

Functional Design and Application of Robot Group Control Intelligent Manufacturing System

Yanbin Zhao^{1,*}, Kuiyu Tang¹

¹School of Humanities, Social Sciences & Law, Harbin Institute of Technology, Harbin, Heilongjiang, China, 150001

Article Info

Volume 83

Page Number: 5690 - 5698

Publication Issue:

July - August 2020

Article History

Article Received: 25 April 2020

Revised: 29 May 2020

Accepted: 20 June 2020

Publication: 28 August 2020

Abstract

The development of robot group control intelligent manufacturing industry is inseparable from the boosting and integration of informatization and industrialization, so as to realize the integration innovation and engineering application of information technology and robot manufacturing equipment integration. At present, there is a big gap between China's intelligent manufacturing of robot group control and that of foreign manufacturing developed countries. This is mainly because there are still many technical gaps in the field of process control, motion control and automation control in China. Based on this, this paper first studies the development status of robot group control intelligent manufacturing technology, then analyzes the digital design of robot group control intelligent manufacturing system, and finally gives the design and application of robot group control intelligent manufacturing system.

Keywords: Robot Group Control, Intelligent Manufacturing System, Design and Application ;

1. Introduction

With the continuous iterative development of intelligent manufacturing and information technology, it brings great development opportunities to the large-scale production of industrial automation and informatization^[1]. At present, the functional design of functional manufacturing system mainly focuses on the core links of functional control, data analysis and management. In the control system design, in addition to meeting the requirements of full intelligent production, but also with the wheel manufacturing system information receiving, uploading and communication functions and capabilities, so as to achieve seamless docking with manufacturing factory information center, automatic logistics management system, automatic transfer and transfer system.

In addition, in the intelligent manufacturing workshop, the control machine position is mainly

realized through information data exchange, including data server, automatic production control server, production process control server, etc. These intelligent information control nodes can effectively record all the manufacturing processes of intelligent manufacturing system and archive and analyze the relevant data, and the corresponding nodes can achieve effective communication and communication, so as to achieve the intelligent manufacturing goal as shown in Figure 1.

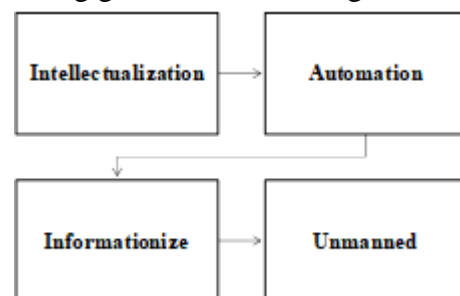


Figure 1. The goal of intelligent manufacturing data information.

In addition, as the basic industry and pillar industry of China's social and economic development, intelligent manufacturing needs to be further developed, so as to realize the important task of rejuvenating the country through science and technology. Under the background of current industrial upgrading and intelligent manufacturing, the international community is also actively withdrawing from the new manufacturing concept. For example, Germany, Japan and other traditional manufacturing powers have put forward the new concept of manufacturing transformation and upgrading. These new manufacturing concepts have brought a huge basis for the development and reform of intelligent manufacturing, including industrial robots, digital technology and other related industries. In particular, intelligent manufacturing of robot group control has become one of the key industries for future development and a new economic growth point.

The development of robot group control intelligent manufacturing industry is inseparable from the boosting and integration of informatization and industrialization, so as to realize the integration innovation and engineering application of information technology and robot manufacturing equipment integration. The key processes and

contents in the field of robot group control intelligent manufacturing are shown in Figure 2.

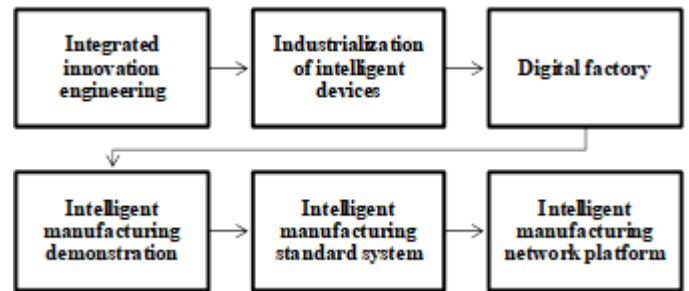


Figure 2. The key processes in the field of robot group control intelligent manufacturing.

At present, there is a big gap between China's intelligent manufacturing of robot group control and that of foreign manufacturing developed countries. This is mainly because there are still many technical gaps in the fields of process control, motion control, and automation control in China. In addition, the gaps in other aspects are shown in Table 1. Therefore, in order to better promote the development of domestic robot intelligent manufacturing industry, it has important practical value to carry out the functional design and Application Research of robot group control intelligent manufacturing system.

Table 1. The gap of robot group control intelligent manufacturing.

Gaps	Specific performance
Intelligent control	Discrete automation, motion control, process control
Development planning	Lack of integrated scientific planning
Human resources	Lack of key talents
Development concept	Standardization, platform, modularization, process and regularization
Process	Low level source code and process experience

2. Development status of robot group control intelligent manufacturing technology

2.1. Development background of robot group control intelligent manufacturing equipment industry

As the pillar industry of national economy, the gap between intelligent manufacturing industry of robot group control and advanced countries makes the transformation and upgrading of national manufacturing industry face greater challenges. The development of robot group control intelligent

manufacturing industry has become an important way and means to upgrade the intelligent manufacturing industry, improve the production efficiency and build automation and digital chemical plants. The construction of intelligent manufacturing industry of robot group control requires the comprehensive realization of perception, analysis and reasoning decision, so as to build a development system integrating advanced manufacturing, information intelligence technology and networking. At present, due to the low level of automation and intelligence of domestic manufacturing industry, it not only leads to low efficiency, but also leads to serious consumption and waste of resources. Therefore, it is urgent to change, so as to build intelligent manufacturing system and system with Chinese characteristics.

Compared with the developed countries, the robot group control intelligent manufacturing industry in China has some disadvantages in the following aspects. First of all, the domestic robot group control intelligent manufacturing industry is lack of effective innovation consciousness and ability, especially the research on corresponding basic fields is very scarce, which leads to the high dependence of the whole industry on foreign suppliers in the field of basic theory and core components, which is very unfavorable to the development of independent and controllable domestic manufacturing industry, so it needs to be changed. Secondly, the current industrial structure of domestic robot group control intelligent manufacturing industry is still not reasonable, most enterprises focus on the vicious competition of low-end products, and there is a serious problem of overcapacity, but on the other hand, high-end products are lack of seriation development.

In addition, as the production efficiency of the whole robot group control intelligent manufacturing industry needs to be further improved, its labor production efficiency is obviously low. With the gradual change of the international situation, especially the rise of trade protectionism, the market competitiveness of the whole industry is low, which

is not conducive to the healthy and sustainable development of the whole industry.

2.2. Development value of robot group control intelligent manufacturing equipment industry

Robot group control intelligent manufacturing industry not only represents the integration of advanced manufacturing technology and information technology, but also has experienced different stages of technological iteration and integration, and has formed its own distinctive development characteristics, mainly including the application stage of digitization, communication and control, network development stage and the latest intelligent big data and cloud computing application stage. With the deepening of the integration of artificial intelligence and robot group control intelligent manufacturing industry, robot intelligent manufacturing based on intelligent control and group control has become the main development goal gradually.

2.2.1. Components of intelligent manufacturing of robot group control

The intelligent manufacturing of robot group control is a global process which integrates the process of R & D, production, management and service. The intelligent manufacturing of robot group control is an intelligent system of production automation and process intelligence based on CNC machine tools, robots and other production equipment. This system integrates ERP system, production process execution system and other intelligent manufacturing process software to form the central nervous system. Secondly, based on sensors, embedded chips, RFID tags, bar codes, the whole intelligent manufacturing process neurons are constructed.

In addition, the link control neuron is constructed based on PLC, so as to realize the goal of environment perception, information acquisition and instruction transmission of the whole intelligent manufacturing process. The construction of the construction elements of the intelligent manufacturing of robot group control realizes scientific decision-making, intelligent design and

reasonable production scheduling, which can not only improve the equipment utilization rate, but also diagnose and analyze the equipment status, so as to ensure the effective operation of the whole manufacturing process. The components of robot group control intelligent manufacturing are shown in Figure 3 below.

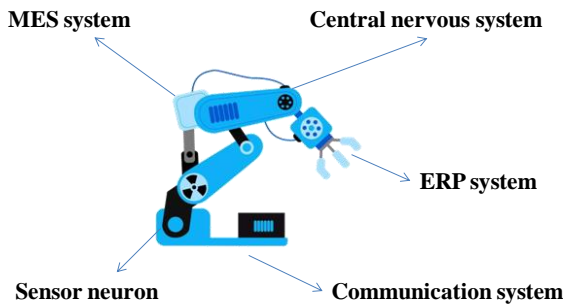


Figure 3. The components of robot group control intelligent manufacturing.

2.2.2. Intelligent path of robot group control intelligent manufacturing.

The intelligent path of intelligent manufacturing of robot group control basically follows the development stage of intelligent manufacturing, that is to build the intelligent framework first, which completes the establishment of intelligent elements, and the matching and docking of relevant human resources, so as to finally build a complete intelligent manufacturing system^[2]. The intelligent development of robot group control intelligent manufacturing industry needs a reasonable and continuous overall planning and top-level design based on its own core pain points, so as to plan a complete development framework and create an efficient robot group control intelligent manufacturing system.

2.2.3. Development status of robot group control intelligent manufacturing market

First of all, at the level of robot group control intelligent manufacturing industry chain, a relatively complete industrial chain has been initially constructed, including key basic components of robot group control, intelligent high-end equipment of robot group control, intelligent measurement and control equipment of robot group control and integrated equipment of robot group control.

Secondly, the industrial clusters of intelligent manufacturing have been formed, as shown in Table 2.

Table 2. The industrial clusters of intelligent manufacturing.

Region	Advantages
Bohai Rim	Regional resources and human resources advantages
Changjiang delta	Relatively balanced level of intelligent manufacturing is
Pearl river delta	International cooperation and innovation service base.
Central and Western	Rapid development, human cost

In addition, the market share of robot group control intelligent equipment is gradually increasing, and gradually occupies a dominant position in the economic structure transformation, which has become the key factor to promote the transformation and upgrading of manufacturing industry. Not only that, the current robot group control intelligent manufacturing has ushered in a financing peak, both the amount of financing and the scale have been significantly increased, as shown in Figure 4 below.

Based on the maturity and monopoly of robot group control intelligent manufacturing equipment field, differentiation, systematization and vertical merger and acquisition are the basic modes to build the industry advantage growth and market scale expansion in this field^[3]. By building a global network, we can create a global integrated organization structure of R & D, manufacturing and service. At the strategic landing level of robot group control intelligent manufacturing technology, relying on the application of the established core technology advantages in specific application fields, it can provide customers with diversified, personalized and more stringent service requirements.

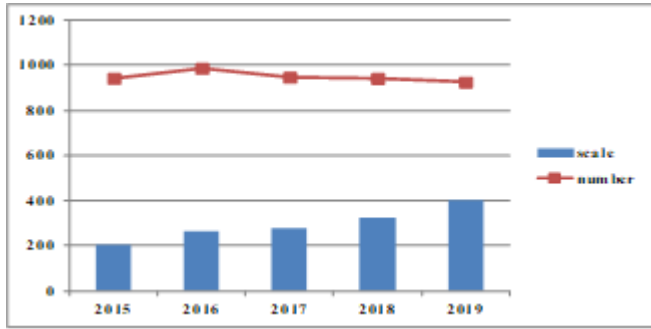


Figure 4. The amount of robot group control intelligent financing and the scale.

2.2.2. Problems existing in robot group control intelligent manufacturing industry

At present, the innovation ability of robot group control intelligent manufacturing industry still needs to be further strengthened and improved. Compared with foreign advanced countries, there is still a big gap in core technologies such as new sensing and advanced control, and many key core equipment still need to be purchased from foreign countries, so it is difficult to realize self-control. Secondly, in the development of technology and new projects, there are still characteristics of long cycle and high cost, which is not conducive to the formation of market competitiveness. In addition, the scale and capital of related enterprises are small, and the positioning of products is low-end, which is not conducive to the construction of a benign development trend of the whole industry.

2.3. Development trend of robot group control intelligent manufacturing industry

With the rapid development of social economy, the labor cost of manufacturing industry is higher and higher, which makes the application of intelligent robot more and more common, which creates new opportunities for the development of robot group control manufacturing industry^[4]. Secondly, thanks

to the strong position of China's traditional manufacturing power, the market prospect of robot group control intelligent manufacturing is very broad, and has an important influence in the whole industry.

In addition, intelligent manufacturing of robot group control has become an important support and guarantee for the transformation and upgrading of China's manufacturing industry in the future. In the future, intelligent manufacturing will be further combined with artificial intelligence, Internet of things, big data and other technologies, so as to deeply optimize the product configuration, production planning and real-time decision-making process of the manufacturing industry, and realize the thorough reform of the whole industry. The application of advanced technology of robot group control intelligent manufacturing will further drive the transformation and upgrading of the whole industry, realize the organic coexistence of human and intelligent equipment, and create a more efficient and effective business process.

In general, the development trend of robot group control intelligent manufacturing industry mainly shows that robots can show their own independence, autonomy and personality, and more prominent in the level of human-computer efficacy, so as to further tap its application potential. In addition, the robot group control intelligent manufacturing industry will further present the development trend of automation, integration, informatization and green, as shown in Table 3 below.

Table 3. Development trend of robot group control intelligent manufacturing industry.

Trends	Features	Advantages
Automation	Automation of manufacturing process	Optimization of manufacturing process
Integration	Production technology,	Upgrade the equipment

	hardware, software and continuously application		
Informationize	Integration of sensor, computer and software	Intelligent improvement	performance
Greenization	Life cycle environmentally friendly	Social and ecological benefits	

3. Digital design of robot group control intelligent manufacturing system

Digital design is the source of robot group control intelligent manufacturing system, and is the core element of realizing digitalization and intellectualization in robot group control intelligent manufacturing industry. The key links and processes in the robot group control intelligent manufacturing system as shown in Figure 5 will be applied to digital design, so as to effectively shorten the product development cycle and reduce the development cost.

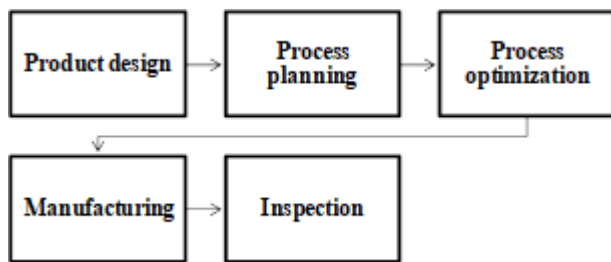


Figure 5. Key links and processes in the robot group control intelligent manufacturing system.

Based on the technology of computer aided software and modeling tools, the whole intelligent guidance process can be digitized and modeled comprehensively, and the robot intelligent manufacturing process can be highly integrated, coordinated and integrated, which can greatly shorten the project cycle and reduce the risk and investment cost.

3.1. Intelligent manufacturing system unit of robot group control

Robot group control intelligent manufacturing system unit can not only improve the utilization rate of the intelligent manufacturing equipment, but also speed up the production rhythm and increase the

output and benefit. The intelligent manufacturing system unit of robot group control is based on the discrete manufacturing site, through the modularization of manufacturing equipment with similar functions, to realize the integration and integration of the whole manufacturing process. These intelligent units can effectively realize the flexible production of products, especially in the case of many kinds of products.

The intelligent manufacturing system unit of robot group control is mainly composed of automation module, information module and intelligent module, so as to realize the intelligent production of multi variety, small batch and even single piece automation^[5]. It can be seen that these units and modules can significantly improve the utilization rate of manufacturing equipment and speed up the production rhythm for small-scale enterprises, so as to realize the continuous improvement of revenue. The five dimensional evaluation radar diagram of the robot group control intelligent manufacturing system unit is shown in Figure 6 below.

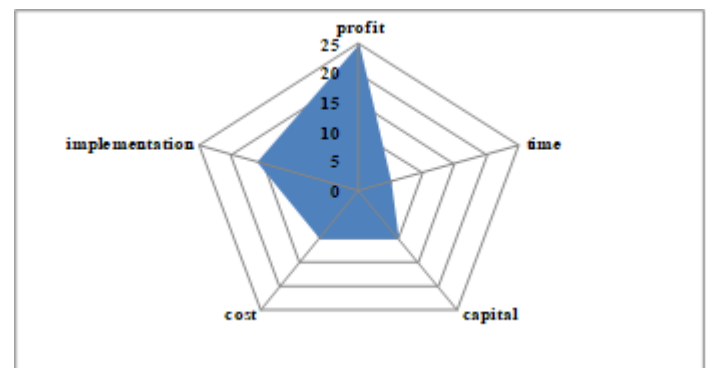


Figure 6. The evaluation radar diagram of robot group control intelligent manufacturing system unit.

3.2. Intelligent logistics storage system with robot group control

As an important part of robot group control intelligent manufacturing, the realization of intelligent logistics warehouse can not only bring considerable space, time and cost savings, but also further improve the efficiency of production preparation, and ensure the smooth and stable operation of the production process^[6]. Secondly, based on the improvement of the utilization efficiency of raw materials, the flexibility and accuracy of the warehousing link can be further released, and the inventory cost will be further reduced with the decrease of the total inventory and personnel demand.

In addition, as the robot group control intelligent logistics storage system is an important front-end guarantee of intelligent manufacturing, its organizational structure can be divided into several levels as shown in Figure 7, including equipment, operation, equipment, etc., so as to realize the rapid inspection of raw materials, warehousing, warehousing management and production line.

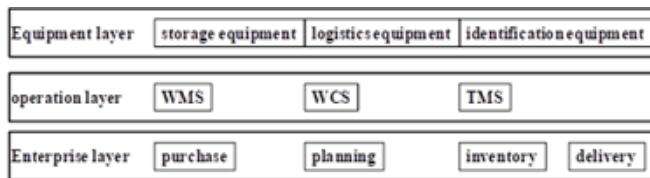


Figure 7. The organizational structure of intelligent logistics warehouse.

3.3. Robot group control intelligent manufacturing customized platform

With the continuous urgency of customer personalized demand, the construction of customized platform of robot group control intelligent manufacturing system is helpful to further enhance the brand value and customer stickiness. In the intelligent manufacturing system of robot group control, in addition to the management software such as CRM, it is also necessary to build a personalized platform to capture the user's needs in advance, and input it into the front link and process of intelligent manufacturing as soon as possible.

Through the construction of customization platform, the differentiated customization of product

parameters and flexible production can be realized, and the on-time delivery of customer personalized requirements can be realized within the scheduled delivery time. Therefore, the intelligent manufacturing system of robot group control needs to realize the synchronous construction of personalized customization platform and all aspects of intelligent manufacturing, so as to meet all the intellectualization and digitization of user scheme and customization process. In addition, through the construction of manufacturing information database, the demand behavior of users is analyzed and managed, so as to further solidify and optimize the manufacturing process and optimize the whole domain.

3.4. Remote operation and maintenance of robot group control intelligent manufacturing

With the continuous extension of the value chain of intelligent manufacturing system, the current operation and maintenance has become a new link and process of value creation. Through the intelligent analysis and management of cloud services and data information, the robot group control intelligent manufacturing system can achieve more accurate user demand capture and analysis. Based on these technologies, we can further optimize and expand the value chain of robot group control intelligent manufacturing, and further extend it to the back end^[7].

In addition, the remote operation and maintenance of robot group control intelligent manufacturing can significantly reduce the fault level of manufacturing equipment, so as to ensure continuous productivity and further enhance the brand and value. Through the integration of intelligent technology and different modules such as data interface, data acquisition and transmission, the accurate analysis of operation data is realized, the product is continuously optimized, the reliability of the product is further improved, and a virtuous iterative cycle process is formed. Based on the construction of operation and maintenance data

center, the data information knowledge base is constructed to realize the value-added of data.

4. The design and application of robot group control intelligent manufacturing system

4.1. Architecture of robot group control intelligent manufacturing system

In the overall architecture design level of robot group control intelligent manufacturing system, based on the organic combination and writing of all the components of the whole system, the automatic operation of the whole process of storage, manufacturing, detection, delivery and delivery is realized. The overall architecture of robot group control intelligent manufacturing system is shown in Figure 8 below.

Through the construction of this architecture, different functions such as storage, NC manufacturing, automatic cleaning, automatic transmission, automatic monitoring, automatic loading and unloading, and information management are realized. The overall principle of the architecture construction of robot group control intelligent manufacturing system is to realize the real-time acquisition, analysis and processing of manufacturing data and parameters, so as to improve the utilization of manufacturing equipment, improve the production efficiency and reduce the maintenance process.

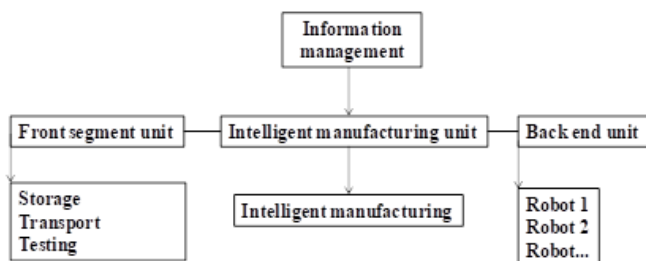


Figure 8. Architecture of robot group control intelligent manufacturing system.

4.2. Design of communication and information management system

First of all, in the technical support level of communication mode of robot group control intelligent manufacturing system, it is mainly based

on communication, data acquisition, logic programming and other functional modules to realize the information transmission and exchange between the front end and the back end of the intelligent manufacturing process. Secondly, in the front-end process of robot group control intelligent manufacturing system, the realization of information and communication management is based on the core controller, which exchanges information with the back-end process in real-time cycle, and controls and manages each unit. In the back-end process of the robot group control intelligent manufacturing system, the dynamic data exchange and sharing is realized by collecting the previous information instructions and outputting feedback to the manufacturing process. The information exchange process of communication and information management system is shown in Figure 9 below.

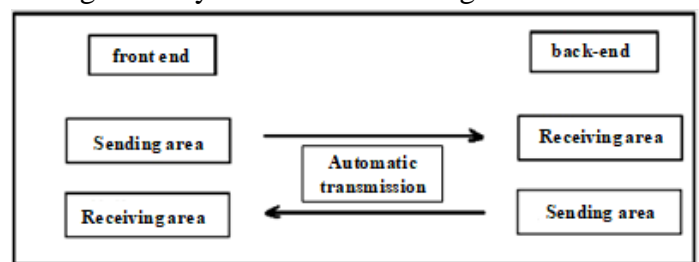


Figure 9. Information exchange process of communication and information management system.

4.3. Logic design of robot group control intelligent manufacturing system

First of all, in the technical support level of CNC machining unit of robot group control intelligent manufacturing system, mainly including CNC machine tool technology and CNC system PMC technology, so as to realize programmable machine tool control. Secondly, in the process design of NC machining unit of robot group control intelligent manufacturing system, the manufacturing process based on computer program is realized through communication with other functional modules and processing of logic signals. In addition, in the level of logic action design of NC machining unit, based on the completion signal of manufacturing machine

tool, the information is further processed by PMC signal.

4.4. Functional design of intelligent manufacturing system for robot group control

First of all, in the technical support level of the loading and unloading unit of the robot group control intelligent manufacturing system, it mainly realizes the communication between the robot system and peripheral equipment through the robot language programming technology and PLC technology, as well as the electronic operation of digital operation. Secondly, in the robot group control intelligent manufacturing system, the information transmission is realized based on hardware interface and robot program.

In addition, in the robot programming level, the robot as language program is mainly written based on the computer to realize the precise control of the robot to make the corresponding action of grasping the workpiece, so as to complete the action flow of the whole loading and unloading unit.

5. Conclusion

In summary, the function design of intelligent manufacturing system mainly focuses on the core links of intelligent control, data analysis and management. In the control system design, in addition to meeting the requirements of intelligent production, but also with the wheel manufacturing system information receiving, uploading and communication functions and capabilities, and the development of robot group control intelligent manufacturing industry is inseparable from the boosting and integration of informatization and industrialization, so as to realize the integration innovation and engineering application of information technology and robot manufacturing equipment integration.

In this paper, through the analysis of the development status of robot group control intelligent manufacturing technology, including the research on the constituent elements, intelligent path and existing problems of robot group control intelligent manufacturing technology, the digital design method

of storage, manufacturing and operation and maintenance of robot group control intelligent manufacturing system is given. In addition, based on the overall design analysis of the robot group control intelligent manufacturing system, the architecture design, logic design and system function design method of the communication and information management system are given.

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