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Continuous Process Control Monitoring Automation System (Cpcmas)

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Abstract. In the earlier years, the connection with the plant was mainly implemented via point-to-point dedicated links, thus, input/output boards capable of handling digital/analog signals were used. The rapid development of monitoring system (MS) techniques opens a new door towards the realization of intelligent automation in industry. In this paper, we present a cost-effective continuous process control monitoring automation system (CPCMAS), based on modular distributed input/output controllers (MDIOC) and a PC based visual human-/machine interface and data acquisition system (HMI/DAS) which integrates a real-time control mechanism and on-line supervision with multiple knowledge resources. Monitoring System (MS) for industries are used to minimize device loads by minimizing data request. The automation system based on MDIOC, relevant diagnostic data for continuous monitoring are transmitted remotely to a control room for analysis using specialized software. The major purpose of this paper is to demonstrate that MDIOCs are responsive to rapid and repetitious control tasks. The key aspect of this CPCMAS platform is its easily accessible flow of information and wiring through network.

Keywords: Ethernet; Synchronous control network; Factory automation; Real-time data communication; OLE Process Control; LABVIEW; Field Point; Distributed systems.

1. Introduction

In the past years, the connection with the plant was mainly implemented via point-to-point dedicated links (Fig.1.) thus, input/output boards capable of handling digital/analog signals (Fig.2) were used. In the earlier years, research work in intelligence automation (IA), and particularly in process control system (PCS), has contributed significantly to the process control automation field. IA techniques have attracted the attention and interest of both academic researchers and engineers. Performance reliability and safety of complex dynamical processes such as power plants depend upon validity and accuracy of sensor signals that measure plant conditions for information display, health monitoring, and control [1].

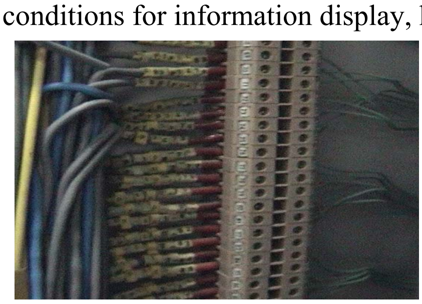

Fig. 1: Point-to-Point dedicated links

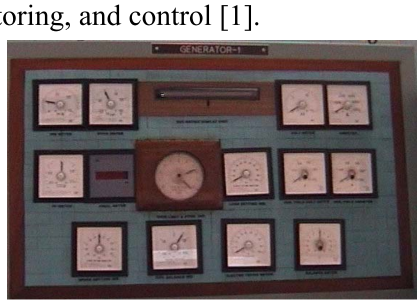

Fig. 2: Digital/Analog Signal Indicators

Redundant sensors are often installed to generate spatially averaged time-dependent estimates of critical variables so that reliable monitoring and control of the plant are assured. Within the last few years, a wide variety of knowledge-based control systems have emerged for modern global industrial growth and competitiveness. Simulation and experimental results for a laboratory-scale factory at Indian Institute of

Technology – Kanpur (IITK) indicated with above framework can perform well in real-time data transmission, which is, accomplishing the synchronous communication over 10 slave nodes. The application of process control technology and the concurrent need for industry-specific intelligent management systems are central to continued intensification of the plant industry. A PC – Based Continuous Process Control Monitoring Automation System (Fig.3.) combines hardware and software to interface monitoring instrumentation with data collection, processing and reporting systems.

CPCMAS provides an efficient tool for monitoring and controlling equipments in processes on-line. In this paper, we present the design and implementation of hybrid CPCMAS at the IITK. It is based on advanced MDIOCs and a PC-based visual HMI. This CPCMAS provides economical and user-friendly solutions to supervisor controlled facilities. The key aspect of this intelligent CPCMAS platform is its easily accessible flow of information and wiring through networks. Information from this CPCMAS platform can be distributed through a company's local area network (LAN) or World Wide Web. The major purpose of this paper demonstrates that MDIOCs are responsive to rapid and repetitious control tasks. Thus providing the user a tool to monitor and control efficiently. This paper comprises of the following: Section 2 begins with the system configuration of the CPCMAS at IITK; Section 3 shows the software planning and implementation of the CPCMAS; Sections 4 and 5 present the application and results of DIOC controlled and PC-based HMI for the CPCMAS at IITK; and Sections 6 end with a summary of the advantages of this Field Point MDIOC-controlled and PC-based HMI for CPCMAS application.

2. System Configuration of the Cpcmas

A view of the developed CPCMAS at IITK is shown in Fig.3. It consists of the following main components

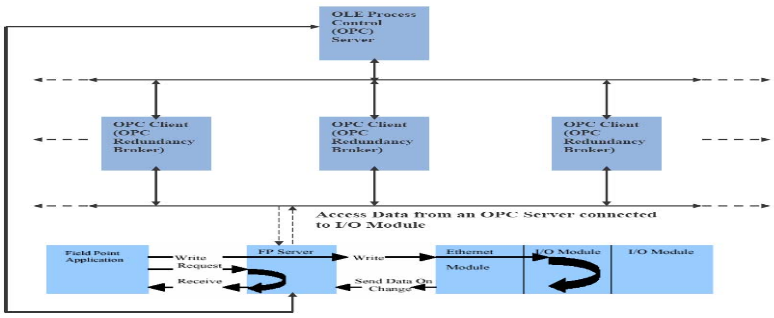

Fig. 3: Continuous Process Control Monitoring Automation System

MDIOC are PC-based, it can be programmed using Lab view standard languages thus creating virtual function required for an application. The MDIOC support with dynamic data exchange (DDE) [2] add functionality to Windows packages on the PC. It is superior to open functionality, data processing, and information connectivity to the conventional proprietary systems. Ethernet network modules (Fig.4) sends updates to the Field Point Server, when data changes. The server then caches the data from I/O modules and uses it to respond to read requests.

Fig. 4: Ethernet Network Module

The network module periodically sends and receives a time-synchronization signal so that it can adjust its clock and provide proper time stamping.

3. Technology behind OPC and Implementation

OPC Redundancy Broker (ORB)[3] enables easy implementation of redundancy in systems that take advantage of OPC technology. ORB is designed for OPC applications that must use redundant hardware and/or software to achieve the highest degree of communication reliability.

Fig.5: Interoperability

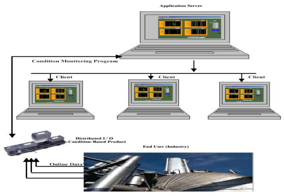

Fig.6: CMS with ECS/OPC server

Interoperability (Fig.5) ensures OPC product intercommunication. OPC provides interoperability of real-time information between the condition monitoring distributed I/O systems and operators using a PC-based system to monitor and control hundreds of measurement control devices located throughout the plant.Condition monitoring software (CMS) and the Distributed I/O Module communicate (Fig.6.) With the Environmental Control systems (ECS) and network through an OPC server.

4. PC-based Visual HMI/DAS

A PC-based visual HMI/DAS based on the Intellution-FIX was developed to monitor the process and log data. The functions of the HMI/DAS are twofold. First, it opens a window between the operator and the process and then displays the process information on the CRT. The PC Windows-based HMI/DAS[4] software provides an icon based and mouse-drive open system for designing quick control strategy and dynamic operator displays.Fig.7.shows the co-relationship of HMI/DAS with users, controllers and computer. Fig. 7 show electric data, and a report sample.

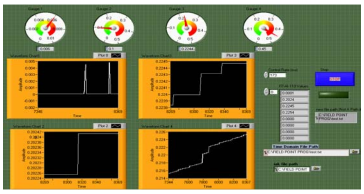

Fig.7: HMI-Data/ Report Sample

5. Experimental Results

The live electric data displays and on-line historical trending (Fig.8 and Fig.9) provide a window for management personnel to realize the current status of energy consumption of the organization. The historical trending gives a review scope to study or trace the energy usage within the past period of time

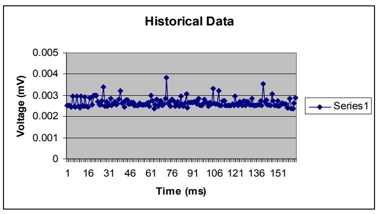

Fig.8: Historical Voltage Data

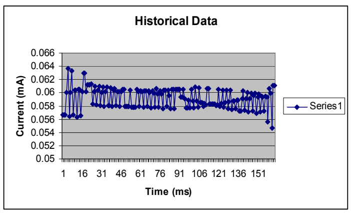

Fig.9: Historical Current Data

6. Conclusion

The main and backup servers rely on lookout redundancy features to realize a mission-critical system that parallels the hardware redundancy while minimizing the data and control loss due to hardware or software failure on a single system element. The system operates in distributed networked modules where users have password protection and hierarchical access to single test facilities for all of the control and data viewing operations. Thus the condition-based maintenance product with the monitoring program minimizes device loads by minimizing data request to monitor, improves equipment efficiency, productivity, prevent problems and safety of operation.

7. References

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