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REMOTE ADMINISTRATION OF CONTROL SYSTEMS

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Abstract

This contribution describes a possibility of implementation of external I/O units for real time control of laboratory models. DataLab I/O is used as external I/O unit. This unit includes digital and analog input/output. Control Web 5 components (pid_controler, boolean_controler) are used for control algorithm. These algorithms are applied at the first control layer in industrial PC DataLab PC/LCD. This application communicates with superior level using RS 485 bus. Second and third control level of control are realized by Control Web 2000 system. Access from the Internet is top level of control of this laboratory task

Abstrakt

Tento příspěvek popisuje možnost nasazení externích USB I/O jednotek pro reálné řízení laboratorních modelů. Jako externí I/O jednotka je použit DataLab I/O. Tato jednotka obsahuje diskrétní vstupy/výstupy i analogové vstupy/výstupy. Pro algoritmy řízení jsou použity komponenty systému Control Web 5 (pid_regulator, boolean_regulator). Tyto algoritmy jsou aplikovány na první úrovni řízení v IPC DataLab PC/LCD. Tato aplikace komunikuje s nadřazenou úrovní pomocí sběrnice RS 485. Druhá i třetí úroveň řízení je realizována s využitím Control Web 2000. Poslední úroveň je přístup z prostředí Internetu.

1 INTRODUCTION

External I/O units are in front of interest at the area of data acquisition from real task at the present time. Connection of these unit is possible e.g. with using RS232 or USB interface, which are standard equipment of PC and IPC. These units enable read from real tasks and output setting (actuating device). Software support for control from PC is provided together with these units. Support from SCADA/MMI systems as is Control Web 2000, Control Web 5, Promotic, In Touch is matter of fact. These visualization systems support standard communication as DDE and OPC server. These software and hardware tools for measurement and control are implemented in laboratory of department of control systems and instrumentation.

2 SYSTEM CONTROL WEB 5

SCADA/MMI Control Web 5 system is used for monitoring and control. Its components enable simple monitoring and archiving of measured data. Control Web 5 System is expanded with possibility of 3D animation. Control Web 5 supports creating application by making large projects. This SCADA/MMI system is used at all three levels of described system at hierarchical structure of control.

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3 DATALAB TECHNICAL EQUIPMENTS

Industrial system DataLab consists from several parts. User can use by needs e.g. only I/O unit (DataLab I/O). This unit makes possibility of external input/output (digital and analog) connection through the standard USB interface for implementation of control algorithms in PC. Further it is possible of Datalab PC or DataLab PC/LCD using for specific control algorithm. These units are industrial PC, whereon OS Windows XP with SCADA/MMI system Control Web 5 is running.

DataLab PC is a new line of compact computers fully compatible with PC standard, but designed to work at industrial applications, laboratories and schools.

DataLab PC computers include low-power VIA EDEN processors, which enable working without active (fan assisted) cooling of CPU and chipset. DataLab ensures durability and reliable operation required in industrial applications. On the other side the compatibility with the PC standard (VIA EDEN processors are fully compatible with x86 architecture) relatively high performance, rich set of interfaces, communication capabilities and low price bring numerous advantages:

- Full compatibility with PC standard allows running of numerous operating systems (Windows 2000, Windows XP, Linux), including systems, which are designed for embedded applications (Windows CE, Windows XP Embedded, Embedded Linux).
- High performance (CPU clock is 400 MHz) and 250MB RAM standard enables running of huge and demanding application.
- Only passive cooling thanks to economic processor VIA EDEN.
- High-quality color TFT screen with diagonal 8 inch, discernment 800x600 points, high brightness 400 cd/m² and long lifetime.
- Possibility of using of OS Windows XP Embedded, which run from Compact Flash Card, therefore computer need no HDD and contain no rotation parts or moving parts. Working out of rotation HDD increase reliability of all system.
- Usage either standard HDD or Compact Flash memory card is possible alternative.
- All standard interface of PC (RS-232C, LPT, Ethernet, USB, PS/2, keyboard and mouse, audio) make DataLab PC/LCD 400 very universal device.
- DataLab PC/LCD 400 computers are ideal solution for Control Web system working [Control Web 5 2007].

4 DESIGN OF REAL APPLICATION

One from the tasks, which interested in measure of thermo process in laboratory of department of control systems and instrumentation, is the task represented hierarchic structure of control. This task allows monitoring and control of hot-air heater from 4 control level. Verification of fundamental knowledge from problems of synthesis of control circuit is possible in this task. This system can be affect by three actuating device (1x lamp and 2x fan). Temperature is measured by three thermistors, located in different distance from source of warm.

Industrial computer, communicated with external I/O unit DataLab I/O is used as controller. Algorithm in IPC implements two PID controlers and two two-value controller. The reason of usage four controllers is possibility of control two values currently with two types of conreollers.

DataLab I/O is input output configurable unit connected to an industrial PC (DataLab PC/LCD) using standard USB interface. This unit enables working with applications in DataLab PC/LCD with discrete inputs and outputs: with 4 (8) analog inputs and 8 analog outputs. A control unit for this system is another industrial DataLab PC, connected to DataLab PC/LCD using RS 485

and to data network, and it communicates with application running on a standard PC. The last end-hardware unit is any PC in internet. Hardware connection is shown in figure1.

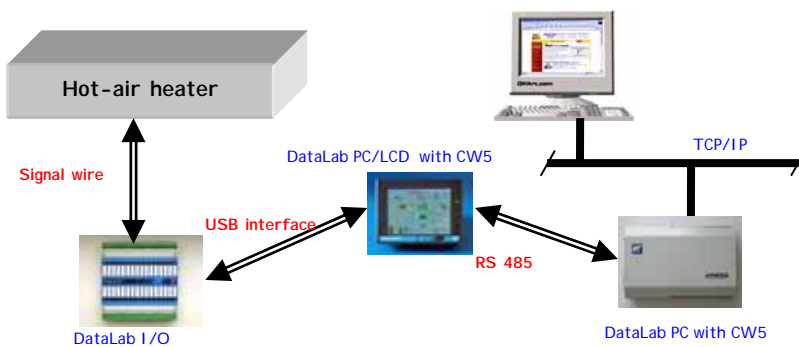


Fig. 1 Hardware connection of laboratory task „Hierarchical structure control “

Application at all three levels is created at software from Moravské přístroje a.s. company. The real-time control task is created at environment Control Web 5 with standard supplied component (panel, button, PID controller etc.). Inputs and outputs from these controllers are mapped directly to analog input and output of this unit (U1, U2, Y1, Y2) with communication driver for DataLab I/O. Configuration and activation of controllers is executed according to particular bytes in frames, which are sending through RS485 interface from higher level control. Actual data from real-time task are sending back. Window of application is shown on next figure.

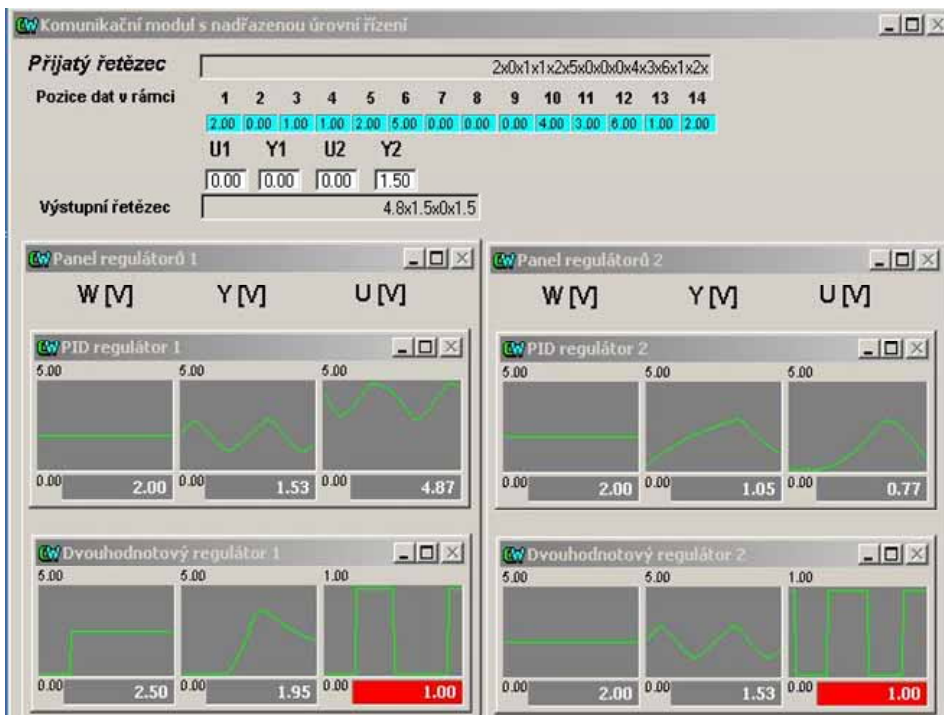


Fig. 2 Application Windows in Control Web 5 environment (DataLab PC/LCD)

Implementation of sophisticated logical structure of all application is very important step for creating applications of remote administration of control systems. Logical structure of the task is shown on fig. 3. Here is described application dividing from the point of view of communication in data network, and from the point of view of communication with selected input/output device, in this case external Datalab I/O unit with industrial computer DataLab PC/LCD. The links between single modules of application are realized by variables, which forms interface between particular function complexes. If Control Web 5 system driver is available for concrete device, it is possible to create OPC server from this equipment helping by special software component from Moravské přístroje a.s. company. This standardization extends possibility of application.

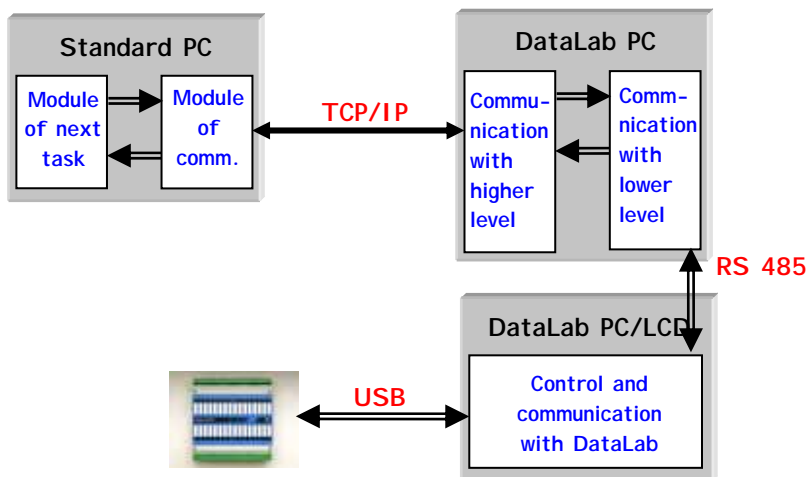


Fig. 3 Logical structure of multilevel control system

Each level of a hierarchical control structure has a specific window for configuration and real task monitoring. Regarding the safety mode of this task, the rights are limited based on higher control levels, for example, it is not possible to change controller's parameters, but the control type with parameters set for a lower level can be changed.

5 CONCLUSIONS

This contribution describes testing the possibility of DataLab system implementation. As the I/O unit the DataLab I/O was used. Datalab PC/LCD is used for the first control level, an application in Control Web system is running here. This application uses standard supplied components of Control Web 5 system (pid_controller, pannels...). This level enables communication with the higher control level using ILAN (RS 485). The second control level is the application in Control Web 2000 system enabling configuration and monitoring. The third control level of this task communicates via TCP/IP data network, on this workplace the http server is located, which helps to access data from real time tasks on internet (intranet).

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