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Design and Implementation of Smart Electricity Load Shifting by Using PLC and SCADA

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Abstract: *The increasing demand for electrical energy and the rapid growth of smart infrastructure require efficient methods for managing power distribution and consumption. Traditional electrical systems often face problems such as overload, energy wastage, and lack of real-time monitoring. To overcome these challenges, this paper presents a system titled "Smart Electricity Load Shifting by Using PLC and SCADA." The proposed system focuses on improving energy management by automatically monitoring electrical loads and shifting them according to priority levels during overload conditions.*

In this project, a Programmable Logic Controller (PLC) is used as the main control unit to monitor electrical parameters and control connected loads through relays. Sensors continuously measure the current and load conditions and send real-time data to the PLC. Based on the programmed logic, the PLC analyzes the load demand and automatically disconnects or shifts low-priority loads when the total power consumption exceeds the predefined limit. This approach helps to maintain system stability and ensures uninterrupted operation of critical loads.

A Supervisory Control and Data Acquisition (SCADA) system is integrated with the PLC to provide real-time monitoring, visualization, and control of the entire system. The SCADA interface allows operators to observe power consumption, receive alerts during overload situations, and manually control the loads when necessary. The integration of PLC and SCADA enhances automation, improves reliability, and enables efficient decision-making in power management systems.

Keywords: Smart Grid, PLC (Programmable Logic Controller), SCADA System, Load Shifting, Energy Management, Power Distribution Automation, Real-Time Monitoring, Industrial Automation

I. INTRODUCTION

The rapid growth in electricity demand and the expansion of modern infrastructure have created significant challenges in the management of electrical power systems. Traditional power distribution systems are mainly designed to supply electricity without intelligent monitoring or automated control mechanisms. As a result, these systems often experience problems such as overload conditions, inefficient energy utilization, power interruptions, and limited monitoring capabilities. In recent years, the concept of smart energy management has gained attention as a solution to improve the reliability, efficiency, and sustainability of electrical power networks [1].

A smart electricity management system integrates automation, communication technologies, and advanced control methods to monitor and manage energy consumption effectively. One of the important techniques used in such systems is load shifting, which helps distribute electrical loads based on priority and system conditions. Load shifting ensures that critical loads continue to operate while non- essential loads are temporarily disconnected during peak demand or overload situations. This approach not only prevents system failure but also improves the stability of the overall power network [2].

Programmable Logic Controllers (PLCs) play a crucial role in industrial automation and electrical control systems. PLCs are widely used because of their reliability, fast response time, and ability to operate in harsh industrial

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environments. They can receive input signals from sensors, process the data based on programmed logic, and control output devices such as relays, motors, and switches. In power management systems, PLCs are used to monitor electrical parameters like current, voltage, and load conditions, and they can automatically control loads according to predefined rules [3].

Another important technology used in modern electrical monitoring systems is the Supervisory Control and Data Acquisition (SCADA) system. SCADA systems allow operators to monitor and control industrial processes in real time through graphical user interfaces. These systems collect data from field devices, display system status, generate alarms, and allow remote operation of equipment. In smart grid and automation projects, SCADA systems are integrated with PLCs to provide centralized monitoring and efficient system control [4].

The combination of PLC and SCADA technologies provides a powerful solution for developing intelligent energy management systems. PLC handles the real-time control and automation of electrical loads, while SCADA provides monitoring, visualization, and remote control capabilities. This integration allows operators to observe system performance, detect faults quickly, and take corrective actions when necessary. As a result, the reliability and efficiency of the electrical distribution system can be significantly improved [5].

In conventional electrical systems, load management is usually done manually, which may lead to delays and operational errors. During peak load conditions, the absence of automated control can cause excessive load on the system, resulting in equipment damage or power outages. Smart load shifting systems overcome these issues by automatically analyzing load conditions and managing power distribution accordingly. This improves system safety and ensures continuous operation of critical electrical equipment such as lighting, control systems, and emergency devices [6].

With the advancement of smart grid technologies, there is a growing need for systems that can manage energy consumption efficiently and support sustainable development. Smart grids integrate digital communication, automation, and intelligent control systems to optimize energy usage and improve the reliability of power supply. Load shifting mechanisms are an essential component of smart grid infrastructure because they help balance energy demand and reduce stress on the power network [7].

In addition, industries, hospitals, commercial buildings, and smart cities require reliable energy management systems to prevent unexpected power failures and improve operational efficiency. Automated load control systems can help organizations reduce energy waste, minimize operational costs, and improve power utilization. The use of PLC and SCADA in such systems makes it possible to monitor energy consumption patterns and implement efficient control strategies [8].

The development of intelligent electrical systems also supports the integration of renewable energy sources such as solar and wind power. Since renewable energy generation may vary depending on environmental conditions, smart load management systems help maintain system balance by controlling loads dynamically. This improves the stability and efficiency of modern power systems and supports the transition toward sustainable energy solutions [9].

Therefore, the proposed project titled "Smart Electricity Load Shifting by Using PLC and SCADA" focuses on designing and implementing an automated system that monitors electricity consumption and shifts loads based on priority levels. The system uses sensors to measure load conditions, a PLC to process and control operations, and SCADA software to monitor and manage the system in real time. The aim of this project is to improve energy management, reduce overload conditions, and enhance the reliability of electrical distribution systems [10]

II. PROBLEM STATEMENT

The increasing demand for electricity in industries, commercial buildings, and modern infrastructure has created significant challenges in managing power distribution efficiently. Traditional electrical systems often operate without intelligent monitoring and automated control, which leads to problems such as overload conditions, energy wastage, unexpected power interruptions, and difficulty in maintaining system stability during peak demand periods. In many facilities, multiple electrical loads run simultaneously without proper priority management, which can cause excessive

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load on the power system and may result in equipment damage or system failure. Additionally, the lack of real-time monitoring and centralized control makes it difficult for operators to detect faults quickly and respond to abnormal conditions. Manual control methods are time- consuming and prone to human error, reducing the overall reliability and efficiency of the system. Therefore, there is a need for an automated and intelligent solution that can continuously monitor electrical loads, manage power consumption, and shift non-critical loads during overload conditions. The integration of Programmable Logic Controller (PLC) and Supervisory Control and Data Acquisition (SCADA) technologies provides an effective approach to address these challenges by enabling real-time monitoring, automated control, and efficient load management in modern electrical power sys.

III. OBJECTIVE

• To design and develop a smart electricity load shifting system using PLC and SCADA for efficient power management.
• To monitor electrical load conditions in real time using sensors and transmit the data to the PLC for analysis.
• To implement an automated control mechanism that can shift or disconnect non-priority loads during overload conditions to maintain system stability.
• To integrate SCADA software for real-time monitoring, visualization, alarm generation, and manual control of electrical loads.
• To improve the reliability, safety, and efficiency of the electrical power distribution system through intelligent load management.

IV. LITERATURE SURVEY

Paper Name: Smart Energy Management in Manufacturing Plants Using PLC and SCADA
Year: 2025
Publication: Advance Research in Power Electronics and Devices
Authors: Vaibhav Vilas Godase
Journal: SSRN / Advance Research in Power Electronics and Devices
Summary: This research paper focuses on the implementation of a smart energy management system in manufacturing plants by integrating PLC and SCADA technologies. The study explains how automated monitoring and control systems can help industries reduce energy consumption and improve operational efficiency. The system collects real-time data from sensors and devices installed in the plant and sends this information to the PLC for processing. The PLC then executes control strategies to manage electrical loads effectively and maintain stable system operation. The research also highlights the importance of automation in improving the reliability of industrial energy systems.
The authors conducted a case study in a manufacturing environment where data was collected over a long period to evaluate system performance. The results showed that the integration of PLC and SCADA can significantly improve energy optimization, reduce operational costs, and enhance monitoring capabilities. The study concludes that smart energy management systems are highly beneficial for modern industries that require continuous and reliable power supply while maintaining efficient energy usage.
Paper Name: Energy Internet-Based Load Shifting in Smart Microgrids: An Experimental Study
Year: 2023
Publication: Energies (MDPI)
Authors: Multiple researchers (MDPI research team)
Journal: Energies Journal
Summary: This research paper presents an experimental study on load shifting techniques used in smart microgrid systems. The study explains how smart grids can manage both shiftable and non-shiftable loads by distributing energy efficiently based on demand and availability. Sensors and controllers are used to monitor electrical parameters such as

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current and voltage, while relays control the switching of loads depending on system conditions. The research emphasizes the importance of load shifting in reducing peak demand and improving the stability of electrical systems.

The paper also discusses how advanced energy management algorithms can control appliances and manage power supply between the grid and local energy sources such as solar panels and batteries. Experimental results show that load shifting helps balance power usage and reduces electricity costs. The study demonstrates that intelligent control strategies can significantly improve the performance of modern energy systems and support the development of smart grids.

Paper Name: A Review on Control and Automation based Smart Grid System and its Impact on Conventional Grid
Year: 2018
Publication: International Journal of Engineering Research & Technology (IJERT)
Authors: Y. M. Saleh Alward, S. N. Joshi, Prashant Singh
Journal: IJERT
Summary: This paper provides a detailed review of smart grid systems and their influence on traditional electrical power networks. The study explains how automation technologies such as PLC, communication networks, and monitoring systems are transforming conventional power grids into intelligent systems. It discusses the limitations of traditional grids, including lack of monitoring, inefficient power management, and difficulty in integrating renewable energy sources. The paper also highlights how automation improves power quality and reliability.

Furthermore, the authors describe how smart grid technology enables better communication between power generation, transmission, and distribution systems. Advanced control systems help operators monitor the grid in real time and detect faults quickly. The research concludes that implementing smart grid technologies can enhance system efficiency, reduce energy losses, and support sustainable power management.

Paper Name: Availability Improvements through Data Slicing in PLC Smart Grid Networks
Year: 2020
Publication: Sensors (MDPI / PMC)
Authors: Paul Negirla, Romina Druță, Ioan Silea
Journal: Sensors Journal
Summary: This research paper focuses on improving communication reliability in smart grid networks that use PLC technology. The study explains that smart grids rely on communication networks to transfer large amounts of data between sensors, controllers, and monitoring systems. However, communication failures and data loss can reduce the efficiency of the system. To solve this problem, the authors propose a data slicing method that improves the reliability of data transmission in PLC-based smart grid networks.

The proposed model helps maintain stable communication even in poor network conditions. The research also highlights the importance of reliable communication in smart grid applications where continuous monitoring and control are required. The findings indicate that improved communication strategies can enhance the availability and performance of PLC-based smart grid systems and support large-scale energy management solutions.

Paper Name: Critical Review of SCADA and PLC in Smart Buildings and Energy Sector
Year: 2024
Publication: Energy Reports / ScienceDirect
Authors: Various researchers
Journal: Energy Reports
Summary: This paper presents a comprehensive review of PLC and SCADA technologies used in smart buildings and the energy sector. The study explains how SCADA systems are widely used for monitoring and controlling industrial and energy-related processes. SCADA collects real-time data from field devices, stores it, and displays system information to operators through graphical interfaces. This allows engineers to monitor the system continuously and make quick decisions when problems occur.

The authors also discuss the advantages of PLC systems, including high reliability, fast response time, and strong resistance to noise in industrial environments. The combination of PLC and SCADA creates a powerful automation system capable of controlling complex processes efficiently. The research highlights that these technologies play a significant role in improving energy efficiency, automation, and operational performance in modern power systems.

Paper Name: An Efficient Approach of Load Shifting by Using SCADA

Year: 2016

Publication: Advances in Science, Technology and Engineering Systems Journal

Authors: Usman Sohail, Muhammad Muneer, Faraz Khan

Journal: ASTESJ

Summary: This research paper focuses on the development of a load shifting system using SCADA technology. The study explains how SCADA can be used to monitor electrical loads and control power distribution in different environments. The system allows operators to observe load conditions and shift loads from one source to another to avoid overload situations. The research also highlights how communication networks play an important role in transferring data between control centers and remote devices. The paper further explains that load shifting techniques help improve the efficiency and reliability of electrical power systems. By implementing SCADA-based control mechanisms, operators can manage energy usage effectively and reduce power interruptions. The research concludes that load shifting systems are important for modern power networks where continuous monitoring and efficient load management are required.

V. PROPOSED SYSTEM

The proposed system titled "Smart Electricity Load Shifting by Using PLC and SCADA" is designed to provide an automated solution for monitoring electrical load conditions and managing power distribution efficiently. The main objective of the system is to prevent overload situations by automatically shifting or disconnecting non-critical loads while ensuring continuous operation of important loads

1. System Overview

The proposed system works by continuously monitoring the electrical load connected to the power supply. Sensors such as current transformers or current sensors measure the amount of current flowing through the loads. This real-time data is sent to the PLC, which acts as the central controller of the system. The PLC processes the incoming data based on predefined logic and determines whether the system is operating under normal conditions or experiencing overload.

When the total load exceeds the predefined limit, the PLC automatically initiates the load shifting process. In this process, loads are categorized into different priority levels such as high priority, medium priority, and low priority. The system first disconnects or shifts low-priority loads to reduce the total power consumption. If the overload condition still exists, the PLC can further manage medium-priority loads while ensuring that critical loads remain active. This process helps maintain system stability and prevents electrical failures.

2. Architecture of the Proposed System

The architecture of the proposed system consists of several important components that work together to achieve efficient load management. The main components include sensors, PLC controller, relay modules, power supply unit, SCADA software, communication interface, and electrical loads.

The electrical loads receive power from the main supply source through relays or contactors. Sensors are connected to measure the electrical parameters such as current and power consumption. These sensors continuously monitor the system and provide feedback to the PLC. The PLC processes this information and controls the relays connected to different loads.

3. Working Principle of the Proposed System

The working principle of the proposed system is based on automated monitoring and intelligent control of electrical loads. Initially, the electrical power is supplied to different loads connected in the system. The current sensor continuously measures the current flow and sends the data to the PLC. The PLC compares the received data with predefined threshold values stored in the program.

If the load is within the acceptable limit, the system continues to operate normally without any interruption. However, if the load exceeds the threshold value, the PLC detects an overload condition and activates the load shifting mechanism. In this stage, the PLC first disconnects low- priority loads using relay control signals. This reduces the overall load on the system.

4. Load Priority Management

In the proposed system, load priority management plays an important role in maintaining system stability. The loads are classified into three main categories based on their importance and operational requirements.

High-priority loads include essential systems such as lighting, safety equipment, and critical control systems. These loads remain active under most conditions and are disconnected only in emergency situations. Medium-priority loads include devices such as fans, office equipment, and other operational devices that can be temporarily turned off if required. Low-priority loads include decorative lighting and additional appliances that can be disconnected first during overload conditions.

5. PLC Control Strategy

The PLC serves as the brain of the proposed system. It receives input signals from sensors and switches and processes them using ladder logic or other PLC programming methods. The control logic is designed to analyze load conditions and send appropriate output signals to relay modules.

The PLC also handles safety conditions such as emergency stop signals and system resets. If any abnormal condition occurs, the PLC can immediately shut down specific loads or trigger alarm signals. The PLC ensures fast response time, accurate control, and reliable system operation.

6. SCADA Monitoring and Control

The SCADA system is used for real-time monitoring and supervision of the entire load management system. It provides a graphical user interface (GUI) that displays important system parameters such as load status, current values, system alarms, and operational conditions.

Operators can observe the real-time status of the system through SCADA dashboards. The system also records historical data, which helps in analyzing energy usage patterns and system performance. In addition to monitoring, SCADA allows manual control of loads, enabling operators to switch devices on or off when necessary.

7. Advantages of the Proposed System

The proposed system offers several advantages compared to conventional power management systems. It provides automated load control, reduces the risk of overload, improves energy efficiency, and enhances system reliability. The integration of PLC and SCADA enables real-time monitoring, quick fault detection, and efficient system management.

Furthermore, the system supports scalable design, which means it can be expanded for larger power distribution networks such as industries, smart buildings, and smart grid infrastructures

VI. SYSTEM DESIGN

The system design of Smart Electricity Load Shifting by Using PLC and SCADA focuses on developing an intelligent and automated power management structure that can monitor, control, and shift electrical loads efficiently. The design integrates hardware components, control algorithms, communication networks, and monitoring software to ensure stable and optimized energy usage. The system is structured in such a way that it can detect overload conditions and automatically respond to maintain system balance while protecting electrical equipment..

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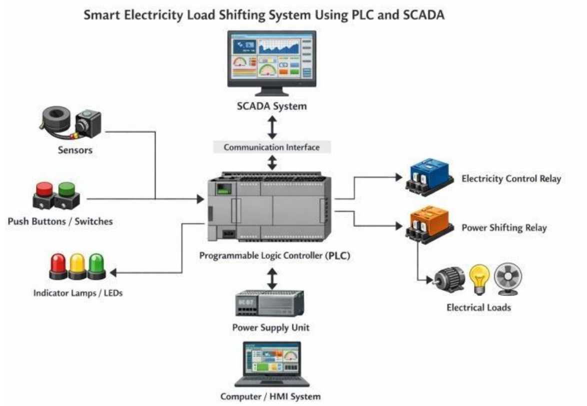

Fig 1: System Architecture

1. Overall System Design

The overall design of the system is based on a centralized control architecture where the PLC acts as the main controller and SCADA works as the monitoring and supervisory unit. Electrical loads are connected to the power supply through relay modules or contactors that are controlled by the PLC. Sensors are installed in the system to measure important electrical parameters such as current, voltage, and power consumption.

The system continuously collects real-time data from the sensors and sends it to the PLC. The PLC processes the data using programmed control logic and determines whether the system is operating under normal conditions or facing overload. If the system detects abnormal conditions, the PLC activates the load shifting mechanism to maintain safe operation. SCADA provides visualization and remote monitoring capabilities, which help operators understand system behavior and take necessary actions when required.

2. Hardware Design

The hardware design includes several important components that work together to build the complete system. The primary components include the PLC controller, current sensors, relay modules, power supply unit, communication module, and electrical loads.

The PLC is responsible for receiving signals from sensors and controlling the relays connected to the loads. Current sensors such as current transformers are used to measure the load current and send analog or digital signals to the PLC input module. Relay modules act as switching devices that connect or disconnect electrical loads based on PLC commands. A stable power supply unit ensures that all components operate reliably without interruption.

The communication module allows the PLC to communicate with the SCADA system through industrial communication protocols. These hardware components are arranged in a structured manner to create a reliable and efficient load management system.

3. Software Design

The software design mainly includes PLC programming and SCADA configuration. PLC programming is developed using ladder logic or function block diagrams that define how the system will respond to different load conditions. The program continuously reads input signals from sensors and compares them with predefined threshold values.

If the measured load exceeds the set limit, the PLC program activates the load shifting sequence. This sequence determines which loads should be disconnected first based on priority levels. The software also includes safety conditions such as overload protection, fault detection, and system recovery mechanisms.

SCADA software is designed to display real-time system data in graphical form. It includes dashboards, alarms, status indicators, and historical data storage. The SCADA interface helps operators monitor the system easily and control operations remotely when needed.

4. Communication System Design

Communication plays an important role in connecting the PLC with the SCADA system and other devices in the network. In the proposed design, communication protocols such as Modbus, Ethernet, or industrial communication standards are used for reliable data transfer.

The PLC sends real-time data to the SCADA server, where it is processed and displayed on monitoring screens. This communication system ensures fast and accurate data transmission between field devices and the control center. It also allows remote access to system information, which improves system supervision and maintenance.

The communication network is designed to handle continuous data flow without delays, ensuring efficient system performance and timely response to abnormal conditions.

5. Load Control Design

Load control is one of the most important parts of the system design. In this design, loads are divided into different categories based on their importance. The system follows a priority-based control method where low-priority loads are disconnected first during overload conditions.

The PLC continuously monitors the total load and checks whether it exceeds the safe operating limit. If an overload is detected, the system begins the load reduction process by switching off non-essential loads. This reduces the burden on the power system and prevents equipment damage.

Once the system returns to normal conditions, the PLC reconnects the loads gradually to avoid sudden power fluctuations. This method helps maintain stable operation and ensures efficient power utilization.

6. Safety and Protection Design

Safety is an essential part of the system design to ensure that the electrical system operates without risks. The proposed system includes multiple protection mechanisms such as overload protection, short circuit detection, and emergency shutdown features.

If the system detects abnormal current levels or faults, the PLC immediately disconnects affected loads and sends an alert to the SCADA system. SCADA then notifies the operator through alarms and warning messages. This allows quick response to system problems and prevents serious damage to equipment.

The design also includes backup control mechanisms to ensure system reliability even during communication failures or unexpected faults.

7. Data Monitoring and Analysis Design

The system is designed to collect and store operational data continuously. SCADA records parameters such as load usage, switching operations, alarm events, and system performance history. This stored data helps in analyzing energy consumption patterns and identifying areas where energy optimization can be improved.

Engineers and operators can use this data to evaluate system efficiency and plan future improvements. Data analysis also helps in predictive maintenance, which reduces downtime and increases system reliability.

8. Scalability of the System Design

The proposed system is designed to be scalable so that it can be expanded in the future. Additional loads, sensors, and control units can be integrated into the system without major changes in the existing structure.

This design approach makes the system suitable for applications in industries, smart buildings, power distribution networks, and smart grid systems. The flexible design ensures that the system can adapt to increasing energy demands and technological advancements.

VII. RESULT

Graph 1 illustrates the variation of electrical load throughout the day and shows the comparison between the system operating before load shifting and after implementing smart load shifting using PLC and SCADA. The horizontal axis (X-axis) represents the time of the day in hours, while the vertical axis (Y-axis) represents the electrical load measured in kilowatts (kW). Two lines are plotted in the graph: one indicates the load condition before the implementation of the load shifting system, and the other represents the load after the smart control mechanism is applied. This comparison helps in understanding how the system improves energy management and reduces peak load demand.

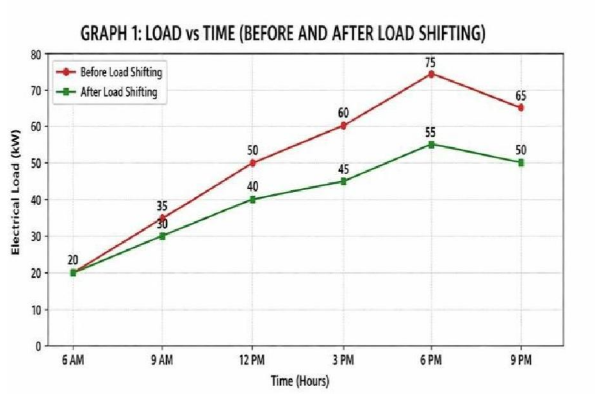

Fig 3:graph 1

From the graph, it can be observed that the electrical load gradually increases during the daytime as more equipment and systems begin operating. In the early morning hours, both systems show similar load values because the demand is relatively low. However, as the day progresses, the load demand increases significantly in the traditional system. In contrast, the PLC and SCADA based system controls the load more efficiently by shifting or temporarily disconnecting non-essential loads, which helps maintain a balanced and stable power supply.

During peak hours, especially in the evening, the difference between the two curves becomes more noticeable. The traditional system reaches a higher load level because there is no automatic control to manage power distribution. On the other hand, the smart load shifting system reduces the peak load by distributing power intelligently and preventing excessive demand on the system. This demonstrates the effectiveness of automated load management in improving system performance and preventing overload conditions.

Time (Hours)	Load Before Load Shifting (kW)	Load After Load Shifting (kW)
6 AM	20	20
9 AM	35	30
12 PM	50	40
3 PM	60	45
6 PM	75	55
9 PM	65	50

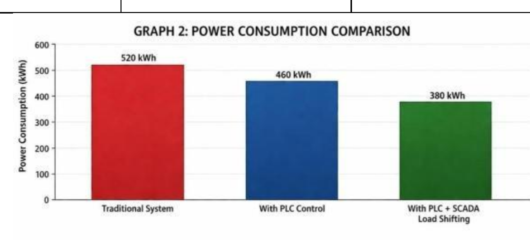

Fig 4: Graph 2

Graph 2 presents a comparison of total power consumption under three different system conditions: the Traditional System, the System with PLC Control, and the System with PLC + SCADA Load Shifting. The horizontal axis (X-axis) represents the type of system used for electricity management, while the vertical axis (Y-axis) shows the total power consumption measured in kilowatt- hours (kWh). Each bar in the graph represents the amount of electrical energy consumed by the system under different control methods.

From the graph, it can be observed that the Traditional System consumes the highest amount of electrical energy, which is about 520 kWh. This is because the traditional system operates without automated monitoring and control, resulting in inefficient energy usage and unnecessary operation of electrical loads. Since there is no intelligent mechanism to manage or shift loads during peak demand periods, the system experiences higher power consumption and reduced efficiency.

When PLC control is introduced into the system, the power consumption decreases to 460 kWh. This reduction occurs because the PLC provides automated control of electrical loads and ensures that equipment operates according to predefined logic conditions. Although this improves efficiency compared to the traditional system, the load management is still limited because real-time monitoring and advanced supervisory control are not fully implemented.

The most significant improvement can be seen in the PLC + SCADA based load shifting system, where power consumption is reduced further to 380 kWh. In this system, SCADA provides real-time monitoring, data analysis, and centralized supervision of electrical loads. The system intelligently shifts non-critical loads during peak hours and optimizes power usage throughout the operation. As a result, the overall energy consumption decreases significantly, demonstrating the effectiveness of smart electricity load shifting techniques.

This graph clearly highlights that integrating PLC with SCADA not only improves system automation but also plays a crucial role in reducing energy consumption, improving operational efficiency, and supporting sustainable power management in modern electrical systems.

System Type Power Consumption (kWh) Traditional System 520
With PLC Control 460
With PLC + SCADA Load Shifting 380

VIII. CONCLUSION

The proposed system Smart Electricity Load Shifting by Using PLC and SCADA demonstrates an effective approach for improving energy management and power distribution in modern electrical systems. The integration of PLC technology enables automatic control of electrical loads based on predefined conditions, while the SCADA system provides real-time monitoring, supervision, and data analysis. Together, these technologies create an intelligent platform that can efficiently manage electricity consumption and respond quickly to changes in load demand.

From the system analysis and graphical results, it is observed that the implementation of load shifting significantly reduces peak load and overall power consumption compared to the traditional system. The PLC automatically controls relays to shift non-essential loads during high demand periods, preventing overload conditions and ensuring stable system operation. At the same time, the SCADA system allows operators to monitor system performance, receive alerts, and control loads remotely, which enhances reliability and operational efficiency.

The study also shows that the smart load shifting system helps in better utilization of available electrical power and minimizes energy wastage. By reducing unnecessary energy consumption and distributing loads efficiently, the system supports cost savings and contributes to sustainable energy management. This approach is particularly useful for industries, commercial buildings, and large electrical networks where efficient power control is essential..

IX. FUTURE SCOPE

The proposed system Smart Electricity Load Shifting by Using PLC and SCADA has significant potential for further improvement and expansion in the future. As the demand for electricity continues to grow, advanced technologies can be integrated into the system to enhance its performance, efficiency, and reliability. Future developments can focus on making the system more intelligent, automated, and adaptable to modern power management requirements.

One possible future enhancement is the integration of the system with smart grid technology. By connecting the PLC and SCADA based load shifting system with smart grids, real-time energy distribution and demand response

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management can be improved. This would allow electricity providers to balance supply and demand more effectively and reduce energy losses across the power network.

Another important future direction is the use of renewable energy sources such as solar and wind power within the load shifting system. The system can be designed to prioritize renewable energy usage when available and shift loads accordingly. This will help reduce dependency on conventional power sources and support environmentally sustainable energy management.

The system can also be improved by incorporating Artificial Intelligence (AI) and Machine Learning (ML) techniques. These technologies can analyze historical load data, predict future energy demand, and automatically adjust load shifting strategies. This predictive capability would make the system smarter and more efficient in handling dynamic power consumption patterns..

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