoring

Human Machine Interface systems are used to displ-ay process information in a simple and understanda-ble format. In a tank-level application, an HMI can show the tank graphic, liquid level, pump status,alar-m messages, and operating mode. The operator can also use the HMI to start or stop the system manually when permitted by the control logic. SCADA systems provide supervisory control and data acquisition fac-lities. They can store historical level data, display tre-nds, generate reports, and provide alarms at a centr-al control station. These features are useful in large industrial plants where several tanks must be monit-ored simultaneously. However, HMI and SCADA systems may increase the total cost and complexity of the project. For small applications, a digital display or LED indication may be sufficient.

2.8 IoT-Based Tank-Level Monitoring

Recent studies have introduced Internet of Things technology into tank-level monitoring systems. In an IoT-based system, sensor data is transmitted through Wi-Fi, GSM, or other communication networks to a cloud platform or mobile application. Users can monitor the tank level remotely and receive notifications when the tank is empty or full.

IoT-based systems provide remote access and data storage advantages. They are useful in domestic-water tanks, agricultural applications, and distribut-ed industrial systems. However, such systems depen-d on network availability, communication security, software configuration, and power supply. For app-locations requiring immediate local control, a PLC remains important even when IoT monitoring is added.

2.9 Comparison of Existing

Method Manual monitoring Simple and low cost Requires continuous human supervision Float switch Economical and easy to install Mechanical wear and limited level points Conductive sensor Low cost and suitable for water Not suitable for non-conductive liquids Ultrasonic sensor Non-contact and continuous measurement Affected by foam, vapour, and turbulence

Pressure sensor Suitable for closed industrial tanks Requires calibration and depends on liquid density Relay-based control Simple for basic applications Difficult to modify and expand PLC-based control Reliable, programmable, and expandable Requires programming knowledge HMI/SCADA system Easy visualization and data monitoring Higher cost and increased complexity IoT-based system Remote monitoring and notifications Depends on network and software availability

2.*10ResearchGap* From the study of existing tank-level monitoring methods, it can be observed that manual and relay-based systems are simple but have limited flexibility and accuracy. Advanced systems such as SCADA and IoT provide more features, but they may be expensive and complicated for small and medium-. Therefore, there is a need for a system that is reliable, economical, easy to operate, and capable of providing real-time level indication and automatic pump control.Using a PLC as the main controller. The system combines a level sensor, PLC logic, display unit, pump control, and alarm indication. It provides real-time tank-level information and automatically controls the pump according to predefined level conditions. The design can also be expanded in the future by connecting an HMI, SCADA system, data logger, or IoT communication module.

2.11 Summary The literature survey shows that PLC-based tank-level monitoring is a practical and effective method for industrial automation. It provides better control, flexi-bity, and reliability than manual and basic

3. *Problem Statement*:

In many domestic, agricultural, and industrial applications, liquid storage tanks are filled and monitored manually. The operator generally checks the liquid level by visually inspecting the tank or by using a simple level indicator. This method requires continuous human supervision and does not provide accurate real-time information about the actual tank level.

Due to manual monitoring, the pump may continue to run even after the tank is completely filled, resulting in overflow and wastage of liquid. On the other hand, if the liquid level becomes too low and the pump continues to operate, dry running may occur. Dry running can cause overheating, mechanical damage, and reduction in the operating life of the pump. Manual operation may also result in delayed responses, human errors, unnecessary energy consumption, and unsafe working conditions.

Basic relay-based control systems can provide automatic switching, but they have limited flexibility and are difficult to modify when the operating requirements change. They may also require more wiring and provide limited information to the operator. In addition, simple systems may only indicate whether the tank is empty or full and may not display the intermediate liquid level.

Therefore, there is a need for an automated system that can continuously detect the liquid level, display the current level clearly, and control the pump according to predefined conditions. The system should also provide warning indications during low-level and high-level conditions.

The proposed project develops a PLC-based tank-level display and control system. A suitable level sensor is used to detect the liquid level in the tank. The sensor signal is supplied to the PLC, where it is processed according to the programmed control logic. The current tank level is displayed using an HMI, LCD, LED indicators, or another suitable display unit. When the liquid level reaches the lower limit, the PLC starts the pump, and when the tank reaches the upper limit, the PLC stops the pump automatically. Alarm signals can also be provided to indicate abnormal or critical conditions.

The main problem addressed by this project is the lack of an accurate, automatic, reliable, and user-friendly method for monitoring and controlling liquid levels in storage tanks. The proposed PLC-based system aims to reduce human effort, prevent overflow and dry running, minimize liquid wastage**,** improve system safety, and provide efficient real-time monitoring

4. *Proposed System: Tank Level Display Using PLC*

The proposed system is an automated tank-level monitoring and control system based on a Programmable Logic Controller (PLC). The main purpose of this system is to detect the liquid level inside a tank, display the level in real time, and control the pump automatically according to predefined level conditions. The system reduces manual supervision and prevents problems such as tank overflow, liquid wastage, and pump dry running.

4.1 System Overview

The proposed system consists of a liquid storage tank, level sensor, PLC, display unit, pump, relay or contactor, alarm indicators, and power supply. The level sensor is installed inside or above the tank according to the selected sensing method. It detects the presence or height of the liquid and sends an electrical signal to the PLC.

The PLC acts as the main control unit of the system. It receives the input signal from the level sensor and processes it according to the control program. The processed information is used for two main purposes:

1.To display the current liquid level to the operator.

2.To control the operation of the water or liquid pump.

The tank level can be displayed as low, medium, high, or full. In an advanced version, the actual level can be displayed in percentage or height using an analog level sensor and HMI.

4.2 *Block Diagram Description*

The working blocks of the proposed system are given below:
Level Sensor → PLC Input Module → PLC Program → Display Unit and Pump Control

The level sensor detects the liquid level and provides the input signal to the PLC. The PLC compares the input condition with the programmed level limits. According to the result, it activates the display, alarm, pump, or other output devices.

The basic system arrangement can be represented as:

Tank → Level Sensor → PLC → HMI/LED Display
PLC → Relay/Contactor → Pump
PLC → Alarm/Buzzer/Indicator

4.3 *Main Components*

1. *Storage Tank*

The storage tank is used to store water or another suitable liquid. The tank may be divided into different level zones, such as low, medium, high, and full. The capacity and material of the tank depend on the application.

2. *Level Sensor*

The level sensor detects the liquid level in the tank. Depending on the design, a float sensor, conductive probe, ultrasonic sensor, pressure sensor, or analog level transmitter can be used.
For a simple system, separate sensors may be installed at low, medium, high, and full positions. For a continuous measurement system, an analog sensor can be used to provide the actual liquid level.

3. *Programmable Logic Controller*

The PLC is the central processing unit of the system. It receives signals from the level sensor, executes the control program, and produces output signals. The PLC controls the pump, display unit, buzzer, and indicator lamps**.**

*The PLC program may include:
*The PLC program may include:
*Low-level detection
*High-level detection
*Pump start and stop logic
*Overflow protection
*Dry-run protection
*Alarm control
*Manual and automatic operating modes
*Emergency stop logic

4. *Display Unit*

The display unit shows the current tank condition to the operator. It may be an HMI, LCD, LED level indicator, seven-segment display, or SCADA screen. The display can show messages such as:

*Tank Empty
*Low Level
*Medium Level
*High Level
*Tank Full
*Pump ON
*Pump OFF
*Sensor Fault

5. *Pump*

The pump is used to fill the tank. It is operated by the PLC through a relay, contactor, or motor starter. The pump starts when the liquid level reaches the lower limit and stops when the tank reaches the upper limit.

6. *Relay or Contactor*

The PLC output generally cannot directly operate a high-power pump. Therefore, a relay or contactor is used between the PLC and the pump. The PLC provides the control signal, while the relay or contactor switches the pump power supply**.**

7. *Alarm and Indicator Unit*

A buzzer or indicator lamp can be connected to the PLC output. It provides a warning when the tank level is too low, too high, or when a fault occurs. This improves the safety and reliability of the system.

4.4 *Working Principle*

The system operates by continuously monitoring the signal from the level sensor. When the liquid level changes, the sensor sends a corresponding signal to the PLC input. The PLC reads the input and compares it with the programmed conditions.When the tank level is below the minimum limit, the PLC identifies a low-level condition. It displays the low-level message and starts the pump. The pump continues to fill the tank while the PLC monitors the level continuously.When the liquid reaches the required operating level, the PLC changes the display to normal or medium/high level. When the liquid reaches the upper limit, the PLC stops the pump automatically. This prevents liquid overflow.If the liquid level becomes critically low, the PLC can activate a low-level alarm. If the level reaches the full or overflow limit, a high-level alarm can be activated. The system can also be designed to stop the pump immediately if an emergency condition or sensor fault is detected.

4.5 *Control Logic*

The basic control logic of the proposed system is as follows:
*If the tank level is low, start the pump.
*If the tank level is normal, continue monitoring.
*If the tank level reaches the high limit, stop the pump.
*If the tank is full, activate the full-level indication.
*If the liquid level is critically low, activate the low-level alarm.

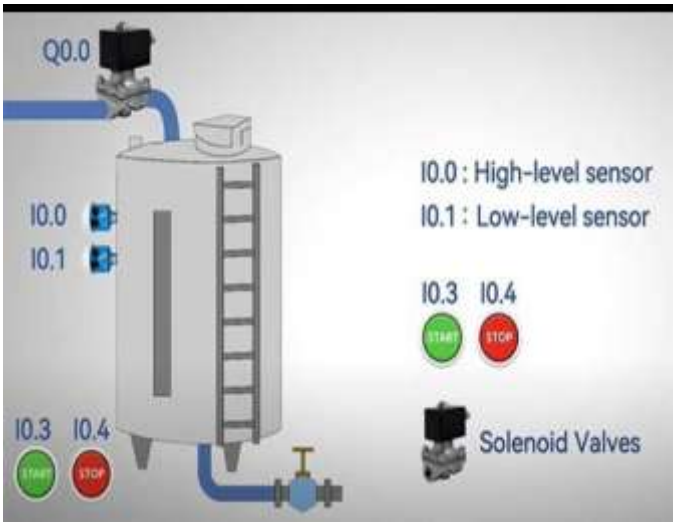
*If a sensor fault is detected, stop the pump and display a fault message.
*The pump should not start when the emergency stop is active.
*The system should avoid frequent ON/OFF operation of the pump by using suitable level differences or delay timers.
A level difference between pump-start and pump-stop conditions is useful. For example, the pump may start at the low-level condition and stop at the full-level condition. This prevents rapid switching when the liquid level is close to one particular limit.

5.Hardware Requirements
•PLC
•Liquid-level sensors
•Water tank
•Water pump
•Relay/contactor
•HMI/LCD/LED display
•Buzzer and indicator lamps
•Start/Stop push buttons
•24V DC power supply
•MCB/fuse and overload •relay
•Connecting wires and •control panel

•Software Requirements

•PLC programming software
•Ladder Logic programming •tool
•HMI configuration software
•PLC simulation software
•Communication driver/•software
•Computer or laptop with •Windows OS

Examples: Siemens TIA Portal, Mitsubishi GX Works, Delta ISPSoft, or Allen-Bradley Connected Components Workbench.



6. Methodology

The methodology of the proposed Tank Level Display Using PLC system consists of sensing the liquid level, processing the sensor signal through the PLC, displaying the level, and controlling the pump automatically.

Step 1: System Design

The complete system is designed by selecting a suitable tank, level sensors, PLC, pump, display unit, relay, and alarm devices. The sensor positions are decided according to the required low, medium, high, and full-level conditions.

Step 2: Sensor Installation

Level sensors are installed at different heights inside the tank. These sensors detect the presence of liquid at each level and send signals to the PLC input module.

Step 3: PLC Input Connection

The outputs of the level sensors, start/stop push buttons, emergency stop, and overload relay are connected to the PLC input terminals. Proper electrical connections and safety protection are provided.

Step 4: ***PLC Programming***

The control program is developed using Ladder Logic. The program includes:

*Low-level detection

*Medium-level indication

*High-level detection

*Full-level detection

*Pump ON/OFF control

*Alarm operation

*Emergency stop logic

*Manual and automatic modes

Step 5: ***Display Configuration***

The HMI, LCD, or LED display is configured to show the tank level and pump status. The display may indicate messages such as LOW LEVEL, MEDIUM LEVEL, HIGH LEVEL, FULL TANK, PUMP ON, and PUMP OFF.

Step 6: Pump Control

When the liquid level falls below the minimum limit, the PLC activates the relay or contactor and starts the pump. The pump fills the tank until the liquid reaches the full-level sensor.

Step 7: Overflow Protectio

When the tank reaches the maximum level, the PLC switches OFF the pump. This prevents overflow and reduces liquid wastage.

Step 8: Alarm Operation

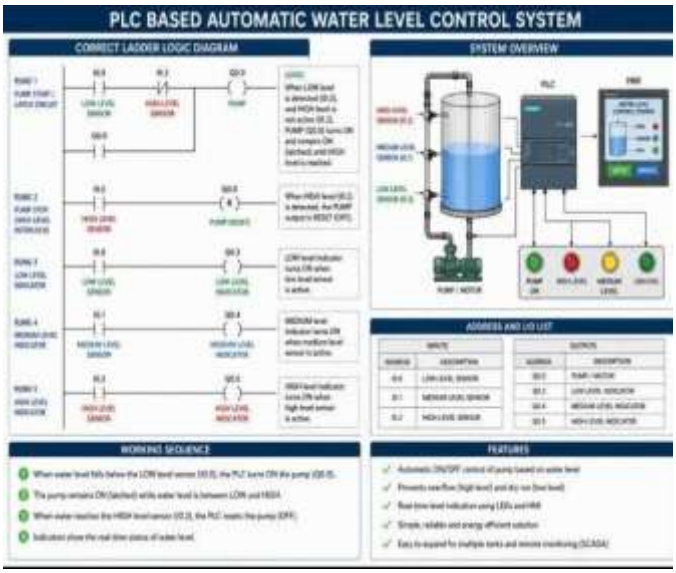
A buzzer or warning lamp is activated during low-level, high-level, sensor-fault, or emergency conditions. This alerts the operator and improves system safety.

Step 9: Program Testing

The PLC program is tested using simulation software or a practical prototype. Different conditions such as low level, high level, full tank, pump operation, and emergency stop are checked.

Step 10: System Implementation

After successful testing, the sensors, PLC, display, pump, and alarm components are assembled in the control panel. The complete system is then operated and verified under practical conditions.



7. *Experimental Results*

The developed PLC-based tank-level display system was tested under different liquid-level conditions. The purpose of the experiment was to verify the operation of the level sensors, PLC program, display unit, pump control, and alarm system.During testing, the liquid level was changed manually to simulate low, medium, high, and full-tank conditions. The corresponding PLC inputs, display indications, pump operation, and alarm response were observed.

7.1 ***Observation Table***

Tank empty/very low Low-level sensor ON LOW LEVEL Pump ON Low-level alarm ON Low level Low-level sensor ON LOW LEVEL Pump ON Warning indication Medium level Medium-level sensor ON MEDIUM LEVEL Pump remains ON Alarm OFF High level High-level sensor ON HIGH LEVEL Pump remains ON or prepares to stop Alarm OFF Tank full Full-level sensor ON FULL TANK Pump OFF Full-level indication ON Emergency condition Emergency input ON EMERGENCY STOP Pump OFF Alarm ON Sensor fault Abnormal sensor signal SENSOR FAULT Pump OFF Fault alarm ON

7.2 ***Experimental Procedure***

The PLC, sensors, display unit, pump, and alarm circuit were connected according to the system diagram.

The PLC program was downloaded using Ladder Logic programming software.
The tank was initially kept at a low liquid level.
The low-level sensor signal was given to the PLC.
The PLC started the pump automatically.
The liquid level was gradually increased.
The display was observed at low, medium, and high-level conditions.
When the liquid reached the full-level sensor, the PLC stopped the pump.
Emergency stop and alarm conditions were also tested.
The results were compared with the programmed control logic.

7.3 ***Results Obtained***

The experimental observations showed that the PLC correctly received the signals from the level sensors and processed them according to the programmed logic. The display unit successfully indicated the tank condition. The pump started automatically when the liquid level was low and stopped when the tank reached the full-level condition.The system also provided proper warning indications during low-level and emergency conditions. The automatic pump control helped prevent overflow and reduced the need for manual supervision. The test confirmed that the system can be used for real-time tank-level monitoring and automatic pump operation.

7.4 Performance Summary

Low-level detection Successful Medium-level indication Successful High-level indication Successful Full-level detection Successful Automatic pump starting Successful Automatic pump stopping Successful Tank overflow prevention Achieved Alarm operation Successful Display operation Successful Emergency stop operation Successful

7.5 ***Discussion***

The experimental results demonstrate that the proposed system is reliable for basic tank-level monitoring and control. The use of a PLC makes the system flexible and easy to modify. Different level limits, delay timers, alarm conditions, and operating modes can be added through program changes.
The system reduces human effort and improves safety by automatically controlling the pump. It also provides a clear display of the current tank condition. However, the accuracy of the system depends on the type, position, and calibration of the level sensors. Proper sensor installation and electrical protection are required for long-term reliable operation.

8.Advantages

•Real-time tank-level •monitoring
•Automatic pump ON/OFF •control
•Prevents tank overflow
•Protects the pump from •dry running
•Reduces human effort and •errors

•Minimizes liquid wastage
•Provides alarm indications
•Easy to operate and •maintain
•Flexible and easy to •reprogram
•efficiency

9.Applications

•Water storage tanks
•Water treatment plants
•Chemical industries
•Food-processing industries
•Pharmaceutical industries
•Agricultural irrigation systems
•Cooling and heating systems
•Manufacturing industries
•Domestic and commercial buildings
•Fuel and liquid storage systems

10. Future Scop

The proposed Tank Level Display Using PLC system can be further improved and expanded to meet adv-anced industrial automation requirements. The pre-esent system provides local tank-level monitoring and automatic pump control. In the future, additional hardware, communication systems, and software features can be integrated to improve the performan-ce, flexibility, and reliability of the system.

*10.1 **IoT-Based remote Monitoring***

The PLC can be connected to an IoT module through Ethernet, Wi-Fi, or GSM communication. The tank level can then be monitored remotely using a mobile application or web dashboard. The user can check the liquid level, pump status, and alarm condition from any location.

*10.2 **Mobile Notifications***

The system can be designed to send notifications to the user when the tank level is low, full, or when a fault occurs. SMS, email, or mobile application notifications can be used. This will help the operator respond quickly without continuously observing the display panel.

*10.3 **SCADA Integration***

The system can be connected to a SCADA platform for industrial-level monitoring and control. SCADA can display real-time tank levels, pump status, alarm history, and trend graphs. It can also store process data for future analysis and maintenance records.

*10.4 **Continuous Level Measurement***

Instead of using only ON/OFF sensors, an ultrasonic, pressure, or radar level sensor can be used. This will allow the system to measure the exact liquid level continuously and display it in percentage, centimetres, or litres.

*10.5 **Multiple Tank Monitoring***

The system can be expanded to monitor and control several tanks at the same time. A single PLC or network of PLCs can be used to control multiple pumps, valves, and storage tanks. This feature is useful in water treatment plants, chemical industries, and manufacturing plants.

*10.6 **Automatic Valve Control***

Motorized control valves can be added to regulate the flow of liquid into and out of the tank. The PLC can control both the pump and the valves according to the tank level, flow requirement, and process conditions.

*10.7 **Flow Measurement***

A flow sensor can be included to measure the amount of liquid entering or leaving the tank. The PLC can compare the flow rate with the tank-level change and identify leakage, blockage, or abnormal pump operation.

*10.8 **Leakage Detection***

Additional sensors can be installed near the tank, pipeline, or pump area to detect leakage. If leakage is detected, the PLC can stop the pump and activate an alarm. This can reduce liquid wastage and prevent damage to equipment.

*10.9 **Advanced Alarm System***

The present alarm system can be improved by adding different alarm levels, such as warning, critical, and emergency alarms. Alarm history can be stored and displayed on the HMI or SCADA system. This allows the operator to identify repeated problems and take corrective action.

10.*10 **Data Logging and Report Generation*** The

tank-level data, pump operating time, alarm conditions, and liquid usage can be stored in a database. Daily, weekly, or monthly reports can be generated. This information can help in process analysis, water management, energy management, and maintenance planning.

*10.11 **Energy-Efficient Pump Control*** The

system can be improved to reduce energy consumption by operating the pump only when required. Variable Frequency Drives (VFDs) can be used to control the pump speed according to the liquid demand. This can

provide smooth operation and reduce mechanical stress on the pump.

10.12 Automatic Fault Detection The PLC program can be enhanced to detect different faults, such

Sensor failure
Pump overload

Pump not running
Dry running
Communication failure
Power failure
Unexpected level change

When a fault is detected, the system can stop the pump and display the corresponding fault message.

10.13 Predictive Maintenance

By recording pump operating hours, current consumption, vibration, and alarm history, the system can help predict equipment failure. Maintenance can then be performed before serious damage occurs. This can reduce downtime and increase the operating life of the pump.

11.Conclusion

The project "Tank Level Display Using PLC" successfully demonstrates an automatic system for monitoring and controlling the liquid level in a tank. The level sensors detect the liquid condition and send signals to the PLC. The PLC processes these signals and displays the tank level through an HMI, LCD, or LED display.The system automatically starts the pump when the liquid level is low and stops the pump when the tank reaches the full level. This helps prevent tank overflow, liquid wastage, pump dry running, and human errors. The alarm and indicator system also provides useful warnings during low-level, high-level, and emergency conditions.The proposed system is reliable, flexible, easy to operate, and suitable for domestic, agricultural, and industrial applications. It reduces manual supervision and improves the safety and efficiency of liquid-level control. In the future, the system can be enhanced using IoT, SCADA, mobile notifications, data logging, and remote monitoring. Thus, the PLC-based tank-level display system provides an effective and practical solution for automatic tank-level management.

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