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Energy Management Systemusing PLC

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Abstract

This paper presents the load control intheindustry during peak hours by using PLC and monitors all load parameters of them olarson PC by using SCADA. The Energy managementis the highest demand of the organizations to reduce their energy cost. Confirm to the regulatory requirements and improve their corporate image. The automation used in the industries has several benefits. To accomplish the automation in the industry we have knowledge of PL Cand SCADA. PLC isa programmable logic controller which controls the load or machines in industry. PLC programming isdonebyusing ladder logic. The overall automation of the industry is controlled by SCADA software. SCADA define as a centralized system that control and monitor the wholesites.SCADA is used for collecting the data from various sensors or machinesand then monitor the proper functioning of the machines. Automation will make the industry safe, cheap, highly efficientand maintained free.

Keywords: PLC,SCADA, Energy saving earning and productivity.

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Introduction

Over the past two decades, the electric power industry's involvement in power Distribution Automation (DA) has been principally focused on remote monitoring and control of the distribution systems and their equipments. Advance in metering and communications have meant that electric power utilities worldwide are increasingly adopting the monitoringtechnology of energy monitoring system to provide better and more efficient services to electric consumers. In order to establish communication between the electricity meter and the calculation of utility, Programmable logic controllers (PLC) can be used.

Development of an online energy monitoring system via PLCs in environment by the use of:

- Data Acquisition Communication Protocol
- Processing within Energy Meter and host central station.
- The objectives of this project is:
- Easiest way for energy auditing process Reduce the manual cost
- Online energy consumption calculation Energy Consumption Monitoring using graph.

PLC

PLC is a device which is designed to perform the logic functions. In the past times these functions are accomplished by relays, timers, etc. These are bulky systems, chances of errors are more and if the fault occurring in these systems then its more time consuming to find the fault in these systems. This problem is over come by PLC. PLC stands for programmable logic controller. RICHARD E. MORLEY invented the first PLC in 1969. The PLC programming procedure replaced a wiring of the relays, timers etc. The PLC programming is written in high level language, which is easier for understandable of the more people. Any machine can be controlled automatically by use of PLC. For automatic control of machines the firstly make the program in the software according to the working process of the machine, then transfer the program to the PLC and after that connect the PLC to the machine. A single PLC can run many machines at same time if their working procedure is same. The PLC has capability for handling several inputs and outputs signal.

A programmable logic controller (PLC) or programmable controller is a digital computer used for automation of electromechanical processes, such as control of machinery on factory assembly lines, amusement rides, or light fixtures. PLCs are used in many industries and machines. Unlike general

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purpose computers, the PLC is designed for multiple inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. Programs to control machine operation are typically stored in battery-backed-up or non-volatile memory. APLC is an example of a hard real time system since output results must be produced in response to input conditions within a limited time, otherwise unintended operation will result.

Problem Formulation

- This new middleware is based onlatest Internet and Intranet technologies, offering the real-time operation and high reliability required for network control systems. Several systems are being manufactured, and some of which are alreadyatthestage of commissioning tests. This system allows the students to access real instruments in area l laboratory via the Internet. Additionally, the suggested architecture helps improve students' skills on SCADA systems in use in industry.
- The adoption of Internet and Intranet technologies has been rapidly spreading and existing systems are being replaced with new systems based on these new technologies. This article analyzes the characteristics and advantages of wireless networks, and then discusses the networking scheme for remote data collection using wireless networks, and analyzes the reliability of network transmission.
- This paper focuses on a SCADA system for the ultrahigh voltage equipment pilot plant of Tokyo Electric Power Corp. Training of this brain is done by programming. The PLC is programmed using the ladder logic. The basic objective after using a PLC isthat PLC has a capability of handling several Inputs, Output signals especially discrete (Figure 1).
- At changing environment of the power system industry, in 1999 Toshiba announced a concept of new middleware for power system network control systems including energy management systems (EMS), supervisory control and data acquisition systems (SCADA), and distribution management systems (DMS) (Figure 2).
- The energy management system (EMS) is the centre of the control system for a power system. EMS extends the scope of the supervisory control and data acquisition (SCADA) systems by the provision of power application software to assist the operator in report monitoring and control of the electrical network. With the emergence of high powered personal computers, EMS functions have moved to PC bases (Figure 3).

Methodology

Phase1:Planning and Research

Literature review

Research existing energy management systems, PLC-based solutions, and energy-saving strategies.

Site survey

Conduct a site survey togather information about the industrial facility's energy usage patterns, equipment, and existing infrastructure (Parasaram, 2022).

Define project scope and objectives

Based on the research and site survey, define the project scope, objectives, and deliverables.

Phase 2: SystemDesign

PLC selection

Select a suitable PLC hardware platform and programming language.

System architecture design

Design the system architecture, including the PLC, sensors, actuators, and communication protocols.

Energy monitoring and control strategy

Develop an energy monitoring and control strategy, including algorithms for energy usage analysis and optimization.

Phase 3: System Development

PLC programming

Develop the PLC program using the selected programming language.

Sensor and actuator integration

Integrate sensors and actuatorswiththe PLC.

Communication protocol implementation

Implement communication protocols for data exchange between the PLC and other systems.

Energy monitoring and control algorithm implementation

Implement theenergymonitoring and control algorithm.

Load control in the industry

The load can be controlled using PLC when the overall industry load is greater than or equal to a specified load during peak hours. The Punjab Electricity Board mentions the peak hours for every industry. Every industry has different peak hours. Every industry takes the permission of load from the electricity board as per the requirement of the industry load during peak hours. When the industry's load is greater than or equal to the specified load during peak hours, then the PLC automatically shuts down the equipments which are connected to the PLC according to the program stored in the PLC. The PLC used for load control is M340. The software used for M340 PLC is Unity Pro XL. Equipments for load control in the industries during peak hours are: PLC M340, SMPS, Indicators, MCB, Relays. Equipments for energy monitoring

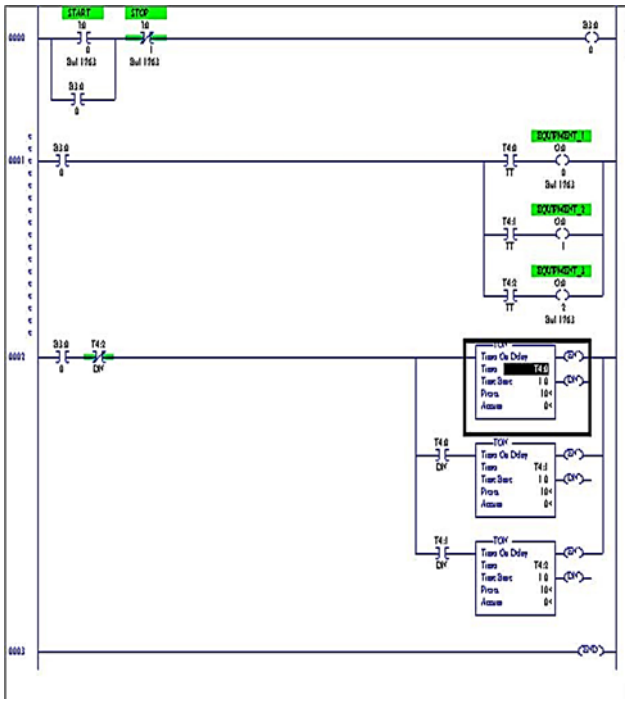

Figure 1: Ladder Diagram

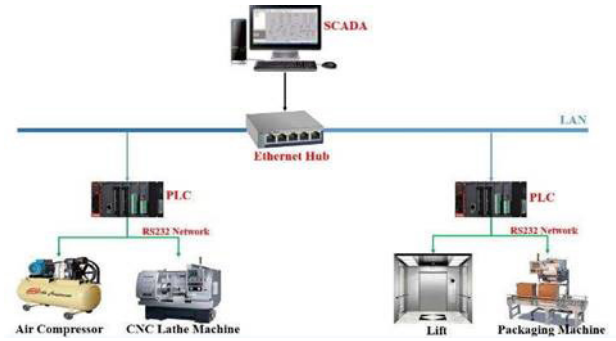

Figure 2: Flow Chart

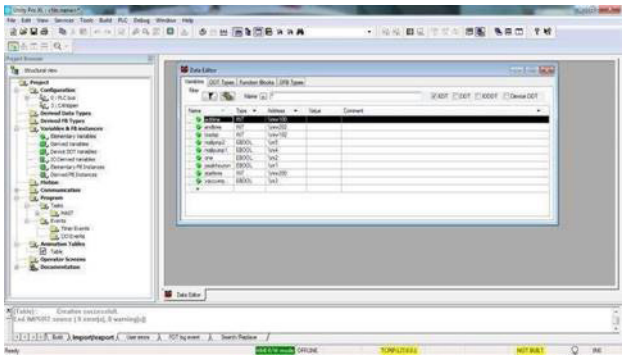

Figure 3: Table of Elementary variables

with SCADA are: Energy Meter, Gateway, Ethernet switch, Ethernet cable, SMPS, Server station, Client station.

Simulation

we have studied the different types of PLC. After that wedecided to use the M340PLC. All the working is done according to ladder diagram. The main features of M340 PLC are that online and offline modification can be done.

Resulte

The proposed system is designed for the automatic load control in the industry so that we can reduce the penalty charges for the industry and for theonline monitoring ofthe various energy meters to reduces the labour cost andchances of error.

Conclusion

The paper presented the load control applications during peak hours. From this we concluded that:

- By manually control of load during peak hours causes industry suffering from penalty charges. But the automatic controls of the load overcome such difficulty. The automatic control of load during peak hours by using PLC and SCADA completely eliminate the penalty charges.
- When the load increases above the load which is mentioned by electricity board during peak hours then automatically shutdown of some machine. There is no need of worker to shutdown the machine manually.
- By using SCADA we can check any parameter of the load of any machine at anytime on computer. So due to overloading and under loadings cause damaging of motors reduced.
- Reducing the damaging of motors by automation so production increases.
- The manually process needs lot of workers in the industry. Due to which labour cost increases. But the automation reduces the labour cost.
- Chances of errors reduced by automation.
- The unskilled person checks any load parameter on computer.
- Manually control is a lot of time consuming process.But automatic control is a time saving processes.

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