Low Cost Distributed Architecture for Supervising Systems

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The evolution of industrial equipment and the increasing use of automation systems had come to become the tasks of monitoring and control very complex. The use of communication and information technologies allows the automation of these tasks, collecting data in complex environments, eventually geographically dispersed, and the respective presentation in a friendly way for the user, using human machine interfaces (HMI). These systems, designed as supervision systems or simply SCADA (Supervisory Control and Data Acquisition), allow collecting data of variables process as temperature, pressure or liquid level, through equipment of data acquisition, in order to be manipulated, analyzed and presented to the user. This information can be visualized by the use of synoptic pictures, with real-time indications of process variables and also stored in databases, allowing an analysis through tables and trend graphs. The use of these systems allows process improvement, as they supply in useful time the current state of the productive process, through a set of forecasts, graphs and reports, in order to taking appropriate decisions, in a automatic way, or for operator initiative. This work presents an open architecture model of low cost for supervision industrial processes. The model presents features of interoperability with several industrial PLC (Programmable Logic Controller) and allows the easy use of tools for user interface programming. It was tested and is working in a real environment for the supervision of unmoulding liquid consumption in a production mould foam line with about 30 sensors and actuators.

Keywords Industrial Process; Supervision; SCADA; HMI; OPC

1. Introduction

The firsts SCADA systems on the market was very expensive and don't have an open architecture that allows a good interoperability with heterogeneous systems and the remains information systems in the organizations. For that reason, a set of specifications was developed by the industry and named OLE for Process Control (OPC). OPC is open connectivity in industrial automation and the enterprise systems that support industry [1]. The system here proposed is not an OPC system. It is a low cost system that supplies features seemed as OPC with interoperability granted, and with practically no programming needs.

2. Proposed architecture

Based on fundamental standards and technology of the general computing market, the proposed architecture adapts and creates specifications that fill industry-specific needs. The proposed architecture allows an easy adaptation to several situations, supplying a set of features and tools that allows an efficient monitoring and process control. The system is constituted by a set of components that make use of standard communication mechanisms in Windows environments as either OLEDB/ADO, COM/DCOM, TCP/IP and RS232. The practical use of the architecture becomes through the reprogramming of the monitoring module which can be developed in any language that allows the use of ActiveX components. Figure 1 illustrates the proposed architecture.

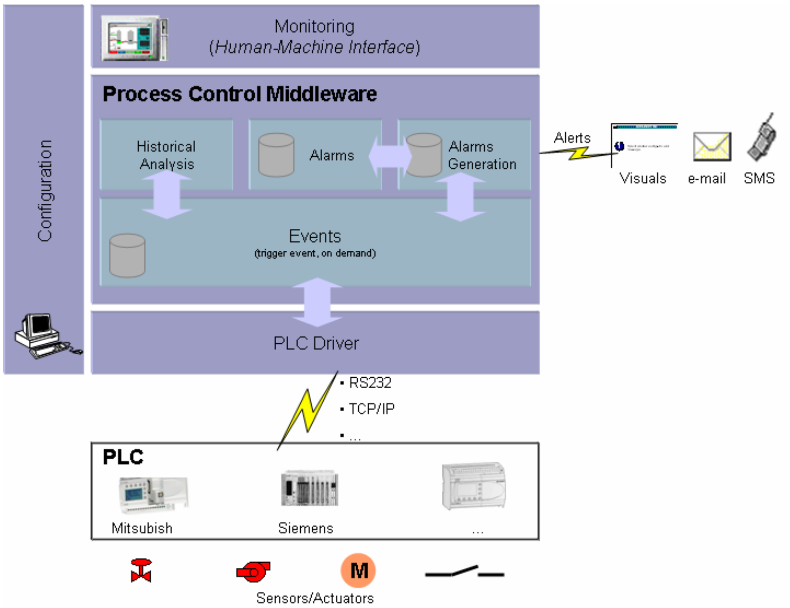

Fig. 1 *Proposed architecture.*

PLC Driver

This component is responsible for PLC communication. The driver consists of ActiveX with a standard interface (properties, methods and events). In such way, the development of drivers for new PLC, consists of the development of the ActiveX with the defined interface, remaining all communication interface with upper level intact - the Process Middleware Control. It acts as a blackbox that "talks" with PLC reading its variables and actuating in its sensors.

Process Control Middleware

This component allows the interoperability with lower layer of PLC link and the upper level of user interface (HMI). It supplies the services and the logic of management and configurations storage, events, alarms as well as a standard set of screens and reports for historical analysis of information. It is constituted by a set of COM/DCOM components and NT services that allow the implementation of the "core system" architecture. All information, as events, alarms and configuration, is stored in a MySQL database, allowing a low cost system, and simultaneously the use a database with good performance, since it is expected the existence of many data in determined control situations. This component also has the responsibility of events and alarms generation for client applications (Human-Machine Interfaces). The events are propagated for the clients through TCP/IP messages. The alerts can be visual (a Window popup dialog), an email sent for determined set of users or an SMS message.

Monitoring (Human-Machine Interface)

This module needs to be reprogrammed for new situations of processes control. For programming, the user have a ActiveX that supply all the communication logic with lower level (the Process Control Middleware) and a set of graphics, like valves, motors and switch that allow an easy design of the process diagram.

Configuration

This module allows the configuration of all system, like PLC's installed and I/O ports; alert configuration (conditions and type of - visual, email, SMS) and gateway configuration of SMS.

3. Application of the model

The model was tested and is working in a real environment for the supervision of an unmoulding liquid consume in a production mould foam line with about 30 sensors and actuators. The main goal of this system is to impute responsibilities to the operators concerning consume. This system makes possible the supervisor to control how consume is related with the production avoiding excessive consume. The PLC used is a Mitsubish AL2-24M R-D, and the driver for those automata was developed as explained in previous section.

The system consists on a server that collects the data from the sensors and stores this information in the MySql database. Is a server responsibility, broadcast all events to the clients that are monitoring the system. The server also have the responsibility of sending alerts through SMS, and e-mail for all the users defined in the system. In this way, it’s possible for a user to receive an alert through SMS, even when he is at home, warning that something is going wrong in the plant floor.

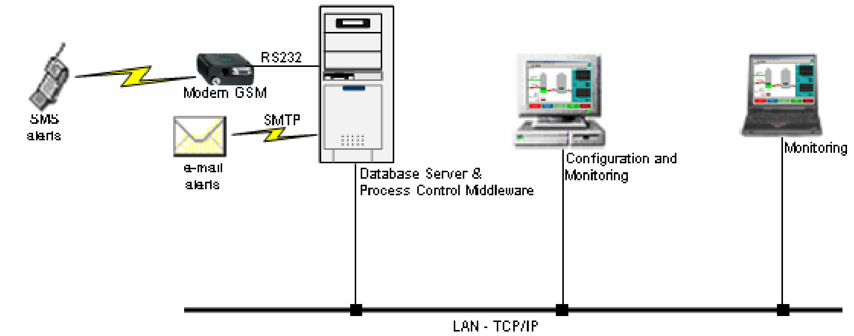

Fig. 2 Implemented architecture.

For monitoring the system, was developed a HMI that show in real-time the state of the process. That HMI also show some historical information allowing a better control. It shows the tendency of liquid consumption by shift or period of time.

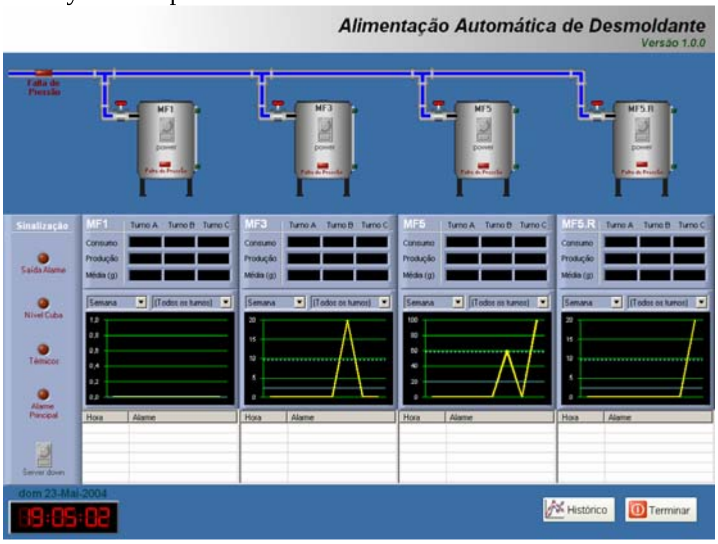

Fig. 3 Human-Machine Interface developed.

4. Conclusions

The model presents features of interoperability with several industrial PLC and allows the easy use of tools for user interface programming, allowing a low cost development of SCADA system with few programming skills.

The model was tested in real time environment with a great success, and the company is now planning to use it with other process control needs.

References

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