Research on Embedded Humanoid Intelligent Control and Instrument Based on PLC

Meiyan Li(✉)

Xi'an International University, Xi'an 710077, China

Abstract. Intelligent control is formed on the development of computer technology. Embedded humanoid intelligent control system has excellent self-organization and self-adaptation capabilities, and has good performance in large-scale complex industrial system control. With the development of instruments and meters, instruments and meters have penetrated into all fields of people's life and become an important tool for human beings to acquire information, understand nature and transform nature. Now the development level of instruments and meters is an important symbol of the development level of modern science and technology. Programmable logic controller (PLC) is a kind of digital operation and operation control device. It is an electronic system developed instead of the traditional relay, which integrates computer technology, communication technology and automatic control technology. Embedded humanoid intelligent control system has superior self-organization, self-adaptive and self-learning ability. The arithmetic operation function and data processing ability of PLC are greatly enhanced, which makes the realization of complex control algorithm on PLC possible.

Keywords: Intelligent control · PLC · Instrument

1 Introduction

With the rapid development of instruments and meters, computer and network technologies are also developing rapidly. Intelligent control technology is an interdisciplinary frontier discipline developed on the basis of artificial intelligence, cognitive science, operations research, system theory, information theory and cybernetics with the rapid progress of computer technology. It is an advanced stage of control theory development [1]. Programmable Logic Controller (PLC) is a control device for digital operation and operation. It is an electronic system developed instead of traditional relay and integrates computer technology, communication technology and automatic control technology [2]. Intelligent control is formed on the development of computer technology. Intelligent control system has excellent self-organization and self-adaptation capabilities, and has good performance in the control of large complex industrial systems. People combine a plurality of individual individuals with certain intelligence to form a humanoid intelligence system with independent control performance and mutual cooperation characteristics [3]. More and more people realize that the cooperation of humanoid intelligent

© ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering 2021
Published by Springer Nature Switzerland AG 2021. All Rights Reserved
E. Bisset Álvarez (Ed.): DIONE 2021, LNICST 378, pp. 380–385, 2021.
https://doi.org/10.1007/978-3-030-77417-2_29

systems can complete more complicated tasks with less cost. Compared with a single agent, humanoid intelligent systems, especially distributed humanoid intelligent systems, have many obvious advantages [4]. The application of embedded system to the field of instruments and meters, and the combination of traditional instruments, sensors and microprocessors, has become the main trend of the development of the instrument and meter industry.

As one of the important development directions of industrial control network, embedded intelligent control instrument is the result of the joint development of industrial data communication technology, control network technology, Internet technology and other technologies. Using a variety of technologies, joint operations can usually complete some single difficult tasks [5]. In the process of in-depth research on intelligent control theory, people find that various control strategies have their own advantages and disadvantages, and a single control strategy cannot have perfect control performance. Intelligent equipment such as PLC, information collector and other data collection and processing devices can play a huge role in industrial and information construction [6]. The decision-making and actions of each individual in the group are independent, but there are extensive altruistic cooperative behaviors within the group. Intelligent control system has excellent self-organization, self-adaptation and self-learning ability, and has shown good performance in the process of controlling large and complex industrial systems [7]. As the most widely used automatic control equipment, PLC equipment is being widely studied and analyzed by people in order to better serve human life and work.

2 Main Features of PLC Intelligent Control System

With the continuous development of science and technology, some programmable intelligent technologies have become more and more widely used in practical applications. PLC intelligent control system has its own distinctive features, mainly reflected in its good expansion performance. Since various modules can be mounted on the rack on the back bus, the modules can be selected according to actual requirements. At present, PLC control technology is widely used in the field of industrial automation. For example, it has grown into a pillar industry in metallurgy, electric power, light industry, chemical industry, etc. Based on the continuous development of computer technology and network communication technology, for the development of automatic control system, the integrated application of corresponding technologies can further strengthen the communication function of PLC. The application of PLC control technology can not only provide a very reliable control application for various automation equipment, but also can put forward a more reliable and perfect solution when controlling, which well meets the development needs of industrial enterprises.

Fuzzy control system combines practical rich working experience to sum up operation experience, thus having fuzzy operation rules to realize effective control. Fuzzy control is a control method that can reflect human intelligence. Automation clients can create automation objects, access objects provided by automation servers, obtain or set properties of objects, or call methods of objects. The interaction between automation objects and automation customers is shown in Fig. 1.

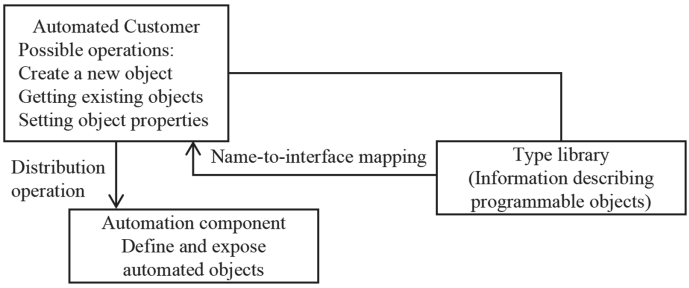

Fig. 1. Interaction between automation customers and automation components.

The development of computer network technology has also continuously increased the requirements for industrial control and management, which has prompted PLC control systems to begin to move from closed centralized systems to open distributed systems. Faced with the object of control, the complexity of the control object is very high, coupled with the particularity of the use environment and the continuity of long-term work, these all place higher requirements on the PLC control technology. Because many field buses are developed by PLC manufacturers, it is closely related to PLC. Programmable can form multiple control devices into a huge control network and then perform unified platform control management. Under this development background, the operation status of each instrument and equipment in the network is operated under the network connection and collected on the operating system. The communication program of PLC control technology is relatively simple, only need to use the communication interface software and special computer to realize the design of the communication program, which greatly reduces the workload of computer programming.

3 Design of Embedded Humanoid Intelligent Control Instrument

When the equipment is in normal working condition, there is a certain logical relationship among the intermediate memory unit, output signal and input signal of the electronic control system. If the equipment fails, this logical relationship will be destroyed. The main program is to optimize the parameters such as the start-up of the wind turbine and the large and small motors. The subprogram is mainly to control the subprogram to stop the program and collect the operation data of the system. The use of PLC analog control module enables it to realize not only process control, but also instrument monitoring through control statements. Under the PLC-based control system, analog control is based on the characteristics of the control object itself, and the integrated system is built after the functional modules are combined [8, 9]. In the position control, the automatic control is mainly realized for the stepping motor, and the pulse is sent to accurately position the corresponding displacement [10–14]. According to the characteristics of the control object, PLC can flexibly realize system control by successfully assembling a complete control system through a combination of functional modules.

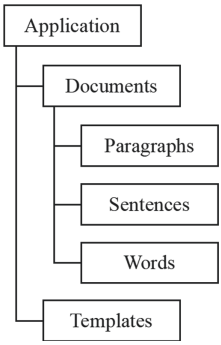

Fig. 2. PLC word processing object model.

Based on the PLC control system, the corresponding command system and frequency converter can realize effective control of the motor with the application of this system equipment, mainly controlling and adjusting the rotation speed. Judging from the control effect, the temperature system has a large inertia load characteristic, and has requirements for steady-state accuracy and anti-interference capability, etc. Through this control system, the requirements of indexes can be met. Many automation objects are provided in PLC control system, and there are inheritance and derivation relationships among these objects, forming a tree-like hierarchical structure. Among them, the Application object is the basic object in PLC object mode and represents the word processing program itself. Figure 2 shows a part of a PLC text object model.

At present, in the actual application of PLC system equipment, a major drawback is the low compatibility of the system itself. Because the corresponding buses and the like in PLC design and R & D are all of a special nature, there are certain differences in the structures designed by different companies. For complex systems that cannot establish accurate mathematical models in engineering practice, they cannot be controlled by traditional control methods, but people can summarize their operating experience into fuzzy operating rules based on rich work practices to achieve effective for them control. The current standard for the specific programming software of PLC control technology is still in planning, which greatly affects the standardized use of PLC control technology. Although this PLC software program is written and implemented with corresponding specifications, in the process of actual use, the industrial production environment itself will still have a certain influence on the practical application of this system [15]. The development of computer and network communication technology, as well as the continuous improvement of the control and management requirements of the industry, make the PLC control system also from the closed centralized system to the open distributed system. When PLC control technology is used, sequence control and logic control can be effectively realized [16–20].

4 Conclusion

With the continuous progress of human society, the application scope of instruments and meters covers almost all fields of human activities. Instruments and meters have

become an important tool for people to understand and transform nature. PLC, as a control element, has great functions and strong operability, it is also an embodiment of human wisdom. Its use is conducive to the scientific and timely management and control of the operation and effectiveness of various equipment in life and production. The application of embedded system in the field of instruments and meters and the combination of traditional instruments, sensors and microprocessors are the result of the common development of industrial data communication technology, control network technology, Internet technology and other technologies, and is also the inevitable trend of the development of instrument industry. With the rapid development of PLC technology, its function is more perfect, the application field is gradually expanded, and the problems in practical application are gradually solved. With the increasing status in the field of industrial automation control, PLC will be an important guarantee and support for the development of industrial automation in the future. In order to promote the further development of China's industry, we should vigorously promote the application of PLC control technology in industrial automation production, so that China's industrial technology continues to develop.

References

1. Hao, C.Y.: Application of intelligent control instrument system in agricultural electrical automation. Automat. Appl. **000**(004), 114–115 (2017)
2. Zhang, K.: Application research of intelligent control instrument system in agricultural electrical automation. Comput. Knowl. Technol. **015**(008), 163–164 (2019)
3. Mo, Z.K.: Application research of intelligent control instrument system in agricultural electrical automation. Agric. Technol. **39**(02), 50–51 (2019)
4. Xiao, C.: Discussion on the design of PLC embedded fan intelligent control system. China New Commun. **18**(9), 123 (2016)
5. Wang, J., Zhou, Y., Zhuang, W.: Design of intelligent material handling system based on PLC and embedded technology. Manuf. Automat. **9**, 28–31 (2019)
6. Han, L., Yu, S., Gong, Y.: Status and development trend of embedded PLC. Automat. Expo **000**(006), 40–41 (2016)
7. Li, Z.M., Gong, L.D., Xu, J.J.: Intelligent research on the safety protection door of CNC machine tools based on fuzzy rules. Digit. Technol. Appl. **37**(02), 20–21 (2019)
8. Li, N.N., Han, H.Y., Cao, F.: Design of intelligent control system for hybrid polishing and cleaning robot. Automat. Instrum. **10**, 9–12 (2019)
9. Shang, W.L., Zhang, X.L., Liu, X.D.: Construction method and verification of industrial control network local trusted computing environment. Inf. Netw. Secur. **220**(04), 7–16 (2019)
10. Kong, C., Ning, Y., Song, C.Y.: Improved PID control for welding intelligent tooling of the front axle of the rack. Comput. Knowl. Technol. **14**(21), 275–276 (2018)
11. Chen, H., Chen, Y., Yang, L.: Intelligent early structural health prognosis with nonlinear system identification for RFID signal analysis. Comput. Commun. **157**, 150–161 (2020)
12. Roopesh, J.: Pterostilbene caffeine co-crystal: bioavailable caffeine alternative enriched with pterostilbene. Matrix Sci. Med. **4**(1), 24–26 (2020)
13. Mathew, O., Temitayo, F.: Evaluation of plasma Na, K, urea, and creatinine in rabbits given amoxicillin overdose supplemented with cucumber (*Cucumis sativus*) fruit juice. Matrix Sci. Med. **4**(1), 20–23 (2020)
14. Abdur, M., Tamanna, Z.: Antibiogram of blood culture isolates of patients from a hospital in Dhaka Bangladesh. Matrix Sci. Med. **4**(1), 1–5 (2020)

15. Chen, C.: A study of group intervention on depression in urban college students. Matrix Sci. Med. **4**(1), 6–8 (2020)
16. Sun, G., Yang, B., Yang, Z., Xu, G.: An adaptive differential evolution with combined strategy for global numerical optimization. Soft Comput. **24**, 6277–6296 (2020)
17. Rabbani, A., Hayat, K., Qamar, A.: The comparative efficacy of nalbuphine and tramadol in controlling postoperative shivering in rabbits. Matrix Sci. Med. **4**(1), 9–14 (2020)
18. Mathew, O., Bukunmi, O.: Possible metabolic abnormalities of lipids in rabbits given amoxicilin overdose and raw cucumber (*Cucumis Sativus*) fruit juice. Matrix Sci. Med. **4**(1), 15–19 (2020)
19. Li, Y.: Study on the characteristics of energy consumption and metabolism during exercise. Matrix Sci. Med. **3**(2), 38–40 (2019)
20. Yang, S.: Relationship study between exercise and acute myocardial infarction in different time periods. Matrix Sci. Med. **3**(2), 41–43 (2019)