

Research and Application of OPC Technology in real-time Communication between Host and SIEMENS PLC based on LabView

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Abstract

OPC full name is OLE for Process Control. Its emergence has established a bridge between application programs based Windows and field process control. OPC standard is a high efficient, reliable, open and interoperated device driver. It is suitable for a wide range of field equipment, and the need to constantly upgrade for the products. OPC servers usually support two types of access interfaces, the automation interface and the custom interface. OPC has now become the default scheme of industrial system interconnection, which brings convenience to industrial monitoring programming and solves the problem of communication protocol. In this paper, we design a monitoring system based on Ethernet architecture, and use OPC technology to realize the real-time communication between PC and SIEMENS S7-300 in LabVIEW system.

Keywords

OPC; Lab VIEW; PLC; SIMATIC NET.

1. Introduction

PLC is a mature industrial controller. PLC has high reliability and strong anti-interference ability, and has been widely used in the field of industrial control, and has become one of the three pillars of modern industrial automation.

Lab VIEW is a virtual instrument development platform launched by NI company; it is the most representative graphical programming software of the virtual instrument field in the world, and has been widely used in industrial automation, testing, processing and control field. Lab VIEW programming is efficient, flexible, object-oriented, and has a strong graphical programming capabilities and visual programming environment, helps to improve efficiency and reduce costs. Therefore, it is well received by the majority of software developers.

Since PLC has such a pivotal position in the field of industrial control, and has incomparable advantages over other controllers. Lab VIEW has a unique advantage in the development of testing and control software. Therefore, man regards the PLC as the core of the control system, uses Lab VIEW to develop system control software, combines with their respective characteristics, plays their respective advantages, can finally develop a powerful, efficient and reliable control system.

In the control system improvement project, the monitoring system is designed based on the above considerations. The SIEMENS PLC is chosen as the control core in the design process. SIEMENS S7-300 PLC is equipped with multi point MPI and distributed DP interface, respectively using MPI protocol and Profibus protocol. Because the Protocol is not open, in order to achieve the communication between S7-300 PLC and the host computer, there are two solutions: First, not using OPC technology, a custom serial communication protocol is developed through serial communication with PC; the other, OPC technology is used to achieve communication, without the need for a custom

communication protocol. Due to the poor anti-interference ability, low transmission rate and short transmission distance of the previous communication method, we choose the latter solution.

2. OPC Technology

OPC full name is OLE for Process Control. It is the application of object linking and embedding technology in the process control of Microsoft. OPC is based on OLE/COM/DCOM technology, using the client / server model, providing a unified standard for object oriented development of industrial automation. This standard defines the method of exchanging automate real-time data between clients by using Microsoft operating system based on PC. By this standard, the hardware developers will develop a unified OPC interface program for their hardware product instead of the software developers. However, the software developers can avoid the development of the driver's work; thereby enhance the openness and interoperability of the system.

OPC can be used as a data interface specification of the whole network, so it can improve the function of the control system and enhance the compatibility of the network. OPC technology is adopted to establish the configuration of the system, simplify the system complexity greatly, shorten the software development cycle, improve the reliability and stability of the software operation, and facilitate the system upgrade and maintenance.

3. Communication Implementation

3.1 System Hardware and Software Configuration

Software configuration: SIMATIC Step 7 V5.4, SIMATIC NET PC SOFTWARE V6.2 SP1, Lab VIEW 8.2. Step 7 and SIMATIC NET PC SOFTWARE V6.2 SP1 are used for SIEMENS PLC programming and configuration OPC Server; Lab VIEW 8.2 is used for PC monitoring system program.

Hardware configuration: PC, Siemens PLC-300(CPU-315 2DP), digital input /output module, Ethernet communication module, analog input /output module, memory card, programming cable, general purpose Ethernet adapter, twine.

In view of the above hardware and software configuration, combined with the advantages of Ethernet communications, and consider the most simplified programming, the communication hardware connection between PC and PLC is designed, as shown in figure 1.

3.2 Configuration of the Communication between S7-300 PLC and OPC Server based on Ethernet

The connection between OPC Server and PLC is established in this paper based on SIMATIC NET. SIMATIC NET is an open, pluralistic communication system at the industrial control level provided by SIEMENS. In order to adapt to the variety of Automation Engineering, it can communicate with PLC, workstations and personal computers on the industrial scene. SIMATIC NET has introduced a variety of different communication networks, which are in line with international standards.

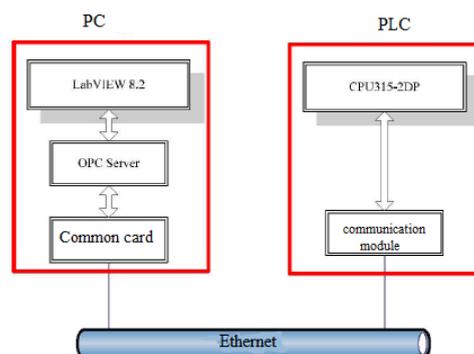


Figure 1. The communication hardware connection between PC and PLC

First, We can establish OPC server on the PC, through the network (Ethernet, Profibus, Profinet, Canbus, etc.). The data of OPC Server can be established mutual mapping relationship with the data of SIEMENS PLC. In this paper, Ethernet is used as the transmission medium; OPC Server is SIMATIC.NET Server OPC, its name is: OPC. Simatic NET.

3.2.1 Configuration PC Station Hardware Rack

When the SIMATIC NET software is successfully installed, you can click Station Configuration Editor to enter the configuration window, select number one slot, then click the Add button to add, select OPC Server and click OK to complete in the add component window. The number three slot is selected to add IE General by using the same method. After inserting IE General, the pop-up dialog box will pop up. By clicking Network Properties, man can configure the network card parameters. After clicking Network Properties, Windows network configuration window is opened, then man selects the local connection properties menu to set the network card parameters, set the IP address and subnet mask. By clicking the Station Name button, E_OPC is specified the name of the PC station.

3.2.2 Configuration Console

Configuration console is the core tool for configuration settings and diagnostics for PC hardware components and PC application program configuration and diagnostics. After correctly completing the hardware configuration of the PC station, man opens the configuration console(start - SIMATIC - SIMATIC NET - Configuration console), can see that the mode of the Ethernet card has been switched from PG mode to Configuration mode, and the slot number (Index) also automatically points to 3. In the Access Points settings window, S7ONLINE is set to point to PC internal (local). This setting is ready for download of PC station configuration.

3.2.3 Set Configuration And Download to PLC

Open SIMATIC Manager to create a new project, for example E_OPC. Then double click Configuration to enter the PC Station configuration interface. In the hardware configuration, you can select the hardware that is compatible with the installed version of the Simatic net software from the hardware catalog window and insert it into the slot corresponding to the PC hardware rack configured in the Station Configuration Editor. You can click the Properties button in the IE General Properties dialog box to open the Ethernet interface parameter settings dialog box, set the Ethernet card's IP address and the corresponding subnet mask as required. The IP address should be consistent with the actual Ethernet adapter IP address. And you can use the New button to build a Ethernet network, then confirm all configuration parameters, complete the network adapter settings.

After the completion of the PC station component settings, you can press the Save button to determine and store the current configuration configuration. After compiling correctly, you can click the Configure Network button to enter the NetPro configuration window. In the NetPro network configuration, after selecting the OPC Server with the mouse, you can insert a new connection into the first line of the connection table mouse button. After confirmation of all configurations, the completed S7 connection is displayed in the connection list. You can click to save the compiler, such as the results obtained by the No error compiler, the correct configuration is completed. As shown in Figure 2.

After completing the configuration of the PC station, you can click download button on the NetPro window to download the configuration to the PC station. After the download is complete, you can open the Station Configuration Editor window to check the component status.

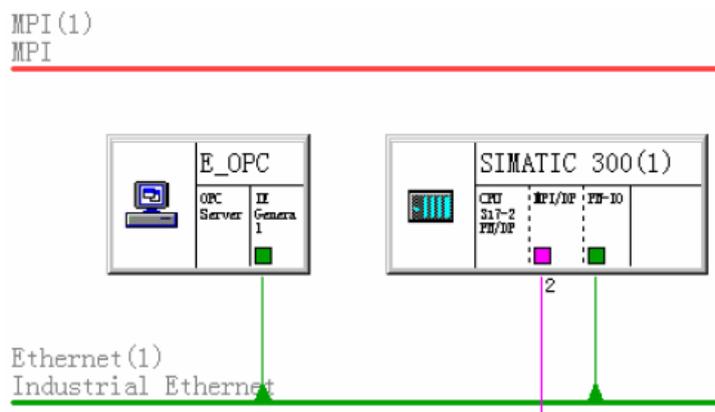


Figure 2. The NetPro window after the completion of correct configuration

3.3 Realization of Real Time Communication between PC and S7-300 PLC By Lab VIEW

Through Lab VIEW, PC and OPC Server communication has three methods: 1) access to OPC Server through ActiveX automation interface; 2) through NI Data Socket technology to achieve communication with OPC Server; 3) communication with OPC Server by using Lab VIEW DSC module. The first two methods are only suitable for connecting with a small number of OPC tags. Because of writing multi-segment code or reading and writing through the For cycle, the speed of reading and writing will reduce, and it makes the system less conducive to maintenance when the number of points will increase. Through the DSC module built communication mechanism with the OPC Server, programming not only becomes very easy, but also programming scale and read-write speed are not limited by the number of points. In view of a lot of points of the actual system, and combining with the actual situation of the project, we chose third methods.

3.3.1 Lab VIEW DSC Module Introduction

DSC (data logging and supervisory control) data recording and monitoring module is designed for distributed data acquisition and monitoring (supervisory control and data acquisition, SCADA) system design. It can easily communicate with the OPC Server, can also generate their own OPC Server. In addition, there are many SCADA commonly used-functions, for example alerts and events based on configuration, user level security applications, graphical development of distributed monitoring and control, real-time and historical data tracking, built-in networking for third party devices and data sharing and integration, distributed data record network database. Because the DSC modules can be seamlessly integrated with the LabVIEW8.2 development environment, SCADA system developed by LabVIEW8.2 and DSC module can make full use of the powerful data processing and analysis function of Lab VIEW, and it has the incomparable advantages of traditional SCADA configuration software.

3.3.2 Using Lab VIEW DSC to Achieve Access to OPC Server

Shared variables can be bound with OPC tag of any computer on a local or the network. When the binding is finished, the user only needs to use the shared variable as a normal variable. It is easy to bind shared variables in LabVIEW8.2. First of all, we must use OPC software provided by SIEMENS PLC to define the data types and addresses of the communication variables of PLC. Then you can open the LabVIEW8.2, and build a new library in the project, then build a new I/O Server in the library, in the process browse OPC Server on the machine or network, then bind I/O Server with OPC Server required to connect. a new shared variable created in Library is bound with the OPC tag listed in I/O Server. Shared variables are bound to data in PLC by OPC. Simatic NET. When this is done, it can be used as an ordinary variable in Lab VIEW programming.

There are several methods to read OPC tag values through shared variables: directly drag the shared variables onto the front panel to bind and operate or drag to the rear panel to program as a variable. These two methods are very simple to use, but the variable is not conducive to the management, when

variables are more. Another is the use of DSC module to provide event methods. The benefit of using event driven methods is: On the one hand, the program does not need to continue to read the value of the OPC tag as polling, but trigger the processing program only when the OPC tag value changes. On the other hand, no matter how many shared variables in Library, our program without any change, can read all OPC tag value in the same array, then the index can be used to obtain the corresponding value of each variable, o this method is the most efficient.

4. Conclusion

This paper describes the communication based on OPC technology between PC and SIEMENS PLC through Lab VIEW. Given are the configuration process and event driven Lab VIEW source code. The method has been successfully applied to a control system improvement project, the system is stable and reliable, and the effect is good. Through the development and debugging work, the OPC technology and SIEMENS PLC, Lab VIEW DSC modules have a deeper understanding of the design work for the future accumulated experience. Lab VIEW DSC and OPC technology will play an increasingly important role in the field of industrial distributed control.

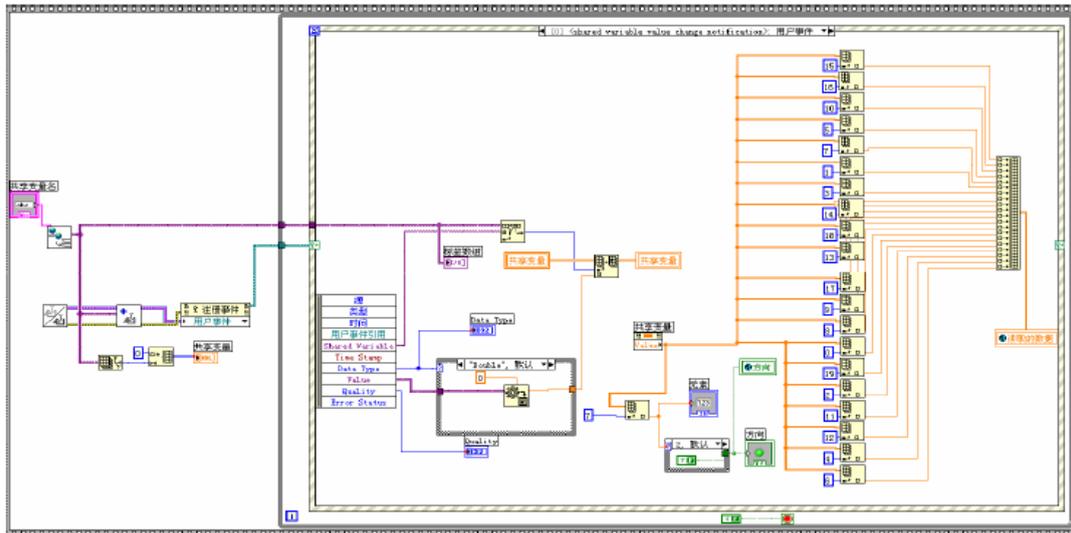


Figure 3. The program using the event driven method to read the value of the OPC tag

References

- [1] Vito Albino, Carmen Izzo, Silvana Kutztz. Input-out-put models for the analysis of local/global supply chain[J]. J. Production Economics, 2002, 78: 119-131.
- [2] Y.Liu, A.Fekete, and I.Gorton. Predicting the performance of middleware-based applications at the design level, Proceedings of the Fourth International Workshop on software and Performance, WOSP04, Redwood Shores, CA, United States, 2004.01.14-2004.01.16:166-170
- [3] N.Mohamed, J.Al-Jaroodi, and H.Jiang, Configurable communication middleware for clusters with multiple interconnection, IEICE Transactions on Information and Systems, 2004, E87:1657-1665
- [4] Xiaoqing Tian, Aiming Lu, Yongshuai Bai, et al. Open NC system design based on embedded flexible manufacturing system[J], Mechanic Automation and Control Engineering (MACE), 2011, V21(5) : 236-239
- [5] Jun Xiao, Liangbo Li, Qiang Huang, et al. Design of a PLC control system in NC wheelset assembly machine[J], Computer Application and System Modeling (ICASM), 2010, V36(4) :542-548
- [6] Igari, Tanaka, Onosato. Development of process planning and machining system for machine-independent STEP-NC data[J], Control and Automation, 2009, 18(15) : 122-128
- [7] Junjie Zhang, Zhenfeng Wang, Junbo Sun, et al. PLC Modeling and Checking Based on Formal Method[J], Journal of Software Engineering and Applications, 2010, V03(11):1054-1059

- [8] National Instruments Corporation. Lab VIEW User Manual. April 2003 Edition. Part Number 320999E-01
- [9] National Instruments Corporation. Lab VIEW Real-Time Module User Manual .April 2004 Edition. Part Number 322154E-01