ISSN 2249-6343
International Journal of Computer Technology and Electronics Engineering (IJCTEE)
Volume 2, Issue 1

Intelligence of PLC for Energy Saving

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Abstract: **Power consumption is an important constraint in the design of induction heater in industrial heater in industrial automation. We are using Hardware and software optimization with the help of PLC ladder logic system. We are adopting this technique in order to reach strong conclusion about their actual impact on the power consumption.**

The basic idea behind power management project is to manage the power in various loads. When any one load increases then one of the loads that is connected out of many is disconnected, in this priorities is assigned to various loads and with the help of hardware and relay logic we will try to manage the load automatically.

Index Terms—PLC, Dynamic power managements, Heater, automation.

I. INTRODUCTION

Energy has been the life-blood for continual progress of human civilization. Energy Saving is an important constraint in the design of induction heater in the industrial revolution. We are using Hardware and PLC ladder logic for optimization energy. We are adopting this technique in order to reach strong conclusion about their actual impact on the power consumption.

Dynamic power management-which refers to selective shutoff or shut-down of systems components that are idle or underutilized-has proven to be a particularly effective technique for reducing power dissipation in such systems. Incorporating a dynamic power management scheme in the design of an already-complex system is difficult process that may require many designs.

Finally we compare the power consumed by all heater when shut on simultaneously and when shut on at different time sharing mode for the same purpose.

Power management is also one of the important constraints for industry. This can also be possible by managing the power of various loads. When any one load increases then one of the loads that is connected out of many is disconnected, in this priorities is assigned to various loads and with the help of hardware and relay logic we will try to manage the load automatically.

The priority of disconnecting is variable and can be changed from time to time. The current requirement of different load is different as the time varies. Hence according to that changing priority we can assign different priority to different load.

When the current in any one load increases then the total load on the generation process increases. The excess load may cause the power plant to trip. The cost involved for restarting a power plant is much more. So when the load increases it is advisable to disconnect any one of the loads that are connected. This process can be implemented in an automatic in this kind of project.

The present method of power management that is applied by the electricity board is manual. The town planning department defines the priority of different areas which can change from time to time. The town planning department keeps the record of the priority that is to be given to various areas. When the current requirement of any area increases then the electricity board which keeps the track of the current requirement to different area, informs the increase in load to the town planning department. The town planning department then ask them to disconnect a load where the power requirement is not so crucial as compared to other areas. For eg. if the four areas are

1. Housing Society
2. Hospital
3. Slum area
4. Industrial area

Now consider that the load in industrial area is increasing at a constant rate then the electricity board reports this change to the town planning department and in reply the town planning department tells them to disconnect the load of slum area .

Then the load is disconnected to stabilize the current. And in the same way when the extra current requirement of the industrial area decreases then the disconnected load is again connected back.

With the power management project we intend to convert this process into an automatic process where a computer is used to define the priority and the disconnecting part is automatic and not manual.

In power management project we place the computer for assigning the priority in the town planning department. The signals are given to the computer of the electricity board where there is the electronic control unit which controls the sequence of disconnecting the load.

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II. Design Methodology:

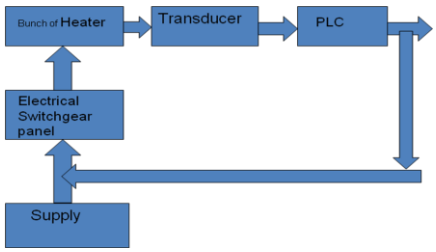

Figure 5: System Implementation

Effect of power consumption depends on target platform where they are run. Regarding hardware point of view concern, a bunch of heater is arranged in sequential manner and using a property of temp heaters are shut off or shutdown at different time sharing mode, with the help of PLC Ladder logic and in parallel with Electrical switchgear Panel. Heater temperature will be sensed by transducer and given as a I/P to PLC according to that a ladder logic that is stored in CPU of PLC will gets activated and it will shut On/Shut OFF the different Heater, So energy saving is possible with this approach.

PLCs are often programmed in ladder logic. This is because PLCs originally replaced relay control systems, and forty years later, we still haven't quite let go. A PLC, like any microprocessor, executes a list of instructions in sequence. Ladder logic tools abstract this; you can program the PLC by wiring up relay contacts and coils on-screen, and the PLC runtime will simulate the circuit that you've drawn. Some of the relay contacts can be tied to input signals from the real world; some of the coils can be tied to outputs. That way you can make your simulated circuit interact with other devices, and actually control things. That is the point.

Actually it's more general than that, because you can incorporate timers and counters and arithmetic operations that you couldn't (easily) perform with just relays. The circuit concept is still useful though, partly just because it's intuitive, but also because it abstracts the concurrency issues. It looks like this:

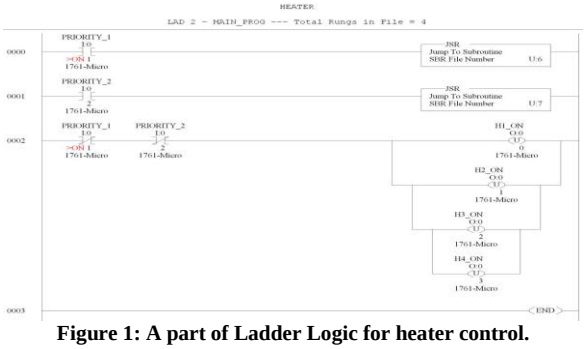

Figure 1: A part of Ladder Logic for heater control.

III. PLC and SCADA

Delegation of Human Control to technical Equipment aimed towards achieving.

ADVANTAGES

Higher productivity, Superior quality of end product, efficient usage of raw materials and energy, improved safety in working condition.

In this, the Control and Automation are done by Manual Operations [9, 12, and 13].

DRAWBACKS**:**

Human Errors subsequently affect quality of end product. Hard Wired Logic Control

In this, Contractor and relays together with timers and counters were used in achieving desired level of automation.

Bulky and complex wiring, Involves lot of rework to implement changes in control logic, the work can be started only when the takes is fully defined and this leads to longer project time.

Electronics Control with Logic Gates

In this, Contactor and Relays together with timers and counters were replaced with logic gates and electronic timers in the control circuits.

Advantages

1. Reduced space requirements, energy saving, less maintenance and hence greater reliability.
2. The Major Drawbacks
3. Implementation of changes in the control logic as well as reducing the project lead- time was not possible.

Programmable Logic Controller

4. In this, instead of achieving desired control and automation through physical wiring of control devices, it is achieving through program say software.
5. Advantages
6. Reduced Space, Energy saving, Modular Replacement, Easy trouble shooting, Error diagnostics programmer, Economical, Greater life and reliability, The Compatibilities of PLC'S, Logic Control, PID control, Operator control, Signaling and listing, Coordination and communication.
7. B. How PLC works
8. Basics of a PLC function are continual scanning of a program. The scanning process involves three basic steps.
9. Step 1: Testing input status
10. First the PLC checks each of its input with intention to see which one has status on or off. In other words it checks whether a switch or a sensor etc., is activated or not. The information that the processor thus obtains through this step is stored in memory in order to be used in the following steps.
11. Step 2: Programming execution

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12. Here a PLC executes a program instruction by instruction based on the program and based on the status of the input has obtained in the preceding step, and appropriate action is taken. The action might be activation of certain outputs and the results can be put off and stored in memory to be retrieved later in the following steps.
13. Step 3: Checking and Correction of output status
14. Finally, a PLC checks up output signals and adjust it has needed. Changes are performed based on the input status that had been read during the first step and based on the result of the program execution in step two – following execution of step three PLC returns a beginning of the cycle and continually repeats these steps .
15. Scanning time = Time for performing step 1+ Time for performing step 2+ Time for performing step 3[4].

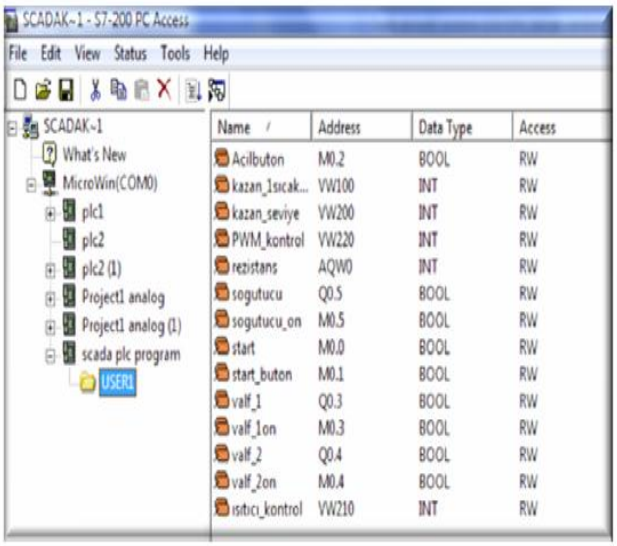

Figure 2: Computer access tag

SCADA stands for Supervisory Control and Data Acquisition. As the name indicates, it is not a full control system, but rather focuses on the supervisory level [12].

It is used to monitor and control plant or equipment. The control may be automatic or initiated by operator commands. The data acquisition is accomplished firstly by the RTU's scanning the field inputs connected to the RTU (it may be also called a PLC – programmable logic controller.). This is usually at a fast rate. The central host will scan the PTU's (usually at a slower rate). The data is processed to detect alarm conditions, and if an alarm is present, it will be displayed on special alarm lists[10].

A. Basics

A SCADA system consists of a number of components [7,13]. The RTU's. Remote telemetry or terminal units. The central SCADA master system.

Field Instrumentation

The SCADA RTU is a (hopefully) small ruggedized computer, which provides intelligence in the field, and allows the central SCADA master to communicate with the field instruments. It is a stand-alone data acquisition and control unit. Its function is to control process equipment at the remote site, acquire data from the equipment, and transfer the data back to the central SCADA system[14].

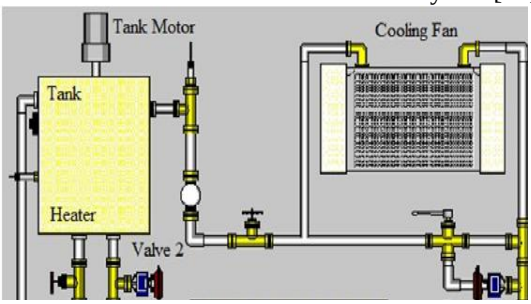

Figure 3: SCADA diagram for the system.

FIX32 software enables you to configure a system environment that provides: [3]

Supervisory control, batch processing, data acquisition, continuous control, and statistical process control for industrial applications. Interfacing of PLC to PC and to SCADA is as follows:

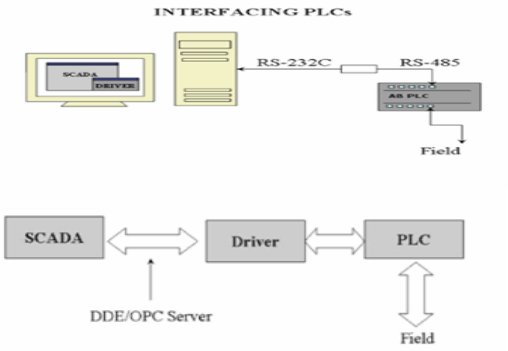

Figure 4: Interface diagram of PC to PLC and to SCADA.

V. CONCLUSIONS

In this study, an appropriate Programmable Logic Control (PLC) ladder diagram for a heater system was created. Additionally, appropriate SCADA software with the program to control and monitor the system from a central point was realized. The messaging between the analogous and digital data, SCADA and PLC was achieved successfully. The most important aspect of any industry is the heater control. Several techniques can be implemented to control the heater in power plant. The method that has to be used relies on varied objectives like superior quality, increased efficiency, high profit and mainly power management.

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With the prime objective of catering to these necessities and the needs of the industrial sector, significance has been given here to automation. The paper presented here has kept in mind, the ceaseless changes that are relentlessly taking place in the contemporary scenario of the industrial segment. Emphasis has been given to the automation process that is now rapidly taking its place in all the power plants across the globe. The Paper has furnished itself to study the integral parts of the entire process involved, their implementation and the problems that may show up have also been given their due importance.

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