DEVICE CONTROL AND MONITORING USING PLC

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ABSTRACT

PLC (Programmable Logic Controller)is playing very important role now days in industries because of its simplicity and robustness. It is used to control many mechanical movements of the heavy machines or to control the voltage and frequency of the power supplies.

Today's world of automation and industries, you have many cost effective control solutions that allow for advanced computer based and remote control. With these advanced control solutions comes with gigabytes of process data that can be utilized for quality control, process optimization and maximizing equipment capacity.

I. INTRODUCTION

The process control system is made up of a group of electronic devices that provide stability, accuracy and eliminate harmful transition statuses in production processes. Operating systems can have different arrangements and implementation, from energy supply units to machines. As technology quickly progresses, many complex operational tasks have been solved by connecting programmable logic controllers and a central computer. Beside connections with devices (e.g., operating panels, motors, sensors, switches, valves, etc.) possibilities for communication among instruments are so great that they allow a high level of exploitation and process coordination. In addition, there is greater flexibility in realizing a process control system. Each component of a process control system plays an important role, regardless of its size. For example, without a sensor, the PLC wouldn't know what is going on during a process. In an automated system, a PLC controller is usually the central part of a process control system. With the execution of a program stored in program memory, PLC continuously monitors status of the system through signals from input devices. Based on the logic implemented in the program, PLC determines which actions need to be executed with output instruments. To run more complex processes it is possible to connect more PLC controllers to a central computer or a master computer.

PLC or programmable controller is a advance electronic microprocessor based device used to monitor and control external devices, such as control of machinery on factory assembly lines, amusement rides, or lighting fixtures. PLCs are used in many industries and machines. Unlike general-purpose the subject invention pertains to facilitating communication between industrial computers, the PLC is designed for multiple inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibrationandimpact. Programs to control machine operation are typically stored in battery-backed or non-volatile memory. A PLC is an example of a real time system since output results must be produced in response to input conditions within a bounded time, otherwiseunintended operations will result.

1.1 Programmable Controllers History

In 1969 the first programmable controller was developed. These early controllers met the original specifications and opened the door to the development of a new control technology.

First PLCs offered relay functionality and replaced the original hardwired relay logic, which used electrically operated devices to mechanically switch electrical circuits. They met the requirements of modularity, expandability, programmability, and ease of use in an industrial Environment. These controllers were easily installed, used less space, and were reusable. The controller programming, although a little tedious, had a recognizable plant standard: the ladder diagram format. By 1971 PLC had spread to other automation industries such as food and beverage, metals and manufacturing, pulp and paper.

II. BASIC PLC HARDWARE ARCHITECTURE

The basic architecture of a PLC consists of main components-the processor module, the power supply, and the I/O modules. The processor module consists of the central processing unit (CPU) and memory. In addition to a microprocessor, the CPU also contains at least an interface to a programming device and may contain interfaces to remote I/O and other communication networks. The power supply is usually a separate module, and the I/O modules are separate from the processor. The types of I/O modules include discrete (on/off), analog (continuous variable), and special modules like motion control or high-speed counters. The field devices are connected to the I/O modules.

Depending on the number of I/O and the particular PLC processor, the I/O modules may be in the same chassis as the processor and/or in one or more other chassis. Up until the late 1980s, the I/O modules in a typical PLC system were in chassis separate from the PLC processor. In the more typical present-day PLC, some of the I/O modules are present in the chassis that contains the processor. Some PLC systems allow more than one processor in the same chassis. Smaller PLCs are often mounted on a DIN rail. The smallest PLCs (often called micro-PLCs or nano-PLCs) include the power supply, processor, and all of the I/Os in one package. Some micro-PLCs contain a built-in operator interface panel. For many micro-PLCs, the amount of I/O is limited and not expandable.

III. FEATURES OF P L C

PLC control system is that it regards PLC as control key component, utilize special I/O module to form hardware of control system with a small amount of measurement and peripheral circuit, to realize control to the whole system through programming.

3.1 High Reliability

Strong anti-interference quality and very high reliability are the most important features of PLC. In order to make PLC work stably in strong interferential circumstance. Many techniques are applied in PLC. Software control instead of relay control mode can decrease faults which are brought about by original electric contact spot outside working badly. Industrial grade components made by advance processing technology can resist interferences, and self diagnosis measures of watchdog circuit for protecting memory can improve performance of PLC greatly.

3.2 Good Flexibility

There are several programming languages for PLC including ladder diagrams SFC, STL, ST and so on. If operator can master only one of programming languages, he can operate PLC well. Every who want to use PLC has a good choice. Based on engineering practice, capacity and function can be expanded by

expanding number of module, so PLC has a good flexibility.

3.3 Quality of Strong Easy-Operating

It is very easy to edit and modify program for PLC by computer offline or online. It is very easy to find out where the fault line by displaying the information of fault and function of Self Diagnosing Function, and all these make maintenance and repair for PLC easier. It is very easy to configure PLC because of modularization, standardization, serialization of PLC.

3.4 SCADA

The word SCADA usually refers to centralized systems which monitor and control entire sites, or complexes of systems spread out over large areas (anything between an industrial plant and a country). Most control actions are performed automatically by Remote Terminal Units ("RTUs") or by Programmable Logic Controllers ("PLCs").Host control functions are usually restricted to basic overriding or supervisory levelintervention. For example, a PLC may control the flow of cooling water through part of an industrial process, but the SCADA system may allow operators to change the set points for the flow, and enable alarm conditions, such as loss of flow and high temperature, to be displayed and recorded. The feedback control loop passes through the RTU or PLC, while the SCADA system monitors the overall performance of the loop.

Data acquisition begins at the RTU or PLC level and includes meter readings and equipment status reports that are communicated to SCADA as required. Data is then compiled and formatted in such a way that a control room operator using the HMI can make supervisory decisions to adjust or override normal RTU (PLC) controls. Data may also be fed to a Historian, often built on a commodity Database Management System, to allow trending and other analytical auditing. SCADA systems typically implementdistributed database, commonly referred to as a tag database, which contains data elements called tags or points. A point represents a single input or output value monitored or controlled by the system. Points can be either "hard" or "soft". A hard point represents an actual input or output within the system, while a soft point results from logic and math operations applied to other points. (Most implementationsconceptuallyremove the distinction by making every property a "soft" point expression, which may, in the simplest case, equal a single hard point.) Points are normally stored as value-timestamp pairs: a value and the timestamp when it was recorded or calculated. A series of value-timestamp pairs gives the history of that pointIt's also commontostore additional metadata with tags, such as the path to a field device or PLC register, design time comments, and alarm information.

IV. HUMAN MACHINE INTERFACE

Human-Machine Interface or HMI is the apparatus which presents process data to a human operator, and through which the human operator controls the process.

An HMI is usually linked to the SCADA system's databases and software programs, to provide trending, diagnostic data,andmanagement information such as scheduled maintenance procedures, logistic information, and detailed schematics for a particular sensor or machine, and expert- system troubleshooting guides. This means that the operator can see a schematic representation of the plant being controlled. For example, a picture of a pump connected to a pipe can show the operator that the pump is running and

how much fluid it is pumping through the pipe at the moment. The operator can then switch the pump off. The HMI software will show the flow rate of the fluid in the pipe decrease in real time. Mimic diagrams may consist of line graphics and schematic symbols to represent process elements, or may consist of digital photographs of the process equipment overlain with animated symbols.

The HMI package for the SCADA system typically includes a drawing program that the operators or system maintenance personnel use to change the way these points are represented in the interface. These representations can be as simple as an on-screen traffic light, which represents the state of an actual traffic light in the field, or as complex as a multi-projector display representing the position of all of the elevators in a skyscraper or all of the trains on a railway.

An important part of most SCADA implementations are alarms. An alarm is a digital status point that has either the value NORMAL or ALARM. Alarms can be created in such a way that when their requirements are met, they are activated. An example of an alarm is the "fuel tank empty" light in a car. The SCADA operator's attention is drawn to the part of the system requiring attention by the alarm. Emails and text messages are often sent along with an alarm activation alerting managers along with the SCADA operator

V. ADVANTAGES OF PLC

In industries that exist right now, the presence of PLC is necessary especially to replace the wiring or cabling systems that previously were used in controlling a system. By using the PLC will get many benefits which are as follows:

5.1 Flexible

In the past, each different electronic device controlled by each controller. Suppose ten machines require ten controllers, but now with only one tenth PLC machine can be run with each program.

5.2 Changes and Error Correction System Easier

If one system will be modified or corrected, the change is only done on the programs contained in computers, in a relatively short time, after that it downloaded to the PLC. If not using a PLC, for example relays the amendments made by altering the wiring cables. This course takes a long time.

5.3 Number of Contacts Many

Number of contacts held by the PLC on each coil is more than the contacts held by a relay.

5.4 Cheaper

PLC is capable of simplifying a lot of cabling compared to a relay. So the price of a PLC at a price cheaper than some fruit relay capable of doing the wiring for the same amount with a PLC. PLC includes relays, timers, counters, sequencers, and other functions.

5.5 Operating Speed

PLC operation speed is faster than the relay. Speed PLC scan time is determined by its in units of milliseconds.

5.6 Resistant Character Test

Solid state devices are more resistant than the relay and test mechanical or electrical timers. PLC is a solid state device that is more resistant test.

5.7 Simplifies the Control System Components

The PLC also have counters, relays and other components, so it does not require components such as additional. Use of relays requires counters, timers or other components as additional equipment.

5.8 Documentation

Printout of the PLC can be directly obtained and do not need to see the blueprint of his circuit. Unlike the printout relay circuit cannot be obtained.

5.9 Security

Changing the PLC cannot be done unless the PLC is not locked and programmed. So there is no unauthorized person can change the PLC program for a PLC is locked.

5.10 Can make Changes By Reprogramming

Since the PLC can be programmed quickly reset the production process that mixes can be completed. For example part B will be executed but sections of A is still in the process, the process in section B can be re-programmed in seconds.

VI. DISADVANTAGES OF PLC

1. Because it is a new technology, so that should require training.
2. Some applications that perform a single function, is not efficient in the use of PLC.
3. Limited usage environments, high temperatures and harsh vibrations can disrupt electronic equipment on the PLC.
4. Need extra security equipment such as really.
5. PLC is not considered necessary when applied to industrial systems that do not need to change the wiring.

6.1 Applications of PLC

There are many various applications of PLC in all industries whish are as below

1. Monitoring
2. Control
3. Configuration/Programming
4. Data Logging

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