Design and Research of Teaching and Training Platform Based on Industrial Internet and Intelligent Manufacturing

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Abstract: Industrial internet and intelligent manufacturing application training platform is a comprehensive teaching and training platform for industrial internet, which contains a complete industrial internet architecture, including: sensing equipment, actuator, wireless sensor network, wired sensor network, industrial master control organization, industrial Internet cloud platform, industrial big data analysis platform. The industrial internet application technology training platform uses emerging technologies such as industrial internet, embedded, big data, mobile application, artificial intelligence, intelligent manufacturing, and built-in industrial internet cloud platform to provide teaching, practical training and scientific research support for the upgrading and reform of relevant disciplines in vocational colleges. The industrial internet and intelligent manufacturing training platform provides hardware and software resources with three layers of architecture, including equipment layer, platform layer and application layer, providing supporting teaching and practical training resources for related teaching. Industrial internet application technology training platform can meet the needs of industrial Internet teaching and training courses, including: "Industrial Ethernet and Network Equipment", "Network Security Technology", "Industrial Internet of Things", "Industrial Automation Control", "Network System Software Design", "Machine Vision Technology", "Manufacturing Execution System (MES) Application Technology" and so on.
***Keywords*:** industrial internet, intelligent manufacturing, platform; equipment, practical training

1. Introduction

The industrial internet is a new industrial ecology, key infrastructure and new application mode that deeply integrates the new generation of information and communication technology with the economy. By fully connecting people, machines and materials, it constantly changes the traditional manufacturing mode, production organization mode and industrial form, and builds a new industrial production, manufacturing and service system that is fully connected with the whole factors, the whole industrial chain and the whole value chain. It provides a way to realize the digital, networked and intelligent development of the real economy. It is vital to understand that the industrial Internet is not only an academic concept, but also that there is a market demand.

That is to say, the industrial internet is a real disruptive innovation, it can have a huge impact on the society, which is one of the most potential industries, it will vigorously promote the transformation and upgrading of traditional industries, lead the development of strategic emerging industries, and realize the strategic adjustment of economic structure. As a strategic commanding point for economic development and technological innovation in the post-crisis era, it has become the forerunner for all countries to build a new social model and reshape their long-term competitiveness.

Intelligent Manufacturing (IM) is a comprehensive system that integrates manufacturing technology with digital technology, intelligent technology and network technology in the whole life cycle of design, production, management and service. Perception, analysis, reasoning, decision and control in the manufacturing process, to achieve dynamic response to product demand, rapid development of new products and real-time optimization of production and supply chain network of manufacturing activities, a general term, can be divided into intelligent design, intelligent production, intelligent management, intelligent manufacturing services four key links.

The manufacturing industry can develop based on talents. The Ministry of Industry and Information Technology and other three government departments jointly issued the "Guide for Manufacturing Talent Development Planning", which means that the "Made in China 2025" planning system has been released and fully implemented, opening the road to manufacturing power. In the guide, the most eye-catching is its list of "10 key areas of manufacturing talent demand forecast".

In the forecast, 10 majors, including new-generation information technology industry, high-end CNC machine tools and robots, aerospace equipment, ocean engineering equipment and high-tech ships, advanced rail transit equipment, energy-saving and new-energy vehicles, electric power equipment, agricultural machinery equipment, new materials, biomedicine and high-performance medical equipment, are listed. By 2020, the new-generation information technology industry, electric

power equipment, high-end CNC machine tools and robots, and new materials will become the majors with the biggest talent shortage, among which the talent shortage of the new-generation information technology industry will reach 7.5 million.

By 2025, the talent gap for the next-generation information technology industry will reach 9.5 million, and that for power equipment will reach 9.09 million. In addition to the 10 fields, the guideline also points out that the focus will be on cultivating technical professionals in advanced design, key manufacturing processes, materials, digital modeling and simulation, industrial control and automation, industrial cloud services and big data application, focusing on areas such as "four-base" construction, intelligent manufacturing and "Internet plus manufacturing."

Advanced information technology has been closely integrated with the manufacturing industry, which is brewing a new industrial reform, gradually forming a new mode of production, industrial forms, business models, and shaping a new economic growth point. Intelligent manufacturing involves more disciplines, the distribution of professional knowledge is scattered, involving different vocational majors, which also poses a higher challenge to the training of professional talents needed by enterprises. Therefore, it is particularly important to design a set of teaching and training platform suitable for industrial Internet and intelligent manufacturing technology.

2. Research background

In addition to learning from foreign experience, the development of China's industrial Internet has deep impetus for development. First of all, the disappearance of demographic dividend and industrial upgrading are the fundamental impetus for its development. Our country and even the world are faced with the sharp reduction of the labor force and the objective reality of aging population. In this context, the demand for intelligent manufacturing is aggravating, which requires the manufacturing industry to upgrade intelligently and make it develop deeply in the direction of industrial Internet.

Secondly, new technologies provide the basic conditions for it. The core technologies of industrial Internet are connection, cloud and network security. With the intelligent development of Chinese manufacturing industry in recent years, the progress of industrial informatization and industrial technology, plus other technologies, such as mobile Internet, big data, artificial intelligence, cloud computing, AR/VR and other technologies widely combined with the manufacturing industry, The core technology of industrial Internet is gradually mature, which makes its development become an inevitable trend.

New demands of enterprises in intelligent manufacturing mode are a direct driving factor for the formation and development of industrial Internet. The transformation and upgrading of manufacturing industry generates new demands. These demands directly promote the integration of manufacturing industry and the Internet. New demands of enterprises in intelligent manufacturing mode are a direct driving factor for the formation and development of industrial internet. The transformation and upgrading of manufacturing industry generates new demands. These demands directly promote the integration of manufacturing industry and the Internet. However, the market situation of Chinese industrial Internet is good and its development is of great significance. However, the market situation of Chinese industrial Internet is good and its development is of great significance.Therefore, it is of great significance to design and develop a teaching and training platform to provide teaching, practical training and scientific research support for the upgrading and reform of relevant disciplines in vocational colleges, promote and support the construction of new vocational specialties in the field of intelligent manufacturing, and cultivate and improve the quality of composite talents with technical skills.

3. Overall design scheme of the training platform

The industrial Internet application technology training platform provides hardware and software resources with three layers of architecture, including equipment layer, platform layer and application layer, providing supporting teaching and practical training resources for related teaching. Industrial Internet application technology training platform can meet the needs of industrial Internet teaching and training courses, including: "Industrial Ethernet and Network Equipment", "Network Security Technology", "Industrial Internet of Things", "Industrial Automation Control", "Network System Software Design", "Machine Vision Technology", "Manufacturing Execution System (MES) Application Technology" and so on.

3.1 Main hardware units and technical indicators of the platform

3.1.1 Industrial robot unit consists of

Industrial robot GSK RB03A, vacuum generator and vacuum sucker composition; Industrial robot 6 degrees of freedom, the load is 3KG, repeated positioning accuracy ≤±0.02mm, arm span 562mm; Industrial robots use industrial Ethernet for communication. Main training content: industrial robot data acquisition and communication parameter setting, programming instruction training, industrial robot handling training, etc.

3.1.2 Machining center simulation unit

The machining center simulation unit consists of GSK 25i numerical control system and numerical control simulation chuck model. It can run the machining program and simulate the machining process. Main training content: numerical control system parameter setting and debugging, numerical control system programming and operation

3.1.3 Main control monitoring unit

The training platform provides a complete master control monitoring unit, including: industrial control host, industrial control PLC, remote IO module, HMI industrial control screen, all industrial components are removable installation, reserved wiring interface and programming interface

3.1.4 Industrial sliding table processing unit

Sliding table machining unit, based on the servo motor structure of sliding table, to realize the workpiece simulation displacement machining; In the process of processing, through the stroke, limit, origin sensor to realize the position of the slide and limit

3.1.5 Industrial raw material transmission unit

The industrial raw material transmission unit takes the stepper conveyor belt as the core, which can simulate the movement of the workpiece raw material on the conveyor belt. In the process of movement, the color sensor, proximity switch, photoelectric reflection and other digital I/O output sensors are used to monitor the material and quantity of raw materials in real time

3.1.6 Sensor network

Industrial Internet application technology training platform has both traditional wireless sensor network communication and industrial wired sensor network communication. It is a training platform for mixed networking of heterogeneous networks.

3.1.7 Network Control Unit

The network control unit is mainly composed of Huawei switches, routers, wireless aps, wireless routers and 4/5G wireless gateways. It is used for industrial network construction and data transmission training

3.2 Platform composition and function

Platform layer: Industrial internet and intelligent manufacturing training platform layer is based on industrial connected cloud platform technology, providing data processing, operation and maintenance, calculation and decision, including three units: industrial connected cloud platform, multi-protocol industrial Netcom, high-performance edge computing. Industrial connected Cloud platform: Practical training platform provides intelligent cloud iot data middleware platform based on industrial connected cloud platform technology, which supports access, classified storage, data decision-making, data analysis and data mining of massive industrial data.

Multi-protocol Industrial Netcom: The multi-network protocol gateway service built into the training platform provides authentication services, data access, address resolution, data push, network configuration and other services for the industrial heterogeneous network, and communicates with the industrial Internet cloud platform through MQTT data service. High-performance edge computing: The training platform integrates high-performance NPU AI computing units, which can run neural network models locally and provide AI algorithm applications such as machine vision.

Application layer: The application layer of intelligent manufacturing training platform provides rich Internet and big data applications, supporting remote and remote use, including three units: visual operation and maintenance application, industrial Internet application, and big data analysis application. Visual operation and maintenance application: H5 visual chart is used for visual display and control of production data, which can update and warn the data in real time.

Industrial internet application: Industrial internet application designed based on the new thinking of industrial Internet. Big data analysis application: Based on the massive industrial data stored on the industrial cloud platform, it provides production basis for management personnel and early warning and prediction for operation and maintenance personnel through big data analysis and inference.

3.2.1 Private cloud platform

Private clouds are built for use separately from industrial Internet and intelligent manufacturing platforms, thus providing the most effective control over data, security and quality of service. The platform owns the infrastructure and can control how applications are deployed on it. The core attribute of a private cloud is proprietary resources. Private cloud platforms have advantages such as data security, stable SLA (quality of service), full utilization of existing hardware and software resources, and no impact on existing IT management processes.

3.2.2 MES production control unit

According to the intelligent production line process, MES management system is customized and developed with production scheduling management, equipment management, measurement and tool repair, production statistics and system Settings and other functions. The design function of the system is completed by referring to the manufacturing execution system of modern factories.It is closer to the actual production, while the system function fully meet the requirements of the competition, meet the competition and daily teaching. Main practice content: MES management system operation and parameter setting, MES management system and equipment interconnection.

3.3 Platform training project

Industrial internet and intelligent manufacturing platform can meet the needs of industrial Internet teaching and practical training courses of intelligent manufacturing technology. The main practical training projects are as follows: Industrial raw material transmission unit installation and debugging, industrial robot teaching, programming and debugging, industrial sensor debugging and data acquisition, CNC machine tool programming and analog processing, digital twin technology application, industrial APP development, MES software operation and data interaction, industrial network construction and security.Through the above learning and training programs, I will clarify the development direction of industrial Internet and intelligent manufacturing related majors, clarify the development path and talent training focus of intelligent manufacturing related majors of the school, and form a clear direction for the construction and development of intelligent manufacturing related majors of the school.At the same time, on the basis of full investigation and demonstration, and by taking advantage of the relatively complete professional group advantages of electromechanical and numerical control majors in traditional industries, we choose the direction as the breakthrough, upgrading and transformation, and follow the "four phases" principle of professional upgrading and transformation.We transform, expand, reorganize and upgrade the mechanical and electrical engineering, numerical control and other majors in the traditional industry, complete the professional upgrade and development, update the original professional content (update teaching content, teaching facilities, etc.), and expand the original professional functions.

We should improve the quality of talents training in the field of industrial Internet and intelligent manufacturing, build a scientific and reasonable talent training system, and configure professional courses related to intelligent manufacturing with the teaching content of integrated process as the core, digital teaching resources as the carrier and modern information technology as the platform to promote the teaching application and improve the quality of talents training in the school.

We will build a teacher contingent with sophisticated techniques and wealth reserve of knowledge as well as prominent teaching ability. Professional development of relevant colleges and universities in the region will be covered, and social training and other activities will be carried out to meet the needs of social personnel skill training, job examination certification and enterprise technical personnel refresher training, so as to enhance the ability to serve the society.

4. Platform features and benefit analysis

The continuous expansion, deepening and improvement of the application of skills reflect the characteristics of the combination of software and hardware in the industrial internet. The independent hardware equipment and client software are connected together through various communication protocols to realize the remote order of APP and the production of factory equipment according to the order. The digital twin technology is introduced to realize the combination of virtual and real, so that the real hardware equipment and the virtual model run synchronously, and the state of the equipment can be observed in the field through the digital twin technology.New technologies of the training platform are increasingly widely applied in the field of industrial Internet, and new technologies such as digital twin, information physical system and low code are increasingly widely applied in the field of industrial Internet, and further promote the integration and innovation of industrial Internet in a wider range, depth and higher level.Through the design and development of industrial Internet and intelligent manufacturing training platform, we can accelerate the training of senior workers in the industrial Internet of the school, provide practical industrial Internet talents for the society and meet the needs of students for further study, enhance the overall teaching level of automation and computer in our school, and serve the regional economic development.

Specifically, it can be summarized as follows: To promote the overall improvement of school-running philosophy, school-running level and school-running quality; To promote the level of professional construction of the school, improve the training of industrial internet and intelligent manufacturing. This not only improves the training quality of highly skilled talents in our school, but also deeply integrates school-enterprise cooperation and introduces enterprise projects in the process of talent training, which will not only bring technology and teachers,at the same time, it also brings the advanced management concept and system culture of modern enterprises, and lets the teachers and students of the school truly feel the advanced nature and superiority of modern management. On the one hand, it lays the foundation for the transformation

and development of each specialty, on the other hand, it can realize the sustainable development of specialty construction. Improve the social service ability, relying on the industrial Internet and intelligent manufacturing superior resources, organizing competitions and other services, using the superior software and hardware resources of the major, cooperating with educational authorities, enterprises and other relevant units, constantly improve the social service ability of the major and expand the regional influence of the major.

5. Conclusion

The technological transformation of industrial internet and intelligent manufacturing will not only lead to the transformation of manufacturing industry, but also have a far-reaching impact on all aspects of society. Especially for the most forward-looking education, it will be a major challenge. At the same time, IT also instantaneously creates a new demand for talents, who should master not only the professional industry knowledge, but also OT, IT, DT and other information technologies. Network is the foundation of industrial internet and intelligent manufacturing training platform.

The industrial Internet platform is a system of massive data collection, collection and analysis based on the demands of digitalization, networking and intelligence of the manufacturing industry. It is a carrier to support the ubiquitous connection, flexible supply and efficient configuration of the manufacturing industry, and its core element is the data collection system. Based on the actual needs of the manufacturing industry and the future technological evolution path above, it should be technologically advanced and forward-looking as an education, which is conducive to the design and research of industrial internet and intelligent manufacturing training platform: (1) To solve the problem of matching the curriculum training system with the talent needs of new enterprises; (2) To solve the problem of the lack of teaching resources and practical training equipment under the background of information revolution, (3) To solve the problem of teacher training with dual qualifications to meet the requirements of new technology; (4) How to use information technology in education and teaching. Finally, through the platform learning practical training project training, we are committed to cultivate high-quality students to meet the needs of the times.

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