A BRIEF SURVEY ON PROGRAMMABLE LOGIC CONTROLLER AND ITS VERSATILE APPLICATIONS USING SCADA SYSTEM

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ABSTRACT

A review of existing literature was performed to support the study undertaken in this notion. A general survey was first performed to chronicle past research efforts in developing the PLC based system using recent technology SCADA. It is the system which obtains a real time data of industrial parameters and displays it in various forms. It is an automatic control system usually practiced in number of industries. In the recent past, researchers have tested a wide array of control system in an attempt to find improved methods of monitoring and controlling the specific industrial parameters.

Keyword: - *Programmable logic controller (PLC), Super visionary Control and Data Acquisition (SCADA).*

1. INTRODUCTION

Automation is use of various control systems for operating equipment, such as boilers, machinery, heat treating ovens and processes in factories, switching in telephone networks, stabilization of ships and steering, aircraft and other applications with minimum involvement of human. The advantage of automation is that it saves labor, however it is also used to save energy, materials and to improve quality, precision and accuracy. The term automation, inspired by automaton, was not commonly used before 1947[1]. In 1930s, industry introduced feedback controllers, which were adopted very fast [2]. Automation has been achieved by various means including, mechanical, pneumatic, hydraulic, electrical, electronics and computers, mostly in combination. Combined techniques are usually used in complicated systems, such as ships, modern factories and airplanes. Engineers can now have numerical control over automated devices. Information technology, together with industrial machinery and processes, can lend a hand in the design, implementation, and monitoring of control systems. PLC is good example of an industrial control system. PLCs are specialized computers which are often used to synchronize the flow of inputs from sensors and events with the flow of outputs to actuators and events.

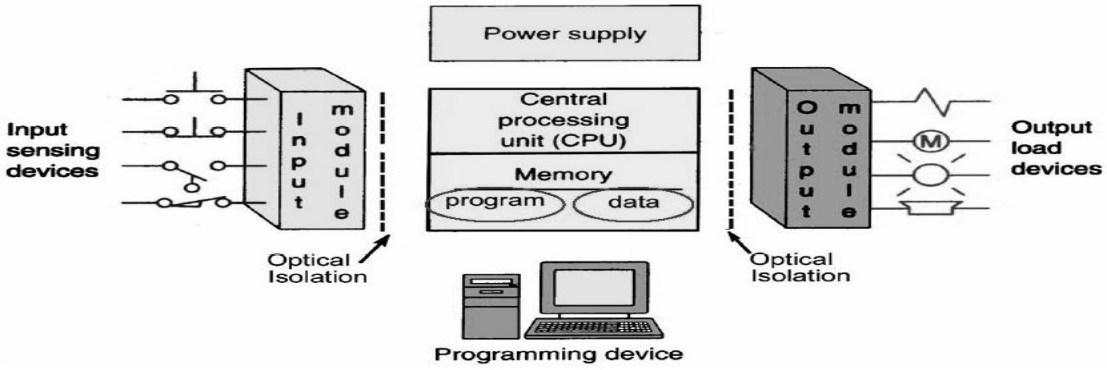

Figure 1 Block Diagram of PLC

Computer human interfaces (CHI) or Human-machine interfaces (HMI) called as man-machine interfaces, are usually employed to communicate with PLCs and other computers with human.Number of automated electromechanical designs is done through the use of small computers called programmable logic controllers (PLC). A specialized computer language is used to program a PLC as it contains a programmable microprocessor. The program is stored in the programmable logic controller in non-volatile memory. PLC is a solid state device which will control the process or output based on the status of input. Following fig 1 shows the basic programmable logic controller architecture. A power supply is to provide power to the PLC and modules. External power supplies that mount to the outside of a framework. Embedded power supply that come as part of the PLC. The main part is CPU which controls the entire PLC processes; it can be divided into processor and memory system. Accordingly, the PLC updates output devices via the output interfaces. Scanning is the process which continues in the same sequence without interruption, and it changes only when a change is made to the control program. PLC provides both in build analog and digital I/O modules.

2. LITERATURE REVIEWS

A brief survey of technologies explored during the past decade and some of them is given below to provide an understanding of the level of research interest in this domain.

In this paper [5], researcher outlined the various phases of operation involved in the adaptation of a manually operated boiler towards a totally automated boiler. The first part of the paper focuses on passing the inputs to the boiler at a required temperature, so as to constantly maintain a particular temperature in the boiler. The Air pre heater and Economizer helped in this method. And the paper mainly focused on level, pressure and flow control at the various stages of the boiler plant. Thus the temperature in the boiler is constantly monitored and brought to a constant temperature as required by the power plant. The automation is further improved by constant monitoring using SCADA screen which is connected to the PLC by means of communication cable. By means of tag values set to various parameters in SCADA the entire process is controlled. At the automated power plant, the boiler is controlled by Variable Frequency Drive (VFD) to put in action the required processes to be carried out at the boiler. Thus the entire cycle is carried out as a paper and at various stages each phase is detailed out. This paper has proved to be very efficient practically as the need for automation grows day by day.

This paper presented a SCADA system for a plant whose product demand is varying according to the temperature [7]. This paper also gives an automatic method of changing a production from one mode to another. There is no manual shifting required. This paper gives a way to get rid off excess production. It also provides the facility to the user to over ride the any one of the unit hardware operation from the control room.

Researchers developed a design of re-usability using modular modeling techniques. Re-implementation of program of existing PLC program based on formulization and visualization [4]. It is done by transformation of FSM in XML format into IEC 61131-3 POUs and project is to be creating to control machine using new controller.

Prior to the development of data acquisition and control system, collecting data from remote field instruments, distributed throughout the plant in huge manufacturing industries, was a quite challenging and multifaceted task. The team of researcher has been developed an industrial data acquisition and control systems equipped these industries with facilities to gather and process data, and perform control actions right from a centralized location, i.e. control room, without actually going to the plant. They introduction of programmable logic controllers (PLC) as a data acquisition and control hardware in these systems increased its reliability and robustness. This paper highlights the design work carried out to develop a cost efficient, simple, robust and intelligent industrial standard data acquisition and control system for two physical field plants that are 50 meters apart from the control room. This work highlights process control application and indeed is an application of industrial electronics engineering. The work carried out for this data acquisition and control system is in correlation with SCADA, DCS and totally integrated automation, which is meant to optimize processes and manufacturing procedures at the same time [8].

At present, the PLC has been widely used in the industry area. But the shortcoming of this controller appears along with the growth of the industry equipments. Such as inferior compatibility cooperate with the new equipments, poor satisfaction of the high calculation and weak communication and so on. Thus, there need new technology to satisfy the increasing industry demands. The soft PLC comes into the world from on kind of condition. The function of PLC is imitated through software on the PC platform. But the soft PLC has shortage also. The sturdiness and instantaneity is worse than the traditional PLC. Therefore, the embedded PLC combines the advantages of traditional PLC and soft PLC, increase the computing power, express the advantages of ladder diagram and open construction to bring a universal platform to the controlled members [9].

In this research paper, the group of authors took efforts on the improvement of demonstrating how industrial temperature automation can be achieves using modest hardware and more refined software details [10]. The prime

concern was to generate firing pulse for an HVAC controlling actuator while displacing them at the same time to vary the magnitude of the ac voltage output. The direction of displacement of the pulse was described by the SETPOINT definition from an HMI using AT commands, and FEEDBACK from the temperature sensor installed in the industrial background. The mathematical modeling was done in LabVIEW for investigating the effect of varying firing angle on the magnitude of the ac voltage. This controlled variation of output ac voltage can be subjected to controlling temperature of the particular industrial environment.

With the help of PLC, researcher has been build and implements logic for Industrial Crane Automation & Monitoring. The soft wiring advantage provided by programmable controllers is Tremendous. In fact, it is one of the most important features of PLCs. Soft wiring makes changes in the control system easy and cheap. If it want a device in a PLC system to behave differently or to control a different process element, all have to do is change the control Program. In a traditional system, making this type of change would involve physically changing the wiring between the devices, a costly and time-consuming attempt [12]. In future definitely PLC is dominated on all other controlling methods.

The team of authors developed ladder logic in MICROLOGIX software and is verified in Allen Bradley PLC [13]. A ladder logic program of a typical application often results in complex software that is difficult to manage during configuration, and especially, during maintenance. The difficulty lies in a typical problem with real-time control software that is exacerbated by ladder logic. Individual components of PLC software are characteristically asynchronous, resulting in unpredictable interactions. This makes the initial configuration of the software (i.e., commissioning) extremely difficult and labour-intensive, but also makes reconfiguration risky. However the system creates a fast, real-time decision making environment. Also the use of SCADA in the industry will not only allow them to minimize the cost associated with the display and recording instruments but will also account for better quality and higher productivity. The process is adaptable to any changes in production capacity or safety requirements. In short integrated automation process produces a reliable quality hardboard production industry with the help of PLC. This paper focuses on an innovative and intelligent monitoring system of process using SCADA.

The main concept of paper is data acquisition & controlling by using SCADA software with the help of PLC. Here PLC is a medium between electrical system & Personal Computer for SCADA to take input and output bits. Automating electrical distributions systems by implementing a supervisory control and data acquisition (SCADA) system is the one of the most cost-effective solutions for improving reliability, increasing utilization, increasing efficiency and saving costs [14].

This paper presented an automatic control of temperature and level of Continues Stirred Tank Reactor (CSTR) using PLC and SCADA. The CSTR is heated using heating-coil and its temperature and level are measured by RTD and float type level sensor respectively. The accurate control of temperature and level are the realistic feature of this system and balances the process. Automation required gaining the complete control of manufacturing process to achieve consistency in manufacturing with increased productivity by shortening manufacturing time. In this paper we consider both Batch and Continues process control using PLC and SCADA. The PLC and SCADA control the process parameters with good accuracy and results are found to be satisfactorily. This is a simple automated process and can be applied in many mixing processes used in industries [15].

In this research paper, the device temperature parameter of different zones of furnace has been constantly monitored and hence it can be further controlled by using DAQ and control system. The constant monitoring of such different furnace zone temperature can produce data-base for scheduling of the machine servicing, troubleshooting and also for future processing. Due to use of microcontroller the computation task has been handled most effectively. Hence group of authors proposed system has been widely used in automotive engineering, instrumentation and power quality monitoring and control applications. Data acquisition system for monitoring such temperature of brazing furnace provides advantages of design simplicity, portability and less cost [18].

This paper reveals the design of LabVIEW based SCADA system for centralized control. It makes use of PLC as a field controller to operate the prototype design of Stenter Machine, widely used in textile industries. LabVIEW, which is a commonly accepted graphical user interface environment, also provides HMI front end. The PLC controller and the LabVIEW based SCADA are communicating through the RS-232 link. The control system is flexible and modular. Due to the intuitive programming of LabVIEW, this system is cost efficient and reliable solution for automation of small scale textile industries [19].

The system introduced by a group of researchers is an experimental study which helps in controlling the characteristics and ON/OFF states of a control valve. A graphical user Interface has been developed using supervisory control and data acquisition (SCADA) and the programming of the control system has been done using programmable logic control (PLC). A descriptive study has been incorporated in this paper to formulize all factors responsible for the change in valve characteristics. This system gives a clear idea about the opening and closing of three types of valves which may be present as per its requirement in an industry. The user of the system is able to

supply input parameters so as to efficiently control the valve. The system is highly efficient and cost effective, as only one interfaced digital system along with a PLC can control many subsequent valves [20].

3. CONCLUSION

System using PLC and SCADA technology is briefly explored with the help of number of application. In this paper, our prime concern was the development of demonstrating how industrial parameters automation can be made possible using a programmable logic controller. We can simply control any load in our system to get better system operation, system reliability and efficiency. Alternatively, SCADA and PLC communication system make it possible to integrate protection control and monitoring specific parameter together for maximum benefit. Higher-speed processors and additional memory will opens the floodgate for advanced features such as vision system integration, motion control and simultaneous support for several communication protocols-while still maintaining much of the simplicity that makes the PLC so attractive to many users. The Automation Centre takes on Industrial and Process Automation projects, creating tailor-made PLC and SCADA solutions for each client. Suppliers and their customers can able to support a huge installed base of equipment controlled by PLCs programmed in ladder logic. Several engineer, technician, electrician, and maintenance personnel who prefer this simple programming technology.

4. FUTURE SCOPE

The challenge continues with providing the connectivity, memory expansion, and processing power improvements required to handle even more complicated applications, while maintaining or even lowering the cost of the final product.

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