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RESEARCH ARTICLE

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DEVELOPMENT OF A REAL-TIME MONITORING AND CONTROL SYSTEM FOR AN INDUSTRIAL PLANT USING PLC AND SCADA TECHNOLOGIES

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ABSTRACT

Automated systems are technological solutions designed to operate with minimal or no human intervention, performing tasks with high precision and efficiency. These systems maximize operations in a variety of areas, including the commercial, industrial, and residential sectors, by combining sensors, actuators, and sophisticated control logic. They are utilized in anything from intelligent home gadgets to complex industrial processes. The design and execution of an extensive automation and control system for an industrial milk processing facility are presented in this paper. Critical manufacturing processes, including water heating and cooling, milk storage, pasteurization, bottling, and cleaning, are all intended to be optimized by the system. Programmable Logic Controllers (PLCs) are employed to control the machinery and equipment, while Human-Machine Interfaces (HMIs) and a Supervisory Control and Data Acquisition (SCADA) system provide centralized monitoring, control, and visualization. The suggested solution combines software and hardware elements to provide an intuitive graphical user interface for process control and operational supervision. The main goals are to increase milk production efficiency, guarantee process dependability, improve product quality, and provide a smooth and user-friendly operator experience.



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1. INTRODUCTION

Automated systems employ cutting-edge technology to manage and execute tasks without direct human intervention, increasing accuracy and efficiency in a variety of sectors. These systems are often built around Programmable Logic Controllers (PLCs), specialized digital computers designed for real-time control in industrial settings. PLCs employ programmable logic to control inputs and outputs in order to connect with sensors, actuators, and other devices. They are necessary for the automation of manufacturing processes, other electromechanical systems, and machinery. PLCs operate constantly, rapidly scanning and updating the control logic to ensure real-time response. These controllers' modular architecture makes it simple to enhance their capabilities and configure them to meet a range of industrial requirements.

Because of their robust architecture and resilience to harsh conditions, PLCs are crucial to the lifetime and dependability of automated systems. Automated systems that manage time-consuming tasks, data collection, and analysis increase the efficiency of scientific research and allow researchers to focus on difficult issues. These systems often include robots, sensors, and artificial intelligence, which expedite testing and enhance data accuracy. The use of automated technologies in labs improves experiment consistency and reproducibility. Researchers' use of automated technology for high-throughput has greatly boosted scientific innovation and discovery.

II. LITERATURE SURVEY

The usage of Supervisory Control and Data Acquisition (SCADA) systems for automation and remote monitoring in the bottle-filling industry is examined in the research in [1], [2]. A sophisticated PLC-SCADA framework for the automated monitoring of petroleum product terminals in an Industry 4.0 setting is proposed by the authors in [3], [4]. Similarly, [5] investigates tank operations and water level control in a semi-automated facility using PLC software in conjunction with SCADA. Simultaneously, [4] focuses on implementing Human-Machine Interfaces (HMIs) for an automated packaging process, enabling remote control and monitoring using mobile applications.

Paper [6] addresses failure reduction in automated metro railway systems by integrating data from the Operational Control Centre, traction SCADA system, traction power control, and power supply system, thereby improving network capacity and operational flexibility. In [7], a low-cost SCADA system for sugar manufacturing is presented, where PLCs control and monitor a laboratory production line. The system combines hardware and software, including PLC programming, HMI design, alarms, and trending systems, and monitors parameters such as temperature, flow, and humidity while detecting potential failures. The design and implementation of a heliostat control system based on a SCADA framework with a standalone remote terminal unit is described in [8], using a fuzzy logic controller integrated on a low-cost microcontroller for precise orientation control.

In [9], the authors suggest employing a PLC Zelio for the SCADA control of a biaxial photovoltaic tracker. The study also proposes a supervision algorithm using SCADA software on VijeoCitect and Android platforms with Tesla SCADA 2, alongside an automatic tracking control method via Zelio Soft 5.4.0. The work in [10] presents a smart automated bottle-filling system integrating PLC-SCADA technology. Bottle filling, warehouse management, and energy-efficient lighting are all automated, and process efficiency is shown through a SCADA simulation. Lastly, [11-13] suggests an analytical model for managing molding machines based on PLC and SCADA, allowing for continuous monitoring using many sensors. The technology guarantees dependable industrial process monitoring, improves power analysis, and permits the collection of quantitative fault data [14-16].

III. GENERAL DESCRIPTION OF MILK FACTORY OPERATIONS

Pasteurization, named after Louis Pasteur, is a crucial process in milk processing. It involves heating milk particles to a specific temperature without recontamination. It serves two purposes: public health to destroy harmful pathogens and keeping quality to improve the quality of milk and milk products.

III.1 PASTEURIZATION METHODS

Milk pasteurization involves heating milk to a specific temperature, holding it for a specific duration, and chilling it to less than 7°C. Combinations of time and temperatures can improve quality, destroy pathogens, or destroy all microorganisms. Selecting the right combination minimizes nutritional loss. Pasteurization methods include Low Temperature Long Time (LTLT) pasteurization, which involves heating milk to a temperature of 63°C and holding it for 30 minutes. Continuous (HTST) pasteurization, also known as Continuous Pasteurization, is carried out continuously in a plate heat exchanger with online detection and recirculation of insufficiently treated milk. It consists of five stages, including regenerative heating, heating, holding, regenerative cooling, and chilling. Flash pasteurization is a severe treatment, heating milk to 85-90°C and holding it for 1 to 4 seconds. Ultra High Temperature (UHT) pasteurization involves heating milk to 135°C and holding it for a minimum of 1.0 seconds, followed by aseptic packaging.

III.2 CIP OPERATION

Cleanliness is crucial for microbiological hygiene and restoring heat transfer and pressure drop characteristics. CIP cleaning is typically a two-stage process using acid and alkali, or specially formulated detergents. In the dairy industry, non-production time for CIP is excessive, ranging from 4 to 6 hours per day. CIP was first developed in the 1950s and is dependent on the type and concentration of solutions used, solution temperature, and time in contact with the deposit substance. Current auto-set CIP cleaning takes about 35 minutes and consists of five steps: pre-rinse, alkali-clean, water rinse, acid rinse, and final rinse.

III.3 BOILER OPERATION

Boiler operation involves the combustion of fuel inside a furnace, which then passes through fire tubes to create steam. This heat energy is transferred to the surrounding water, generating steam and storing it in the same vessel. There are two main types of boilers: water tube boilers, used in large power plants, and fire tube boilers, used for small-scale applications. The horizontal return fire tube boiler is most suitable for low-capacity thermal power plants, with a large steam drum submerged in water. The fuels burnt in the furnace and combustible gases move into the fire tubes, travel through them, and finally come into the smoke box. The hot gases transfer heat to the water via the tube walls, creating steam bubbles that come to the water's surface. As the amount of steam increases, the steam pressure inside the drum increases, reducing the boiling temperature of the water and reducing the rate of production of steam.

Advantages of a fire tube boiler include its compact construction, easy fluctuation of steam demand, and cost-effectiveness. However, disadvantages include high required steam pressure rising time due to large water, limited output steam pressure, not very dry steam, and the risk of explosions. Air-cooled chillers are refrigeration systems that cool fluids and work in tandem with the air handler system of a facility. They consist of four major parts: a compressor, an evaporator, a condenser, and an expansion valve. These chillers are used in large buildings like indoor malls, industrial buildings, hotels, and hospitals, as well as locations with multiple buildings requiring cooling, such as theme parks and outdoor malls. Components of an air-cooled chiller include a compressor, a condenser, fans, an expansion valve, and an evaporator or heat exchanger. The compressor provides the driving force that moves the refrigerant around the system, while the condenser transfers heat from the refrigerant to the air.

The expansion valve expands the refrigerant from its liquid form into a gaseous form before entering the evaporator, creating a pressure drop across the path of the refrigerant that runs to the evaporator. In conclusion, boiler operation involves the combustion of fuel, the transfer of heat energy to the surrounding water, and the use of air cooled chillers and air-cooled chillers.

III.4 FILLING MACHINE

Filling machines are essential tools for filling and packaging various food products, with various types and ranges available in various sectors. The machine has a transfer station, a filling station, a tightness control station, a filling station with an adjustable volumetric dozer, a looping station with a cap transfer, an MB pneumatic motor, an EV3 solenoid valve, and an advance cylinder E. The transfer station feeds the filling conveyor belt via cylinder A, while the filling-capping belt is actuated by jack G. The tightness control station is connected to a rack mounted on the cylinder, and the looping station is equipped with a cap transfer by cylinder F.

IV. CURRENT FACTORY WORK DESCRIPTION:

The factory work description includes various types of equipment used in milk factories. Air-cooled chillers, bottle machines, fire tube boilers, continuous pasteurization, and CIP systems are examples of this equipment. Air-cooled chillers use a compact Programmable Logic Controller (PLC) to cool water, which is then circulated through the factory for air conditioning. The PLC controls the operation of the chiller by monitoring the temperature of the water and adjusting the compressor speed. Bottle machines have filling, capping, and labeling operations with a simple HMI that provides a user-friendly interface for operators to interact with the machine. Fire tube boilers use relay logic control systems to heat water and generate steam. These systems use sensors to monitor various aspects of the boiler's operation, such as water level, temperature, and pressure.

Relay logic control systems, such as the burner and water pump, operate by activating or deactivating relays to control the operation of boiler components. Continuous pasteurization equipment uses a compact PLC and simple HMI to heat and cool liquid products to a specific temperature for a specific amount of time. The process involves heating the product to a specific temperature, holding it at that temperature for a specific amount of time, and then cooling it back down to a safe temperature. Cleaning In Place (CIP) is a cleaning process commonly used in milk factories to clean and sanitize equipment. The CIP system uses a series of components and control systems to automate the cleaning process. The compact PLC monitors various sensors and adjusts the operation of the components as needed. At the same time, the simple HMI provides a user-friendly interface for operators to monitor and control the CIP process.

V. PROBLEMATIC & OBJECTIVES

The objective of Human-Machine Interface (HMI) is to facilitate intuitive communication between humans and machines, enhancing operational efficiency and control in industrial processes. Through graphical interfaces and interactive elements, HMIs aim to present complex data in a user-friendly manner, enabling effective monitoring, control, and decision-making in diverse automation environments [17]. Any monitoring system must have a data acquisition system in order to gather data from the system's many sensors. After that, the data is digitized for storage before being transferred to a control center for processing and display. The purpose of this study is to explore novel system development and project execution methodologies, including:

- Creation a developed HMI for each operation.
- Create a PC station for fully control and remotely control.

V.1 SOFTWARE EQUIPMENTS OF THE SCADA SYSTEM

V.1.1 Tia Portal Software:

For configuring and programming SIMATIC controllers, including PLC and PC-based variants, SIMATIC STEP 7 is an all-inclusive engineering tool. Regardless of user experience, it is appropriate for building SIMATIC S7-1200 and SIMATIC HMI Basic Panels because it provides transparency, intelligent navigation, and straightforward processes. Programming software for industrial automation, SIMATIC STEP 7, is commonly used to set up controller families, including SIMATIC S7-1200, S7-1500, S7-300/400, and WinAC. It comes in two flavors: WinAC TIA Portal 13 SP1 version Basic for network configuration, and Basic S7-1200 Configuration and STEP 7 Professional for S7-1200, S7-1500, and S7-300/400 configuration. In addition to saving configuration time, the software offers advantages, including simple technology item development and instant online diagnostics [18-20].

V.1.2 PLC Configuration

To configure a Siemens S7-1500 PLC in TIA Portal, follow these steps:

- Add the hardware to the project, configure communication settings, and add hardware modules.
- First, select the appropriate device type and model. Then, configure the communication settings by specifying IP address, subnet mask, gateway address, and network parameters.
- Finally, add the required digital and analog input/output, communication, and power supply modules, and configure the parameters for each module, such as input/output addresses and module type.

The principal screen, also known as the home page, is the main interface of the SCADA system, offering a comprehensive overview of the system, key information, alerts, and notifications. It allows users to configure and alter the settings of their connected devices or components, print reports, logs, and other essential SCADA system information, and view trends over time. The report section allows users to build detailed reports based on collected data, providing insights, statistics, and summaries of the system's performance.

The log-on area provides a safe identification mechanism for accessing the system, typically requiring a user name and password or additional credentials. The exit area allows users to safely exit the system, ensuring proper management of unsaved data or configurations. The shutdown department is responsible for shutting down the system, often used for maintenance or switching off the entire system. OB1 is the main organization block in a programmable logic controller (PLC) program, executed cyclically and containing the main program logic.

It coordinates other program blocks and ensures system operation. OB1 may also include calls to other organization blocks and other program parts. OB30 is a cyclic interrupt organization block in a programmable logic controller, executed at a specific time interval, executing cyclic tasks like reading inputs, performing calculations, and updating outputs. The PID Compact function block with a cyclic interrupt OB30 allows precise system control by setting parameters like proportional gain, integral time, derivative time, and filter time, optimizing PID controller performance [21].

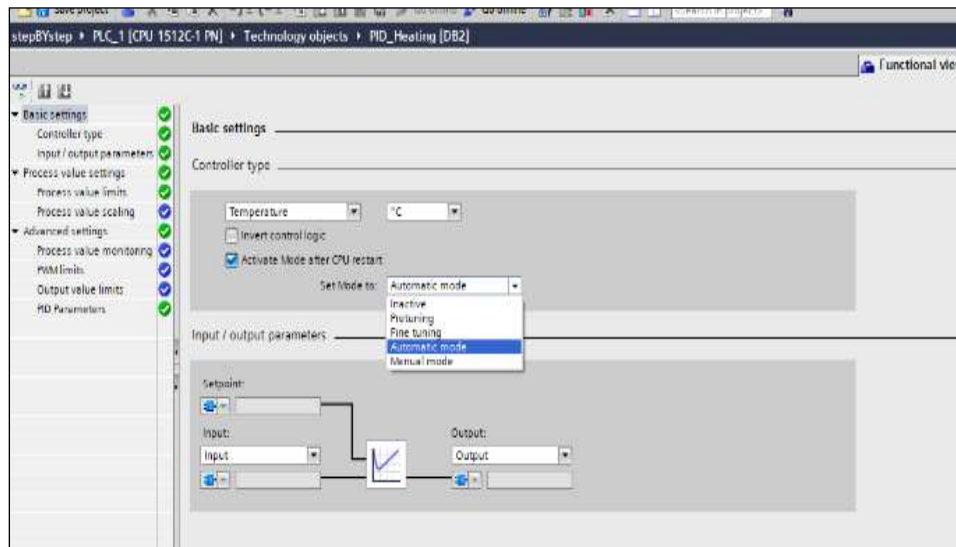


Figure 1: PID settings screen.
Source: Authors, (2026).

Siemens PLCs use two types of programming blocks: FC and DB. FC defines specific functions, reusable for multiple parts of the program. DB is used for complex operations requiring multiple inputs and outputs, like mathematical calculations or data manipulation. DB, or Data Block, defines a collection of data elements used in a program. They store input and output data, intermediate results, and can be structured to meet program requirements. TIA Portal's programming environment allows for the creation and editing of function blocks and data blocks, enabling easier development, testing, and maintenance of modular code.

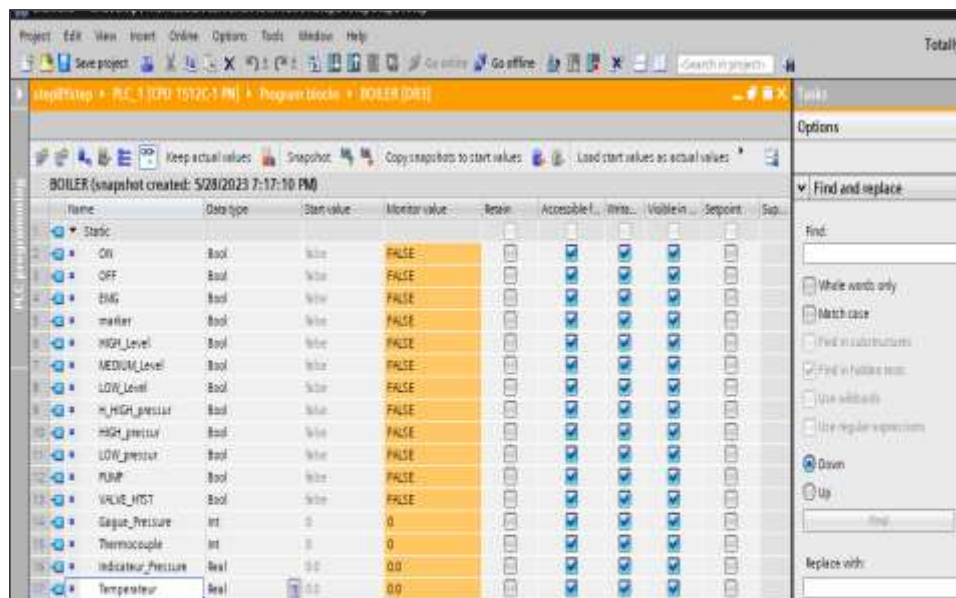


Figure 2: Data block for a fire-tube boiler.
Source: Authors, (2026).

The HMI TP1200 Comfort is a 12-inch touchscreen interface designed for industrial automation applications. It features high-resolution graphics, communication options, and can display and control PLC system data. Programmable using TIA Portal, it supports Ethernet, PROFIBUS, and PROFINET protocols and is rugged with an IP65 rating for protection against dust and water [22-24].

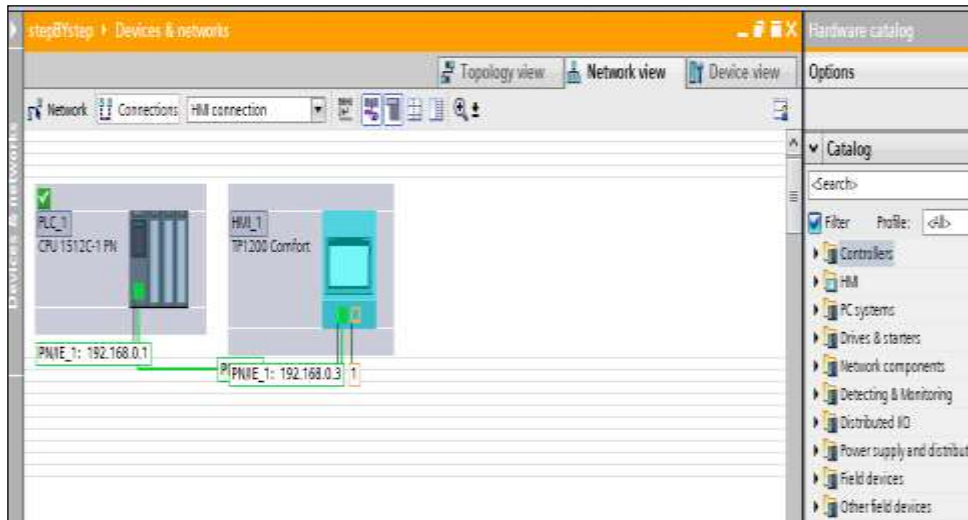


Figure 3: Connection between PLC and HMI.
Source: Authors, (2026).

TIA Portal HMI Tag Management tool allows engineers to create and configure HMI tags, enabling real-time monitoring and control of automation systems through data type, address, and properties [17], [25].

V.1.3 HMI Screens Created

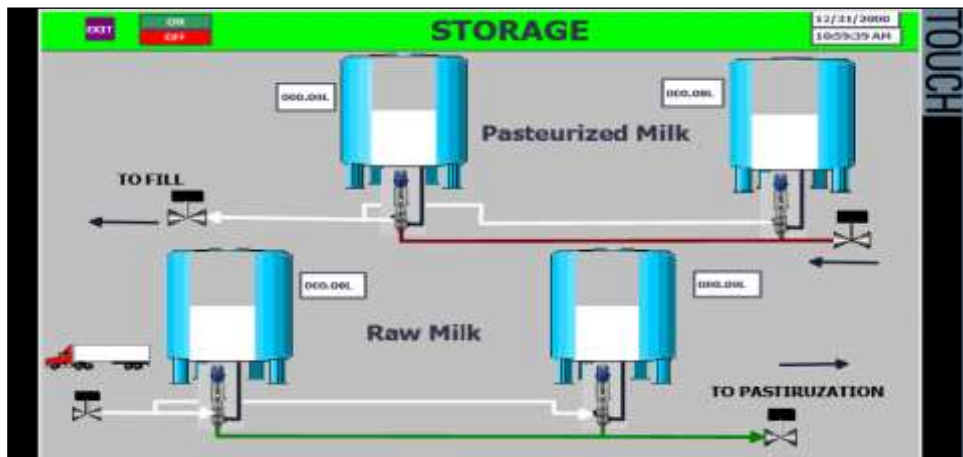


Figure 4: HMI Storage screen.
Source: Authors, (2026).

PLCsim is a TIA Portal simulation tool that enables engineers to test and debug PLC programs in a virtual environment, reducing errors and downtime. It simulates the behavior of various Siemens PLCs, improving system efficiency and reliability.

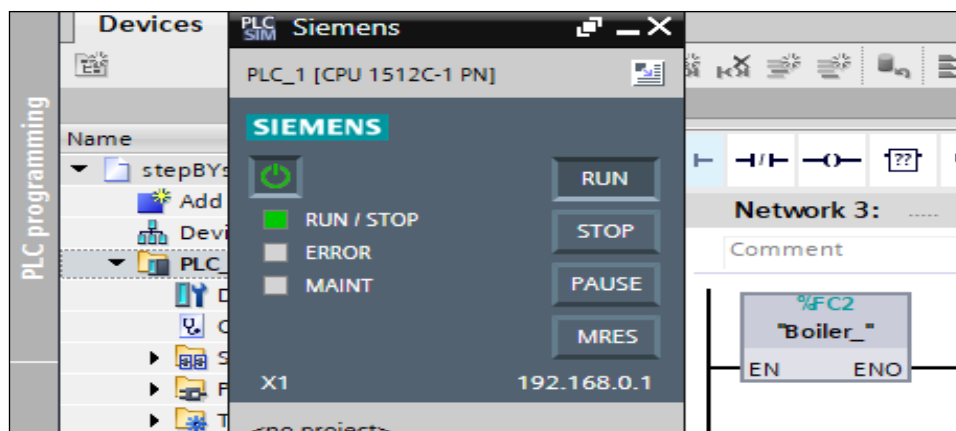


Figure 5: PLCsim window screen.
Source: Authors, (2026).

A PC Station in TIA Portal is a software interface connecting a PC to a Siemens PLC, enabling data exchange and communication. It aids in industrial applications like data logging, process monitoring, and control system visualization, enabling the creation of powerful HMI applications.

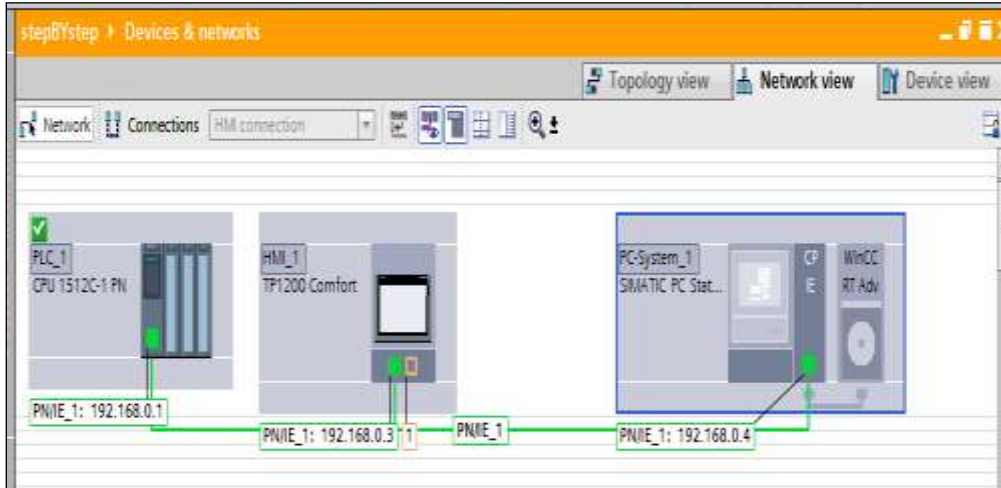


Figure 6: Connection between PLC and PC station.
Source: Authors, (2026).

Trends are graphical representations of data from a Programmable Logic Controller, used to visualize changes in process variables and system performance, enabling operators and engineers to identify potential issues before they escalate.



Figure 7: Trend of levels of tanks.
Source: Authors, (2026).

Historical data analysis from a Programmable Logic Controller (PLC) provides valuable insights into system performance, process variables, and production trends. It helps operators optimize production and identify potential issues. By identifying low production periods and trends in process variables, operators can optimize production and improve quality and efficiency.

The screenshot shows a 'Historical Data for HTSTB' window. It contains a table with columns for 'Date', 'Time', and 'Value'. The data is organized into rows for different variables like 'scada_Temp' and 'scada_pH'. The values are displayed in scientific notation.

Date	Time	Value
09/09/2024	11:50:00	4.5085E+10
09/09/2024	11:50:01	4.5085E+10
09/09/2024	11:50:02	4.5085E+10
09/09/2024	11:50:03	4.5085E+10
09/09/2024	11:50:04	4.5085E+10
09/09/2024	11:50:05	4.5085E+10
09/09/2024	11:50:06	4.5085E+10
09/09/2024	11:50:07	4.5085E+10
09/09/2024	11:50:08	4.5085E+10
09/09/2024	11:50:09	4.5085E+10
09/09/2024	11:50:10	4.5085E+10
09/09/2024	11:50:11	4.5085E+10
09/09/2024	11:50:12	4.5085E+10
09/09/2024	11:50:13	4.5085E+10
09/09/2024	11:50:14	4.5085E+10
09/09/2024	11:50:15	4.5085E+10
09/09/2024	11:50:16	4.5085E+10
09/09/2024	11:50:17	4.5085E+10
09/09/2024	11:50:18	4.5085E+10
09/09/2024	11:50:19	4.5085E+10
09/09/2024	11:50:20	4.5085E+10

Figure 8: Historical window screen.
Source: Authors, (2026).

Alarms are notifications in a PLC system, triggering events like sensor failure or machine fault. They alert operators and engineers to potential issues. TIA Portal allows customization of alarm settings, such as priority, severity, and acknowledgement requirements.

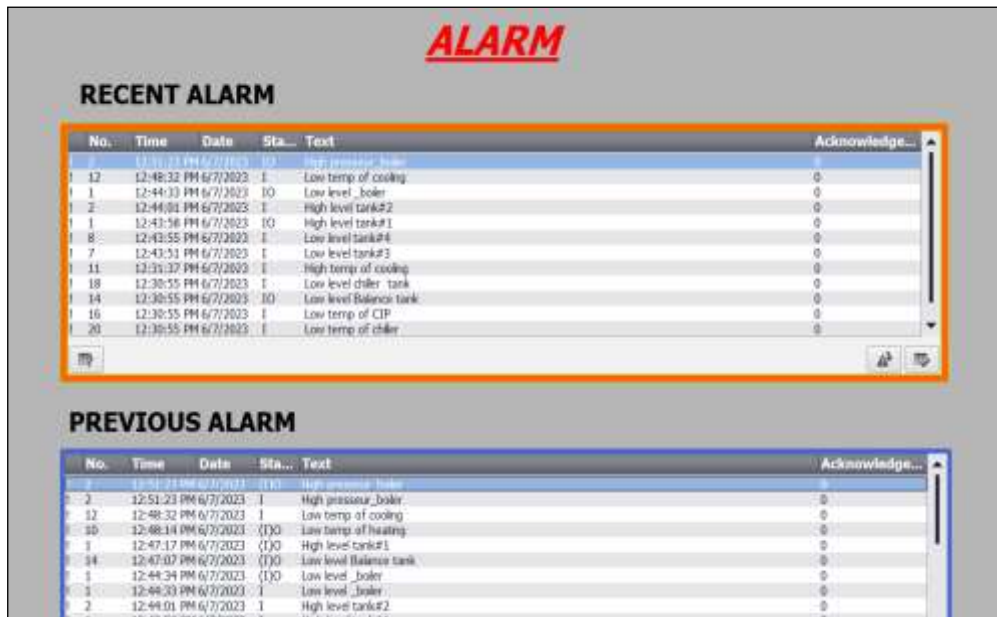


Figure 9: Alarms screen.
Source: Authors, (2026).

Recipes are parameters and values used to configure a Programmable Logic Controller (PLC) system in industrial automation. They improve efficiency, reduce errors, and ensure consistency across production runs. They store and recall parameters automatically, reducing setup time and reducing defects or product variations. PLC systems are monitored and troubleshooted for errors, ensuring reliability and uptime in industrial automation systems. Diagnostic features include online diagnostics, trace functionality, error handling, and simulation tools.

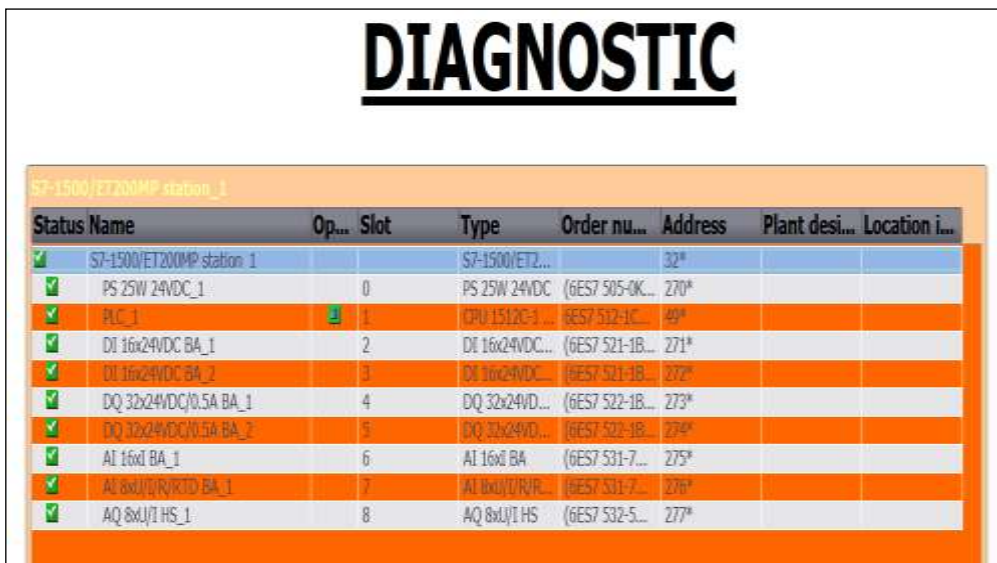


Figure 10: Diagnostics screen.
Source: Authors, (2026).

Security in PLC systems ensures data integrity and reliability in industrial automation applications. Features include user management, password protection, encryption, and firewall protection.

VI.4 SCADA Screens

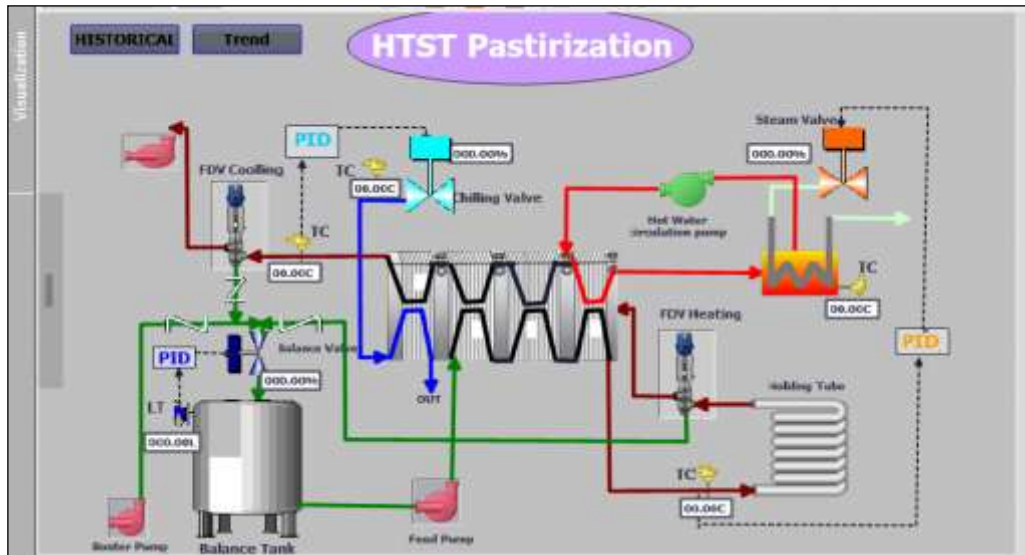


Figure 11: Pasteurization screen.
Source: Authors, (2026).

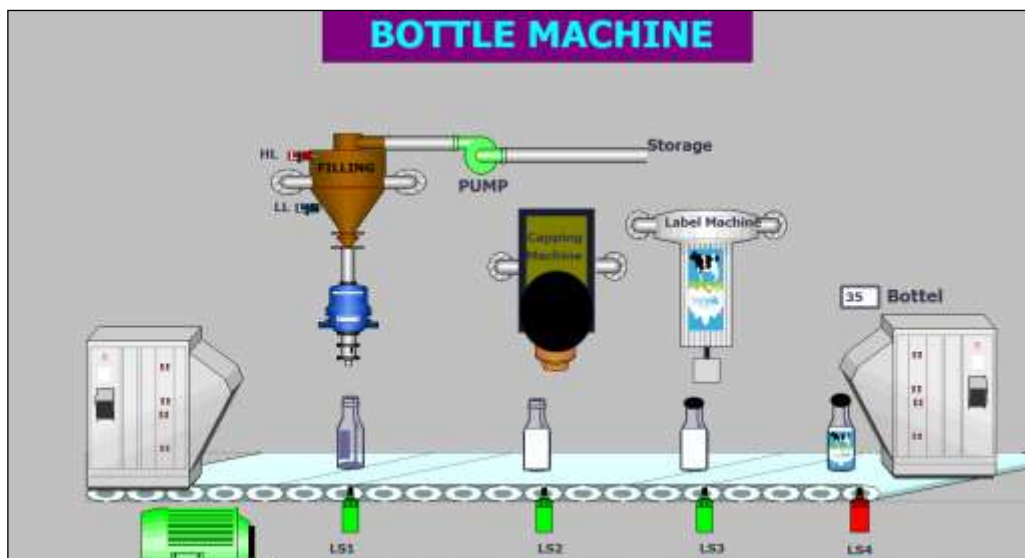


Figure 12: Bottle machine screen.
Source: Authors, (2026).

VI. RESULTS AND DISCUSSION

This work focuses on automation and supervision of an industrial process using Siemens PLC and SCADA, specifically the Siemens S7-1500 programmable logic controller and Tia Portal programming program. The work aims to provide a practical understanding of automation steps and master the Tia Portal programming software for PLCs in the Siemens S7-1500 range. We initially paid attention to the factory's presentation before discussing the overall operations and ongoing projects there. The goal is to serve as a guide for automation projects using the S7-1500 APIs and the TIA PORTAL programming language.

VII. CONCLUSION

In this study, PLC and SCADA technologies were used to build and install a real-time monitoring and control system for an industrial milk processing facility. The TIA Portal engineering platform was used to design the system, which is based on the Siemens S7-1500 PLC. It incorporates the Cleaning-In-Place (CIP) procedure, pasteurization, bottling, water heating and cooling, and milk storage. The system facilitates centralized supervision using HMI and SCADA interfaces, enabling operators to keep an eye on process variables, operate machinery, and react swiftly to events and alarms. The results show that the proposed solution improves operational efficiency, reliability, and production consistency while reducing manual intervention and human errors. Effective process monitoring and decision-making are supported by features including trend analysis, historical data logging, and real-time visualization. The results show that the proposed solution improves operational efficiency, reliability, and production consistency while reducing manual intervention and human errors.

VIII. AUTHOR'S CONTRIBUTION

Conceptualization: Benarabi Bilal, Achbi Mohammed Said, Rouabah Boubakeur and Boutalbi Mohammed Chaker.

Methodology: Benarabi Bilal, Achbi Mohammed Said, Rouabah Boubakeur and Boutalbi Mohammed Chaker.

Investigation: Benarabi Bilal, Achbi Mohammed Said, Rouabah Boubakeur and Boutalbi Mohammed Chaker.

Discussion of results: Benarabi Bilal, Achbi Mohammed Said, Rouabah Boubakeur and Boutalbi Mohammed Chaker.

Writing – Original Draft: Benarabi Bilal, Achbi Mohammed Said, Rouabah Boubakeur and Boutalbi Mohammed Chaker.

Writing – Review and Editing: Benarabi Bilal, Achbi Mohammed Said, Rouabah Boubakeur and Boutalbi Mohammed Chaker.

Resources: Benarabi Bilal, Achbi Mohammed Said, Rouabah Boubakeur and Boutalbi Mohammed Chaker.

Supervision: Benarabi Bilal, Achbi Mohammed Said, Rouabah Boubakeur and Boutalbi Mohammed Chaker.

Approval of the final text: Benarabi Bilal, Achbi Mohammed Said, Rouabah Boubakeur and Boutalbi Mohammed Chaker.

IX. REFERENCES

- [1] S. A. Muthukumaraswamy and N. Nadgauda, "Design and development of industrial automated system using PLC-SCADA," in IEEE 10th GCC Conference & Exhibition (GCC), 2019, pp. —, doi: 10.1109/GCC.2019.
- [2] O. Rashad, O. Attallah, and I. Morsi, "A smart PLC-SCADA framework for monitoring petroleum product terminals in Industry 4.0 via machine learning," *Measurement & Control*, vol. 55, no. 7-8, pp. 830-848, 2022, doi: 10.1177/00202940221098765.
- [3] K. Chakraborty et al., "Development of PLC-SCADA-based control strategy for water storage in a tank for a semi-automated plant," *J. Instrum.*, vol. 15, no. 04, Art. no. T04007, 2020, doi: 10.1088/1748-0221/15/04/T04007.
- [4] R. B. Mofidul et al., "Design and implementation of a remote controlling and monitoring system for an automatic PLC-based packaging industry," in 2019 1st Int. Conf. on Advances in Science, Engineering and Robotics Technology (ICASERT), 2019, pp. 1-6, doi: 10.1109/ICASERT.2019.
- [5] I. Tomar, I. Sreedevi, and N. Pandey, "PLC and SCADA-based real-time monitoring and train control system for the metro railways infrastructure," *Wireless Pers. Commun.*, vol. 129, no. 1, pp. 521-548, 2023, doi: 10.1007/s11277-022-09694-4.
- [6] N. N. N. Abdulsattar, F. F. Mustafa, and S. M. Hadi, "Design and implementation of SCADA system for sugar production line," *Al-Khwarizmi Eng. J.*, vol. 15, no. 2, pp. 80-88, 2019.
- [7] E. Salgado-Plasencia et al., "SCADA-based heliostat control system with a fuzzy logic controller for the heliostat orientation," *Applied Sciences*, vol. 9, no. 15, Art. No. 2966, 2019, doi: 10.3390/app9152966.
- [8] F. M. Raimondi and A. Guercio, "Implementation of a supervisory control and data acquisition for a biaxial photovoltaic tracker by means of a low-cost PLC Zelio," in 2023 IEEE Int. Conf. on Environment and Electrical Engineering & 2023 IEEE Industrial and Commercial Power Systems Europe (EEEIC/I&CPS Europe), 2023, pp. 1-6, doi: 10.1109/EEEIC-I&CPS.2023.
- [9] N. Nadgauda, S. A. Muthukumaraswamy, and S. U. Prabha, "Smart automated processes for bottle-filling industry using PLC-SCADA system," in *Intelligent Manufacturing and Energy Sustainability: Proc. of ICIMES 2019*, Singapore: Springer, 2020.
- [10] D. Gayathri, R. Dinesh, and T. Dharanidharan, "Monitoring and controlling the fuel injection in molding machine using SCADA and PLC," in 2021 3rd Int. Conf. on Signal Processing and Communication (ICPSC), 2021, pp. 1-5.
- [11] J. Prihantoro et al., "Implementation of SCADA web client for monitoring geothermal power plant 3 MW Kamojang–Indonesia," in 2022 2nd Int. Conf. on Electronic and Electrical Engineering and Intelligent System (ICE3IS), 2022, pp. 1-6, doi: 10.1109/ICE3IS.2022.
- [12] N. Hosseinzadeh, A. Mousavi, A. Teirab, S. Varzandeh, and A. Al-Hinai, "Real-time monitoring and control of a microgrid—Pilot project: Hardware and software," in 2019 29th Australasian Universities Power Engineering Conf. (AUPEC), Nov. 2019, pp. 1-6, doi: 10.1109/AUPEC.2019.
- [13] K. Bagal, C. Kadu, B. Parvat, and P. Vikhe, "PLC-based real-time process control using SCADA and MATLAB," in 2018 4th Int. Conf. on Computing Communication Control and Automation (ICCUBEA), 2018, pp. 1-5, doi: 10.1109/ICCUBEA.2018.
- [14] A.-M. Mateoiu et al., "Supervisory monitoring and control solution on Android mobile devices for the water industry 4.0," *Sustainability*, vol. 15, no. 22, Art. no. 16022, 2023, doi: 10.3390/su152216022.
- [15] O. Duymazlar and D. Engin, "Design, application and analysis of an OPC-based SCADA system," *Politeknik Dergisi*, 2023, pp. 1-1. 2023.
- [16] S. Howimanporn, S. Chookaew, and C. Silawatchananai, "Real-time evaluation of position control of directional wheel conveyor using fuzzy embedded PLC and
- [17] Achbi, M. S., Ammari, A., & Zatout, A. A. Study, Realization and Maintenance of Industrial Processes (doctoral dissertation, university of kasdi merbah ouargla).
- [18] M. S. Achbi, Surveillance et commande tolérante aux défauts appliquées à une classe des systèmes dynamiques hybrides (Doctoral dissertation), 2022.
- [19] E. L. Abdallah, M. Ouassaid, and Y. Zidani, "Development of a real-time framework between MATLAB and PLC through OPC-UA: A case study of a microgrid energy management system," 2022.
- [20] M. S. Lamri and Z. Tati, Supervision en temps réel d'un procédé industriel basé sur un automate programmable utilisant SCADA et MATLAB, University of Kasdi Merbah Ouargla, 2022.
- [21] Ignacy, D., Gomółka, L., & Kopka, R. Development of a real-time framework between Matlab/Simulink and SIEMENS PLC for automated relocation of products in the warehouse. In 2024 28th International Conference on Methods and Models in Automation and Robotics pp. 93-97, 2024.
- [22] M. S. Achbi and S. Kechida, "Methodology for monitoring and diagnosing faults of hybrid dynamic systems: A case study on a desalination plant," *Diagnostyka*, vol. 21, no. 1, pp. 27-33, 2020, doi: 10.29354/diag/121809.

- [23] L. Mhamdi et al., "Diagnosis of hybrid systems through bond graph, observers and timed automata," *Diagnostyka*, vol.21, no.3, pp.113-125, 2020, doi: 10.29354/diag/125567.
- [24] C. E. Kerrouche and N. Barouda, *Etude et conception d'un système de supervision et commande d'un procédé industriel*, University of Kasdi Merbah Ouargla, 2022.
- [25] Achbi, M. S., Rouabah, B., Benarabi, B., Mahboub, M. A., & Kechida, S. (2024). IoT-based monitoring of a dual-axis solar tracking system. *Przegląd Elektrotechniczny*, 100.