Research and Practice on Promoting Professional Reform and Building a Good Ecology for Domestic Robot Enterprises with the Construction of Robot Industrial Institutes as the Starting Point

Taking the Construction of EFORT Robotics Industrial Institute in Wuxi Vocational and Technical College of Commerce as an Example

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Abstract. Aiming at integrating the four chains, promoting the professional reform and improving the enterprise ecology, the college and the corporation have conducted feasibility study of the construction project of "Wuxi Vocational and Technical College of Commerce- EFORT Robotics Industrial Institute" and finally succeeded in organization and implementation. From the above process, both sides have made a useful exploration in the 5 aspects of training bases, professional core curriculum system, teacher training, management mechanism and project implementation. This paper treats the experience in constructing the industrial institute, which has certain reference significance for the majors (group) of relevant vocational colleges.

Keywords: Modern industrial institutes · Industrial robot technology · Professional reform · Enterprise ecology

1 Introduction

In 2018, *The Guidelines for the Construction of National Intelligent Manufacturing Standard System (2018 Edition) and The Classification of Strategic Emerging Industries (2018 Edition)* gave policy support to industrial robots. In 2020, 248 colleges and universities across the country established robotics majors [1]. The new Vocational Education Law is a leading document for the development of vocational education, in which "integration of industry and education" has appeared 9 times and "school-enterprise cooperation" has appeared 5 times. The modern industrial institute is an important carrier to realize the deep cooperation between schools and enterprises and the "double main body" of vocational education; the construction of "double high" in higher vocational education also takes it as the key construction content, and gives strong support from policy and funds [2].

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As an irreplaceable important equipment and means in advanced manufacturing industry, the industrial robot has become an important symbol to measure a country's manufacturing level and scientific and technological level [3]. China is in an important period of accelerating transformation and upgrading. The robot industry with industrial robots as the main body is an important path choice to solve the rising human costs and environmental constraints in China. China's industrial robot market has continued to perform strongly in recent years, and the market capacity has been expanding. The upsurge of industrial robots drives the construction of robot industrial parks. Beijing, Shanghai, Shenzhen, Harbin, Wuhu, Tianjin, Xuzhou, Changzhou, Kunshan, Chongqing, Tangshan and Qingdao have begun to build robot industrial parks. The development of the industry is in urgent need of a large number of high-quality and highly skilled professionals. Talent shortage has become the bottleneck of industrial development, which should and must be solved through the integration of industrial chain and education chain [4].

2 Analysis of Pain Points and Cooperation Hotspots Between Schools and Enterprises

2.1 Basic Information of Industrial Robot Technology

Industrial robot technology is a powerful support for the realization of intelligent manufacturing, intelligent equipment, intelligent home and intelligent society. Intelligent robots and systems are the development focus of the third generation of robots. Closely focusing on the major needs of robot intellectualization and industrialization, and centering on "intelligent interaction technology", they realize "visual interaction", "auditory interaction", "motion interaction" and "network interaction", which provide new methods, key technologies and innovative applications for the development of emerging industries such as security monitoring system and intelligent service system ubiquitous robot networks, human-computer cooperative robots, intelligent manipulators, ROS robot systems, intelligent factories, human-computer interaction systems [5]. Wuxi Vocational and Technical College of Commerce lags behind in the first generation of industrial robot education. At a time when China attaches great importance to manufacturing, industrial chain restructuring and optimization, and when China views strengthening the localization and substitution of key products and parts and controllable core technologies as her national strategies, the development of intelligent robots and their systems is facing rare opportunities and challenges. Robotics requires not only survival, but also development. Opportunities should not be missed.

2.2 Achievements and Shortcomings of this Major

In 2020, the School of Intelligent Equipment and Automotive Engineering of Wuxi Vocational and Technical College of Commerce not only started the industrial robot specialty, with double certificate teaching and learning promoted by competition but also established industrial robot operation and maintenance industry school alliance, and complete the training and assessment of industrial robot operation and maintenance

1 + X project. So far, she has participated in the provincial competition of industrial robot technology application for four consecutive years and won the national third prize once, the second prize twice and the third prize three times. She has begun to have an influence in the same type of specialty.

However, at present, there are still several restrictive factors in the development of this major, which are shown as follows:

Firstly, the professional development direction is not clear, and the differentiated and transcendental development has not been realized. Secondly, the training equipment is extremely short, which is difficult to meet the basic teaching and training. Thirdly, for lack of leading talents in the field of robotics, creating high-level teachers still has a long way to go. Fourthly, professional start-up has not formed a window effect, and the enrollment problem needs to be solved urgently.

The internal causes and corresponding solutions are as follows:

This major was founded late and missed the opportunity of industrial robot professional development. For example, Wuxi Vocational College, Changzhou Electromechanical College, Anhui Electromechanical College and other colleges have formed their own characteristics in specialty construction, resulting in scale accumulation effect. In order to solve the problem of difficult specialty development, so we must aim at the pain points and development priorities of the robot industry chain (intelligent robot and ROS system), strive to make this major a key node in the robot education chain (to connect the ontology enterprise at the top and the integrated application enterprise at the bottom and to pay attention to the cultivation of intelligent robots and system talents and to providing localization services).

The school owes a lot on teachers and training equipment. Firstly, so far, the number of sets of the equipment in our School of Intelligent Equipment and Automotive Engineering is small, with only three industrial robots as the assets of the school. Secondly, the equipment type is single, with only 6-axis general-purpose industrial robots, and with no intelligent manipulator service robots, man-machine cooperative robots, arc welding robots, spraying robots, spider mobile phone and robots. Thirdly, the project teaching with practical application scenarios is not perfect, such as no seventh axis system, machine vision, sensor fusion, ROS system, etc.

The school lacks in-depth cooperation with international and domestic first-class robot enterprises, so it is urgent to cooperate with domestic first-class robot enterprises to hire industry professors and improve the level of teachers.

The school has not cooperated with relevant majors of secondary vocational schools and well-known industrial robot related enterprises to realize the cooperative training of talents.

Therefore, we should strive to cooperate with first-class robot ontology enterprises, build and share productive training bases, solve the dilemma of insufficient training equipment through lightweight asset operation and strengthen the training of teachers' ability and professional construction, which is an effective way to solve the above four internal reasons.

2.3 Current Situation of the Robot Industry

The future market for robot applications will be in general-purpose industries with a large number of small and medium-sized enterprises. At present, the number and field of applications are only the tip of the iceberg. Foreign robots account for a relatively high proportion in the automotive industry, but their application in the general industry has just started, which is an opportunity for domestic independent brand robots to change lanes and overtake [6]. From the perspective of future robot market forecast, the sales scale of robots in the Chinese market will exceed 1million by about 2025 and in 2029, the global sales of robots will be close to 9million, and the annual market scale of robots will reach 60billion US dollars. Considering system integration and maintenance services of stock robots, the scale of the whole industrial chain will reach 200billion US dollars, truly becoming a trillion market [7].

The following general industrial pain points and problems hinder the batch application of traditional industrial robots (including foreign mainstream brand robots) in general industrial small-and-medium-sized enterprises:

(1) Complex programming: lack of robot engineers and high employment cost. (2) Complex process: lack of standardization. (3) Lack of process engineers who understand both robots and processes. (4) The products are diverse, with poor consistency. (5) The robot intelligence and flexibility are not enough, so the robot needs to be adjusted repeatedly.

From the technical level, robot ontology enterprises will focus on the development of intelligent robots (non-teaching), learning control robots, adaptive control robots, etc. [8]. However, we need to cooperate with the outside in education and training, technical support and application innovation: through school enterprise cooperation, we can integrate the industrial chain, education chain, talent chain and innovation chain, build a good enterprise ecology, and solve the localization and differentiation needs of third-party enterprise customers.

2.4 Summary

Through professional analysis and industry analysis, the university can carry out in-depth cooperation with enterprises on the localized technical services most needed by domestic robot enterprises. For this reason, Wuxi Vocational and Technical College of Commerce and EFORT Intelligent Equipment Co., Ltd. have jointly built a robot modern industry institute through many consultations, jointly explored various school running modes such as mixed ownership, jointly built the application technology specialty of industrial robots, and formed an intelligent manufacturing specialty cluster with close connection and four chain integration by integrating the School of Electromechanical Specialty. It is determined that the college and the enterprise will carry out strategic cooperation, invest equipment funds in a 1:1 manner, and establish EFORT Robotics Industry Institute and EFORT (Southern Jiangsu) technical service base, with the following three centers:

(1) Education-Training Center: The center jointly carries out the training of modern apprenticeship system for robot technology application, with no less than 40 students per session. It is estimated that no less than 120 people will be provided with the third-party enterprise customer training in southern Jiangsu (Yangtze River Delta) every year.

(2) Technical Service Center: Based on the high-quality service requirements of the EFORT robot market, the center can realize the four functional needs of the localization technical service of EFORT robot products, the exhibition and promotion of new products, the general education of robot related majors and the enterprise culture education. Meanwhile, the industrial institute provides spare parts warehouse and office conditions, and the enterprise technical service personnel and school personnel undertake the technical services.

(3) Application-Innovation Center: The center not only carries out technology research and development, achievement transformation and standard formulation in the following directions of machine vision fusion, flexible cooperative robot, ROS system and innovation integrated application, but also supports enterprise technology innovation.

3 Feasibility Demonstration of the Construction of EFORT Robotics Institute

The construction of "EFORT robotics Industrial institute" has significantly improved the experimental teaching and scientific research conditions of our "industrial robotics" professional group, promoted the experimental teaching of the professional group, increased the proportion of open experimental projects and innovative experimental projects on the basis of meeting the existing comprehensive and designed experimental projects of "industrial robotics", and created conditions for the cultivation of undergraduates majoring in "industrial robotics" in the future. At the same time, it also creates good conditions for the comprehensive experimental teaching of engineering majors such as "mechatronics" and "intelligent building". The following is the demonstration from four aspects: necessity, feasibility, progressiveness and practicality.

3.1 Necessity

Building a shared robot industrial institute with EFORT Intelligent Equipment Co., Ltd. is the need of industrial upgrading in the field of intelligent manufacturing and intelligent equipment, and also the requirement of the development of the robot industry. China is now the largest market for industrial robots, but far from being a global provider of advanced robot technology and equipment. The mainstream products in the market are still the four family products of FAUNC, ABB, Yaskawa and KUKA. The market share of the three domestic Giants (Shenyang Xinsong, Nanjing Easton and Wuhu EFFORT) is not high. In addition, from a global perspective, the robot industry has not yet bred a trillion-level monopoly, and the robot market is still a free competitive market. At present, there are three general open-source robot operating systems, of which ROS system is the most widely used. According to the experience in the development of smart products such as mobile phones, if there is a general open platform, in a large free competitive market, Chinese enterprises may take advantage of the advantages of the large market to achieve industrial upgrading and gain market priority (such as consumer business of Huawei, Xiaomi, etc.). Today, when China is striving to build an industrial chain and controllable core technologies, and the localization and replacement of key

products and components, intelligent robots and systems are facing rare development opportunities. Accordingly, ubiquitous robot networks need more intelligent robots and system application talents. With the increasing demand, it is necessary to prepare for the construction of relevant training bases from now on.

Preparing for the establishment of the industrial institute is also an urgent need for the development of robotics. Many industrial robotics majors have developed their own characteristics, with pearl-jade in front. It is very difficult for this major to replicate successful experience. Therefore, only in the differentiated development, aiming at the industry and technology frontier, and striving to achieve overtaking in curves, can we create characteristics and make high-quality products. Nanjing Polytechnic Vocational University has invested a lot in industrial robots, with a training building worth more than 100 million, to mention just a few and Wuxi Vocational College and Shenzhen Vocational College also have heavy asset operation, whose mode is difficult for our school to realize. The traditional industrial robot can easily cost 150000–400000 yuan, while the intelligent manipulator can be as low as 30000–90000 yuan. In the future, robots will not only play a role in FA (factory automation), but also become human helpers in daily life or special operations. As we know, if people want to succeed, they should gather together, because people are creatures based on cooperation. The same is true of robots in the future and they should also form networks. Various autonomous, intelligent, self-propelled or extended seventh axis robots, intelligent robotic arms, man-machine cooperative safety robots and service robots will be connected to the robot network, which will replace the traditional industrial robots and have become the trend of the robot industry. In a word, with the boom of intelligent robots and systems, new racetracks have emerged, showing a new possibility for the development of robotics in our institute.

3.2 Feasibility

The school and enterprises jointly build and share the productive training base, which meets the requirements of the construction of "double high" in the college; the enterprise provides some equipment and technical service support, which can reduce the investment cost of training equipment; as a leading talent in the robotics field, Lijin Xu, Chairman of EFORT, is employed as an industry professor of this major, which is bound to integrate the resources of enterprises, schools and other parties, determine the direction of professional development, and have a certain impact on building first-class teachers and high-quality majors.

Establishing the industrial institute can achieve a win-win situation for the government, schools, enterprises and students. The robotics major of the college is short of equipment, teachers and productive training base. Therefore, it is urgent to cooperate with enterprises through appropriate investment of the school to solve the training conditions required for practical teaching, 1 + X project training assessment, competitions and external social training at a low cost; at the same time, enterprises can also make appropriate use of the school's teaching resources to complete the construction of EFORT southern Jiangsu training base, so as to realize the localization cultivation and technical services of third-party talents at a low cost.

We are supposed to seize the opportunity of robot education chain integration and play a leading role in technology promotion, training and service demonstration in the

field of intelligent robots and systems while promoting the localization and replacement of robots, thus building the major into a key node of the education chain.

3.3 Progressiveness

New construction concept: taking the opportunity of jointly building an industrial institute with EFORT, the college and enterprises have jointly built a shared industrial institute and open courses (ROS system application and intelligent robot application).

New technology and products: with intelligent interaction as the center, we can realize and enhance the ability of visual interaction, voice interaction, action interaction and network interaction, introduce domestic first-class human-computer cooperative robots, intelligent robots, intelligent manipulator, machine vision and ROS systems, create practical typical application scenarios of intelligent robots, and build a first-class intelligent robot industrial institute in the province.

The school can realize asset light operation, improve the quality of talent training, and realize the differentiated and transcendent development of robot specialty.

3.4 Practicality

In terms of teaching contents: in addition to helping to learn traditional industrial robot programming, the equipment of the industrial institute also supports the use of Python language to realize intelligent manipulator and ROS system, and supports the use of AI language to realize action and communication logic.

On the integration of professional resources: in addition to the robotics specialty, the industrial institute can also be used for the electromechanical integration specialty group services such as electromechanical integration specialty and intelligent building, and can also provide services for the automation specialty of the Internet of things.

In terms of social services: in addition to teaching, the industrial institute can also be used for social training, third-party technical training and services.

4 Construction Countermeasures of the Industrial Institute

4.1 Construction Objectives

As a key project of in-depth integration of industry and education of Wuxi Vocational and Technical College of Commerce, EFORT Robotics Industrial Institute has completed the construction and operation of one base and three centers within five years, giving full play to the functions of teaching training, technical services and application innovation. Besides, according to the actual needs of the post, EFORT Robotics Industrial Institute will straighten out the professional talent training system, and improve the level of teachers and the training quality of students (trainees), finally achieving the general goal of promoting professional reform and construction and building a good enterprise ecology through the integration of the four chains.

4.2 Main Construction Contents

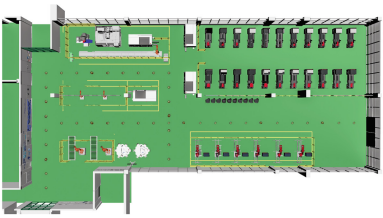
(1) Construction of Training Bases

Both the University and the enterprise shall invest equipment funds in a 1:1 manner to provide EFORT Robotics Institute with instruments, equipment and related supporting software. The main equipment includes 6 sets of disassembly and assembly robot workstations, 2 sets of handling and stacking robot workstations, 2 sets of welding robot work, 1 set of turning milling composite demonstration line, 1 set of double arm cooperative robot, etc., which have been installed and debugged in place. It is mainly used in *Industrial Robot Technology Foundation and Application, Electrical Design Technology Foundation, Robot Mechanical System and Modeling, Industrial Robot Operation and Maintenance, Industrial Robot Off-line Programming and Simulation, Visual Technology and Application, Intelligent Device Innovative Design, NC Machining Theory and Training, ROS System Application, Intelligent Robot Application, Electromechanical Transmission and Control Teaching and Training of Electromechanical Control Theory and Practice, Electromechanical Integration Technology, Hydraulic and Pneumatic and other main courses* (Fig. 1).

(2) Curriculum System Reform

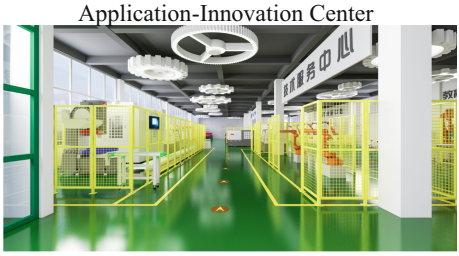
It is necessary to revise the training plan for industrial robotics professionals, promote the in-depth integration of professional education, science and technology innovation competitions and industrial institutes, and achieve multiple wins for teachers, students, enterprises and industries. According to the actual conditions and personal interests of teachers, they can claim equipment, organize training through online and offline mixed methods, quickly understand relevant technologies, and make use of leisure time such as summer vacation to carry out curriculum reform and lesson preparation. This is the key to the substantive promotion of the industrial institute, which, however, has many difficulties. On the basis of obtaining the support of enterprises, we must also make full use of the learning enthusiasm of young teachers and the rich experience of senior professors, and the college should properly introduce the reward and subsidy policy to encourage it, so as to effectively complete it.

After in-depth investigation and discussion, the major believes that students majoring in industrial robot technology can be divided into system operation and maintenance personnel, system operators and system integration engineers from the training level. At each level, they need skills related to mechanical engineering, electrical engineering and application programming related to industrial robots and peripheral intelligent devices, and there are differences in the skill levels required at different levels. From the perspective of technological development, its technological evolution direction should be industrial robot technology - industrial robot system technology - intelligent industrial robot system technology. It is necessary to introduce relevant teaching contents of MV (machine vision), AI, industrial Internet and MES into the curriculum system. According to the post demand and the actual situation of the major, the core curriculum system of the major is optimized. The items to be adjusted in the brackets are shown in Fig. 2. The course content should be combined with the equipment and actual industrial scenes of the industrial institute as much as possible, and teachers are encouraged to make gradual but clear-cut adjustments to the teaching content. According to this principle,



Base Site Layout

Application-Innovation Center



Technical Service Center

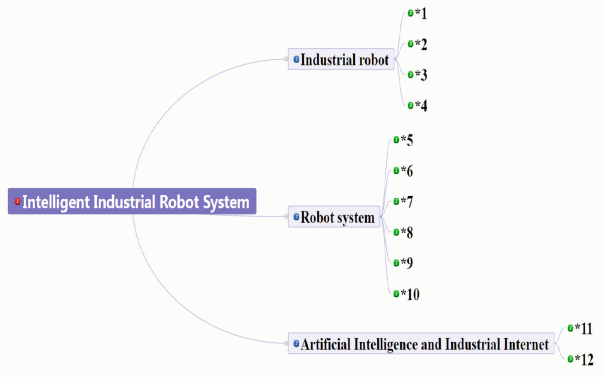
Education and Training Center

Fig. 1. Layout Rendering of EFORT Robotics Industrial Institute

the personnel training program has been revised, and the tasks of equipment claim and curriculum reform have been completed.

(3) Teacher Training

This major needs to cultivate technical backbones who are proficient in Electromechanical, hydraulic, pneumatic, optical, micromagnetic integration, multi axis operation coordination control and multi system autonomous control technology, especially dual qualified talents in industrial robot application, machinery manufacturing and automation, and electromechanical integration technology (hereinafter referred to as the robot professional group). The above majors involve the integration of mechanical subsystem and control subsystem. With the development of the times, it is urgent to integrate



Topology of the Course System

1. Technical Basis and Application of Industrial Robots
2. Robot Mechanical System and Modeling, Hydraulic and Pneumatic Theory and Practical Training (Tools, Tooling Design, Installation, Adjustment and Repair)
3. Fundamentals of Electrical Design Technology (including Drawing, Reading, Installing, Wiring, Configuring and Troubleshooting)
4. Industrial Robot Operation and Maintenance (including 1+X Verification), Offline Programming and Simulation of Industrial Robots (including Welding Robot Application and Complex Scene Programming Application)
5. PLC, Electrician Certification (Increasing the Communication Project with the Robot, the Motion Control Project Realized by EtherCAT Communication)
6. Vision System and Application, Textual Research on Dechuang (ie intelligent manufacturing technology and Application of Visual Inspection System Direction)
7. Human-Machine Interface and Communication Technology (Touch Screen Configuration + Industrial Control Field and Common Communication Technologies in the Field of Measurement and Control)
8. Application of Mechatronics Technology (including Computer Vision, Motion Control, MES Applications, etc.)
9. Robot System Integration Technology (including 7th Axis Expansion, Machine Vision, etc.)
10. Theory and Practical Training of NC Machining (Increasing the Communication Project with the Controller)
11. Fundamentals of Programming
12. Innovative Design of Smart Devices (Projects to Increase Python and ROS)

Contents of Each Unit

Fig. 2. Topology of Core Curriculum System Planning for Industrial Robots

computer vision (including machine vision) and other new technologies. The development direction of teachers in this major can be based on the six unit technologies of mechatronics and C5W (CAD, CAM, CAE, CV, CONTROL and WEB), and appropriately introduce ABCD (artificial intelligence, big data, cloud computing, decentralized programs and digital twins) to cultivate master talents with originality.

At present, China's domestic industrial robots are mainly used in some middle-and low-end automatic production lines, and they still have difficulty with high precision requirements and complex application scenarios [9]. Firstly, in terms of the mechanical subsystem, the ability of optimal design and precision manufacturing is insufficient. Secondly, in terms of the control subsystem, there are many arrears in multi axis motion coordination and multi system motion coordination (motion interaction), human-computer intelligent interaction, sensor fusion, etc., resulting in unsatisfactory research on high-precision servo, RV Reducer, real-time embedded micro system and complex application scenario algorithm.

The research and development of high-end equipment and new technologies, on the surface, is Electromechanical Integration Technology, but in essence, is Control Engineering Science (especially Modern Cybernetics and Intelligent Cybernetics), and its core is mathematics. Teachers who need to develop the intelligent robot professional group can learn control theory learn MATLAB, ANSYS, 20SIM, PROTEL, Multisim, TCAD design software, learn Python and other programming languages and Open CV Tensor flow Halcon Paddle padder Cognex vision and other open source or commercial libraries, and study SOC, board level and system level real-time embedded systems and low delay time system development (VxWorks, μTenux, raspberry pie, Ubuntu, Hongmeng system, etc.), various network components such as lamp, various databases (mysql, SQLite), various communication protocols (such as EtherCAT, DeviceNet, MODBUS, CAN), general robot development platform (ROS system), etc. according to their own needs. On this basis, in the field of intelligent robot new scene landing application, we can choose the such directions as the seventh axis development, machine vision, industrial Internet of things, coordinated control of motion dynamic parameters under multi axis and multi system coupling, human-machine and machine-machine association to carry out educational, scientific and technological research and innovation with enterprises or third parties. According to their own characteristics, every teacher should find the right direction and go deep into one subject. They should not be greedy for more and faster. They must work for a long time.

(4) Institutional Level

The board of directors of EFORT Industrial Institute has been established. The chairman of EFORT is the chairman of the board of directors, and the school is coordinated by the Secretary General. So far, two board meetings have been held, The Articles of Association of the board of directors have been formulated, and the directors have been elected. At present, the three centers have been put into operation and are exploring the endogenous operation mechanism of the industrial institute, which needs in-depth study on the teacher development mechanism, funding sources and benefit distribution methods.

(5) Project Implementation Level

In order to promote the integration of the four chains, in addition to normal teaching and training activities, the industrial institute is also responsible for organizing and implementing local socialized training, technical services and innovation of complex (new) application scenarios. Relevant teachers also need to complete the construction of teaching materials, topics and scientific research work and daily management of the industrial institute according to the construction requirements of the industrial institute. The work is very heavy. To this end, the operation management system of the industrial institute has been formulated, and the project responsibility system has been implemented to ensure that everyone has something to do, everyone can improve and everyone can gain.

5 Conclusion

(1) Taking the construction of the EFORT Robotics Industrial Institute of Wuxi Vocational and Technical College of Commerce as an example, this paper summarizes the construction work of the industrial institute, and studies the feasible path for the four

party system of government, administration, enterprises and schools to jointly create an industrial ecology and deepen professional reform: following the principles of joint consultation, joint construction and sharing, innovation, pragmatism and win-win, taking the construction of the modern industrial institute as the starting point, focusing on the cultivation of highly skilled talents of intelligent robots, and reconstructing the education system of intelligent robot system; we need to actively participate in the construction of industry education integration enterprises and the Robot Valley of Taihu Science and Technology Innovation Belt, and promote the deep integration of technology, resources, services and personnel, which is not only the requirement of the new *vocational education law* but it is also the only way to realize the transformation and development of industrial robot professional groups and create a good industrial ecology of intelligent robot education cultivation chain, technology service chain and application innovation chain.

(2) The construction of modern industrial institutes must find the "pain points" of enterprises, industries and schools, and the intersection of interests (cooperation fields) of multiple parties, which must be accurate and requires in-depth research and consultation, the attention of senior management of colleges and enterprises, and the in-depth research of project leaders.

(3) The construction of modern industrial institute must be like this: "Learning must be ready for use, and using must be suitable for the land". It must meet the local needs and realize differentiated development from the actual situation of the specialty, the regional development focus and the actual needs of the benchmarking enterprises.

(4) The construction of modern industrial institutes is a new thing. Formalism and bureaucracy should be avoided. It is necessary to establish an endogenous mechanism, be pragmatic in implementation, and realize the win-win of governments, schools, industries, enterprises, teachers and students so as to truly lead professional development, build a good ecosystem of enterprises, and make contributions to industrial upgrading and regional economic development.

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References

1. Xia Jiren, The Mode, Characteristics and Effective Path of the Construction of Modern Industrial Institutes [J] Journal of Ningbo Institute of Engineering, 2022, 34 (02): 104–110
2. Xiang Wei, Huang Zhenzhen, Peng Huawu, Research and Practice on the Construction of Industrial Institutes under the Coordination of Governments, Schools and Enterprises – Taking the Advanced Manufacturing Industrial Institutes of Xiangyang High Tech Zone as an Example [J] Journal of Xiangyang Vocational and Technical College, 2022,21 (03): 34–38
3. Zhao Yun, Nie Shuping, Huang Jieyu, Research on the Interaction between Enterprise Innovation and Enterprise Ecosystem [J] Economic issues, 2018, (06): 70–74
4. Wang XiangJun, Exploration on the Path of Jiyuan Vocational and Technical College to Build an Industrial Institute [J] Journal of Jiyuan Vocational and Technical College, 2022,21 (02): 23–28

5. Su Peng, Practical Exploration on the Construction of Industrial Institutes in Higher Vocational Colleges under the Background of Integration of Industry and Education [J] Theoretical Research and Practice of Innovation and Entrepreneurship, 2022, 5 (09): 67–69
6. Zhang Yu, Wang Wei, Key points, Operation Mechanism and Implementation Path of the Construction of Mixed Ownership Industrial Institutes in Higher Vocational Education [J] Education and Career, 2022, (09): 44–51
7. Yao Yuhua, Huang Bin, Sun Lixin, Industrial Institutes: Connotation, Dilemma and Construction Path [J] Journal of Yangzhou University (higher education research edition), 2022, 26 (02): 36–44
8. Wu XingJie, Enterprise Ecosystem Quintuple Code [J] Enterprise management, 2018, (05): 106–109
9. Liu Fei, The Dilemma of China's Industrial Robot Industry [J] Industry Watch, 2022 (04): 78–81,84