

COMMENT ON POPULAR VIEWS OF INDUSTRIAL CONTROL AUTOMATION TECHNOLOGY

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ABSTRACT

Industrial Control Automation Technology is a kind of integrated technology that uses Control theory, instruments and apparatuses, computer and other information technology. At the same time, it makes the process of industrial production come to the detection, control, optimization, operation, management and decision making, get to the objective target about improving production, increasing quality, decreasing consumption, securing safety. The article will mainly analyze and state the popular technology from eight aspects, hope to bring reference and inspiration to the experts of this field.

Keywords: *Industrial Control Automation; Technology; Comments*

1. INTRODUCTION

Industrial Control Automation Technology has been regarded as one of the most important technology in the field of modern manufacture in the 20th century, which mainly solves the problems of production efficiency and consistency. Although the automation system itself can't create benefits directly, it has obvious promoting effect on the course of production.

The development of our Chinese Industrial Automation mostly is in the introduction of complete sets of equipment, at the same time, to digest and absorb, then the second development and utilization. At present, our Chinese Industrial Control Automation Technology, industries and applications have developed greatly, and the Chinese Industrial computer system has formatted. Industrial Control Automation Technology is developing to the direction of Intelligent, Networked and Integrated. The Development is mainly discovered from the following aspects:

Industrial Control Automation; Development of PLC; System of DCS; Development of Control System, Instrumentation Technology; Development of Numerical Technology, Industrial Control Network; Industrial Control Software.

2. BASED ON INDUSTRIAL PC LOW-COST INDUSTRIAL CONTROL AUTOMATION WILL BECOME THE MAINSTREAM.

As we all know, from the beginning of 1960s, the western countries have begun to depend on technology progress—new equipment, new technology and computer application—to transform the traditional industry, make the industry develop fast. At the end of 20th century, the great change is the formation of global market in the world. Global market leads to an unexpected fierce competition, making the enterprises improve the new products, as well as the time to market, quality, decreasing cost and perfect service system, this is T, Q, C, S of enterprise. Although CIMS combined information and system integration seek to more perfect T, Q, C, S, make the enterprise come to “in the correct time, make the correct information regard as correct ways to transfer the correct person, make the correct decisions—five corrections. But this kind of automation needs invest a lot of money, thus it is the developing model of high investment, high benefits and high risk. Therefore, it is difficult to be adopted by small and medium-sized enterprises. In China, small and medium-sized enterprises, Quasi large enterprises are entering the road of low-cost Industrial Control Automation[1].

Industrial Control Automation mainly has three levels, from down to up are the basic automation, process automation and management automation,

and its core is the basic automation and process automation.

Since 1990s, because of the development of PC-based industrial computer, industrial PC, I/O equipment, monitoring equipment, control network consisting of PC-based automation system have the rapid proliferation, become the important ways of making low-cost industrial automation come true. Our Chinese Chong Qing Steel-Iron Company, which is the large enterprise almost all the heated stove, also demolished the original DCS or single loop digital regulator to use the industrial PC to form the control system, and the fuzzy control algorithm. Thus, it achieved favorable effect[2].

In recent years, industrial PC has enjoyed great development in China. From the global perspective, industrial PC mainly includes two types: IPC and Compact PCI, their deformation machine, for example, AT96 and so on. The basic and process automation have improved the requirements about the industrial PC running stability, hot-plug and redundancy configuration. The existing IPC has been unable to fully meet the requirements, will be gradually died out of the field. It would be replaced by the Compact PCI-based industrial control computer, but IPC will occupy Management Automation Layer. Our country sets up the industrial automation projects "to the industrial control computer based on open control system", The target is to develop the PC-based control system with independent intellectual property rights, in 3-5 years, occupying 30%-50% of the domestic market, and make the realization of industrialization[3].

3. PLC IS DEVELOPING TO THE DIRECTIONS OF MINIATURIZATION, NETWORKING, PC AND OPENNESS.

Recently, there are more than 200 enterprises manufacturing PLC with the products of more than 300. In our country, the foreign products are mainly occupying the market of PLC, such as the products of Siemens, Modicon, A-B, OMRON, San Ling and GE. After many years' development, there are 30 enterprises manufacturing PLC in China, but they can't format large-scale production capacity and famous brands, that's to say, PLC can't form manufacture industry. In the application of PLC, our country is very active, and the applied industries are widespread. Experts said that domestic sales volumes of PLC are 150000-200000 sets, it is 2500000000-3500000000yuan, and its increasing rate per year is 12%[4].

Miniaturization, networking, PC and open are the main directions of future development for PLC. Based on the early years of PLC automation, PLC is bulky and expensive. But in recent years, the mini-PLC has emerged, its price is only a few hundreds Euro. With the further development and perfection of Soft PLC control configuration software, installation of soft PLC configuration software and PC-based control market share will gradually grow.

At present, one of the greatest developing fields of process control is expand of Ethernet technology, including PLC. Now more and more PLC providers start offering Ethernet interface. We can believe that PLC will continue to transfer to the open control system, especially the control system based on industrial PC.

4. THE DCS SYSTEM OF FACING THE TEST TUBE INTEGRATED DESIGN.

Distributed control system DCS (Distributed Control System) published in 1975, manufacturers mainly in the United States, Japan, Germany and other countries. From 1970s later period of our country, first, large imported sets introduce foreign DCS, such as chemical fiber, vinyl, fertilizer and other imported project. At that time, the DCS of the main industry of our country (such as electric power, petrochemical, building materials and metallurgy etc.) all import from the foreign countries. In the early 1980s, in the course of introduction, digestion and absorption, at the same time, began to develop domestic DCS technology[5].

In recent 10 years, especially since "Nine Five", our country's DCS System R & D and production development are very rapid, the rise of a batch of outstanding enterprises, such as the Beijing company, Shanghai Xinhua company, Zheda control company, the Zhejiang company via, TT & C company, Electric Power Research Institute and Beijing Kang Tuo Group and so on. This batch of enterprises research and product the DCS system, not only the number of species increases substantially, and product technology level is achieved or be close to the international advanced level. In a few short years, foreign DCS system in our country can't appear to the rule all the land any longer. These specialized companies not only occupy a certain market share, accumulated capital and technology of development, at the same time, make the imported DCS system's price also drops substantially, make the automation of our country

promote a career to make contribution. At the same time, the export of domestic DCS system is increasing year by year[6].

5. THE CONTROL SYSTEM IS DEVELOPING TO THE DIRECTIONS OF FCS.

Because the development of 3C (Computer, Control, Communication) technology, process control system developed from DCS to FCS (Fieldbus Control System). FCS PID can be controlled completely decentralized to the field device (Field Device). Based on fieldbus FCS is fully distributed, digital, open and interoperable, new generation production process automation system, it will be replaced with a scene of a 4-20mA analog signal lines, it brings revolutionary change to the traditional industrial automation control system architecture.

The development of computer control system will move towards the direction of fieldbus control system (FCS) after experiencing based type pneumatic instrument control system, electric unit combination type analog control system, centralized digital control system and distributed control system (DCS). Although based on fieldbus FCS is developing very quickly, but the development of FCS have a lot of work to do, such as standard, intelligent instrumentation. In addition, the improvement and maintenance of the traditional control system also need DCS, so FCS completely replacing the traditional DCS still needs a longer process, at the same time, DCS itself is also in constant development and perfection. To be sure, combined with DCS, industrial Ethernet, advanced new techniques such as FCS will have powerful vitality. Industrial Ethernet and fieldbus technique is regarded as a flexible, convenient, and reliable transmission mode, have more and more applied in the control field, and will occupy a more important position[7].

6. INSTRUMENTATION TECHNOLOGY IS DEVELOPING TO THE DIRECTIONS OF DIGITAL, INTELLIGENT, NETWORK-BASED, MINIATURIZATION DIRECTION.

After fifty years' development, industrial instrumentation of our country has been established, initially has formed a relatively complete production, scientific research, marketing system. Now, there are more than 6000 enterprise manufacturing industrial instrumentation, annual

sales are about 10000000000 Yuan, become the second instrument producer except Japan in Asia. According to the statistics, except complete sets of projects supporting the introduction of instrumentation, last year, we import various types of instrumentation about nearly \$6000000000. It is about China instrumentation 50% of total industrial output value. But at present, instrumentation industry products of our country mostly belong to the middle level, with the development of international digital, networked, intelligent, miniaturized products, they have gradually become the mainstream, the gap will also further increase. At present, high-grade, large-scale instrument and equipment of our country depend on imports. Mid-range products as well as many of the key components of foreign products in China, occupies more than 60% of the market share, and homebred analysis instrument share the total global market less than 2/1000[5].

The major future developing trend of instrument technology: Instrumentation will develop to intelligent direction, produce the intelligent instrument; measurement and control equipment will develop to PC, virtual instrument technology will develop quickly; instrumentation will network, produce network equipment and remote measurement and control system.

7. NUMERICAL CONTROL TECHNOLOGY IS DEVELOPING TH THE DIRECTIONS OF INTELLIGENT, OPEN, NETWORK AND INFORMATION.

Since 1952, Massachusetts Institute of Technology of the United States developed the first pilot CNC system, up to now, it has gone through the course of 51 years. In the recent 10 years, with the rapid development of computer technology, a variety of different levels of open CNC system has emerged as the times require, its development is very rapid. Now, it is going to the directions of standardized open system. As far as structure form is concerned, In the world, CNC system can be broadly divided into 4 types: 1. the traditional NC system; 2. "PC embedded NC" structure of the open NC system; 3. " NC embedded PC " structure of the open NC system; 4. SOFT CNC system[8].

The development and production of numerical control system in our country, during the time of "seven five ", its introduction, digestion, absorption, " eight five " key and " Nine Five " industrialization, has obtained very great progress, basically mastered the key technology, established numerical control

development, production base, cultivated a batch of talents of NC, has preliminary formed its own CNC industry, has also led to the development of electrical control and drive control technology development. At the same time, Chinese characteristic the economic NC system has developed through these years, performance and reliability of product has been greatly improved, gradually recognized by the users.

Intelligent, open, network, information has become the main trends of the future numerical control system and numerical control machine tool: to the directions of high speed and high efficiency, high precision, high reliability, to modular, flexible, intelligent, networked and integrated directions; to the PC-based and opening directions; the emergence of new generation of CNC machining process and equipment, machinery processing is developing to the directions of virtual manufacturing; information technology (IT) and the combination of mechanical and electrical integration of advanced machine tools, machine tools will be developed; nanotechnology will form new developing trends, and will have new breakthrough; machine tool will accelerate the development of energy saving and environmental protection, occupy the vast market[9].

8. INDUSTRIAL CONTROL NETWORK WILL GO TO THE COMBINATION DIRECTIONS OF WIRED AND WIRELESS.

Wireless LAN Technology can be very convenient to connect wirelessly network equipment, people can freely access to cyber source at any time anywhere. And this is the important developing direction of modern data communication system. Wireless local area network can be in the no network cable condition, providing Ethernet interconnection function. In the promotion of the development of network technology, wireless local area network is changing people's ways of life.

In the field of industrial automation, there are tens of thousands of sensors, detectors, computers, PLC, card readers and other equipments, need to be attached to each other to form a control network. Usually, the communication interfaces these devices provide are RS-232 or RS-485. Wireless LAN device uses the isolation type signal converter, makes the transformation of industrial equipment RS-232 serial signal and wireless LAN and Ethernet signal conversion, conform with the IEEE

802.11b wireless LAN and Ethernet IEEE 802.3 standard, support the suggestions of standard communication protocol for TCP/IP networks, effectively expand the industrial equipment networking communication ability[7].

The combination of Computer network technology, wireless technology and intelligent sensor technology produced the new conception about "based on wireless networked smart sensor". This kind of based on the wireless networked smart sensor makes the industrial field data directly come into the network transmission, dissemination and sharing through wireless link.

9. INDUSTRIAL CONTROL SOFTWARE IS DEVELOPING TO THE DIRECTIONS OF ADVANCED CONTROL.

The industrial control software is regarded as an important component, the development of domestic HMI configuration software in recent years has made great progress. Through combining hardware with software, it can provide a more complete solution for enterprises to measure, control, integrate. On this basis, industrial control software will go to the advanced directions from the man-machine interface and the basic strategy.

Advanced process control APC (Advanced Process Control), at present, there is no strict and uniform definition. Generally speaking, it will be based on the mathematical model and must use the computer to realize the control algorithm. It is referred to as advanced process control strategies. Such as: adaptive control; predictive control; robust control; intelligent control (expert system, fuzzy control, neural networks)[7].

Because advanced control and optimization software can create huge economic benefits, so the software is worth double. Many international companies have launched hundreds of advanced control and optimization of software products. They have formed a powerful process industry application software industry. So, it is significant to develop our country's own independent intellectual property rights of the advanced control and optimization software, thus to break monopoly and import substitution of foreign products.

In the future, industrial control software will continue to develop in the directions of being standardized, network-based, intelligence and open development.

10. CONCLUSION

Industry information refers to that in the industry production, management, management process, through the information infrastructure, in the integrated platform, to realize the information acquisition, information transmission, information processing and utilization.

The vigorous development of industrial automation is the effective way and means to accelerate traditional industry to transform upgrade, thus to improve the overall quality of enterprises, the national overall strength, and the adjustment of industrial structure, rapid liven large and medium-sized enterprise. Our country will continue to implement a series of industrial process automation—special high-tech industry to replace industrialization with information. Thus to promote the further development of industrial automation technology, strengthen technological innovation, realize industrialization, solve the deep-seated problems of the development of national economy facing, to further improve the overall quality of the national economy and comprehensive national power, realize the leaping development

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