The Exploration of University-enterprise Cooperation in the Internet of Things Engineering

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Abstract: A series of national strategies such as service innovation-driven development and "Made in China 2025" are supported to actively respond to the new round of scientific and technological revolution and industrial transformation. The Ministry of Education decided to foster the construction of a batch of new engineering professionals leading the technical college of the future to deepen, expand, breakthrough, and promote colleges and institutional innovation, complete the future science and technology innovation talents of prospective and strategic training, and seize the future development of science and technology. New engineering majors mainly refer to majors for emerging industries, with the Internet and industrial intelligence as the core, including big data, cloud computing, artificial intelligence, blockchain, virtual reality, intelligent science and technology, and other related engineering majors. New engineering majors use intelligent manufacturing, cloud computing, artificial intelligence, robotics, and other applications for the upgrading and transformation of traditional engineering majors. Compared with traditional engineering talents, emerging industries and the new economy in the future need high-quality compound new engineering talents with strong practical ability, strong innovation ability, and strong international competitiveness. In this construction process, local colleges and universities play a supporting role in regional economic development and industrial transformation and upgrading. This paper expounds on the problems of university-enterprise cooperation, studies the Internet of things engineering professional university-enterprise cooperation practice teaching mode, including scientific and reasonable university-enterprise cooperation practice teaching course plan, build complementary cooperation practice teaching teachers, create economical university-enterprise cooperation practice teaching environment, advance university-enterprise cooperation practice teaching resources platform with the time, and establish a solid university-enterprise cooperation practice teaching guarantee mechanism.

Keywords: New engineering; Internet of Things engineering major; School-enterprise cooperation; Talent training

1. Introduction

1.1. Concept of new engineering

New engineering majors mainly refer to majors for emerging industries, with the Internet and industrial

intelligence as the core, including big data, cloud computing, artificial intelligence, blockchain, virtual reality, intelligent science and technology, and other related engineering majors. New engineering majors use intelligent manufacturing, cloud computing, artificial intelligence, robotics, and other applications for the upgrading and transformation of traditional engineering majors. Compared with traditional engineering talents, emerging industries and the new economy in the future need high-quality compound new engineering talents with strong practical ability, strong innovation ability, and strong international competitiveness. However, compared with the traditional engineering majors, the new engineering majors mainly refer to the majors targeted for emerging industries, with the Internet and industrial intelligence as the core, including big data, cloud computing, artificial intelligence, blockchain, virtual reality, intelligent science and technology, and other related engineering majors. Among them, the Internet of Things is an interdisciplinary discipline, involving communication technology, sensing technology, network technology, RFID technology, embedded system technology, and other knowledge. With the continuous development of the Internet of Things technology, the application of the Internet of Things has gradually penetrated all walks of life, such as smart homes, smart cities, smart medical care, and so on. In this rapidly changing era, the practice of the Internet of Things technology has a wide range of applications and far-reaching impact.

1.2. Internet of engineering major

Internet of Things engineering is a higher learning undergraduate course involving professional computer requirements, mastered in mathematics and other related natural science knowledge and the Internet of Things, communication and sensing, basic theory, basic knowledge, basic skills and basic methods, training to systematically master the Internet of things related theory, methods and skills, communication technology, network technology, sensing technology and other information in the field of broad professional knowledge of senior engineering and technical personnel. The joint training of talents by schools and enterprises can realize resource sharing, complementary advantages, and common development, and build a win-win cooperation mode of mutual assistance. The development of the times demands jointly cultivating applied technical talents suitable for social development, serving regional economic development, and combining the concept of applied education with enterprise practice, as depicted in **Table 1** and **Table 2**.

1.3. The background of "new engineering" construction

The Internet of Things engineering in personnel training and course construction still needs innovation. Internet of Things engineering professional university-enterprise cooperation practice teaching mode, such as scientific and reasonable university-enterprise cooperation practice teaching course plan, make complement each other university-enterprise cooperation practice teaching teachers, build economical university-enterprise cooperation practice teaching environment, advance with the time of university-enterprise cooperation practice teaching resources platform, and establish a stable university-enterprise cooperation practice teaching guarantee mechanism is particularly important. The cultivation of school-enterprise collaborative innovation and entrepreneurship talents is studied, which is conducive to changing the phenomenon of disconnection between teaching and practice in China's higher education and improving college students' ability to learn, innovation, practice, communication, and social adaptation. Collaborative talent training is an inevitable choice for universities and enterprises to achieve a win-win situation. This is to meet the demand for talent in the popularization stage of colleges and universities is conducive to improving the ability of talent training, scientific research, and social service of colleges and universities [1].

Table 1. Course structure

The type of course		Total class hours	Theory teaching class hours	Practice teaching and the learning time	The proportion of practice credit hours in the total credit hours
Public basic courses	Public compulsory course	1052	640	412	39.16%
	Public elective courses	128	128	0	0
Basic subject courses		256	240	16	6.25%
Professional education courses	Major basic courses	416	160	256	61.54%
	Professional core course	512	196	316	61.72%
	Professional development class	224	84	140	62.50%
	Professional practice course	576	0	576	100%
Comprehensive education curriculum		168	0	168	100%
The proportion of theory and practice			43.46%	56.54%	
Total		3332	1448	1884	

Table 2. Course structure

The type of course		Total credits	Theoretical credits	Practice credits	The proportion of practical credits to the total credits
Public basic courses	Public compulsory course	56	36.5	19.5	34.8%
	Public elective courses	8	8	0	0
Basic subject courses		16	15	1	6.25%
Professional education courses	Major basic courses	26	10	16	61.54%
	Professional core course	32	12	20	62.5%
	Professional development class	14	7	7	50%
	Professional practice course	24	0	24	100%
Comprehensive education curriculum		8	0	8	100%
The proportion of theory and practice			48.1%	51.9%	
Total		184	885	95.5	

1.4. The background of school-enterprise cooperation

The current state of the Internet of Things engineering major. Innovation and entrepreneurship education is a sort of teaching idea and mode that adapts to the needs of economic society and national development strategy. In the face of such a severe employment situation, this paper studies the school enterprise collaborative innovation and entrepreneurship personnel training, which is conducive to changing the phenomenon that the teaching and practice of higher education in China are disconnected, and improve the abilities of learning, innovation, practical, communication and social adaptability of college students. University enterprise collaborative talent training is an inevitable choice for universities and enterprises to achieve a win-win situation. It adapts to the needs for talents in the stage of popularization of higher education, and is conducive to improving the ability of talent cultivation, scientific research, and social service in colleges and universities [2].

The quality requirements of talents have also increased accordingly. The problems of oversupply and shortage exist in the training of engineering talents in local universities, such as the mismatch between training

specifications and demand structure, and the disconnection between training subjects and use subjects. To solve the problem of disconnection between the training of engineering talents in undergraduate colleges and the market, this paper discusses the practical teaching system of the integration of university and enterprise for engineering talents in the new era, puts forward an effective way to solve the contradiction between supply and demand of engineering talents, and trains high-quality engineering talents that meet the needs of enterprises [3].

The concept of school-enterprise cooperation in China began to rise in the 1980s, and the original idea came from Western countries. At present, the domestic research on enterprise-school cooperation needs to be improved, and China's research in this aspect is more carried out from a practical perspective, with a lack of relevant systematic research. In recent years, influenced by educational reform, vocational education has been paid more and more attention and has been recognized by all walks of life. The cooperation between enterprises and vocational schools has become a major trend in social development. School-enterprise cooperation can effectively cultivate talents with professional quality. At the same time, school-enterprise cooperation and the integration of industry and education have become a focus of the development of vocational schools. Therefore, Chinese enterprises pay more and more attention to the impact of school-enterprise cooperation on attracting and retaining talent. With the attention of the Chinese government to vocational education, more and more vocational school students have provided impetus for the development of enterprises after graduating from school. But there are also some problems in just graduated students. Their practice foundation is relatively weak and workability does not conform to the requirements of the company's business, so the applied and technical talent demand and supply problem is increasingly serious, the enterprise management and development has brought great pressure, inspiring the enterprise thinking of talent training and acquisition mode. The mode of school-enterprise cooperation can solve this problem, promote industrial integration, and provide enterprises with the talents needed for their development.

2. University-enterprise cooperation

2.1. The concept of school-enterprise cooperation

School-enterprise cooperation means that schools and enterprises jointly train students to meet the talent needs of modern companies.

2.2. The significance of university-enterprise cooperation

School-enterprise cooperation is the only way for new engineering construction and one of the important ways to promote the reform of professional training mode [4]. As an education mode for schools and enterprises to jointly cultivate talents, school-enterprise cooperation has been recognized by many enterprises, which plays an important role in accelerating the development of human resources in China, improving the employment rate of graduates, and improving the overall quality of China's labor force.

2.2.1. Enterprise level

The cooperation between enterprises and schools can meet the talent needs of enterprises, ensure that the talents coming in can quickly adapt to the job position, and further reduce the recruitment cost, post-entry training cost, and employment risks of enterprises. At the same time, due to the cooperative relationship, students have already practiced in enterprises during the school period. They have a certain understanding of the enterprises, have certain work experience, can identify with the enterprise culture, and enhance their sense of identity. Through the cooperation of enterprises and schools, the personnel with technical ability can also improve the competitiveness of enterprises.

2.2.2. School level

University-enterprise cooperation can fully improve the employment rate of college graduates. School-enterprise cooperation is when college graduates directly sign labor contracts with the enterprise to determine the labor relations according to the intention of both sides, which reduces the interview process and improves the employment rate of students. As far as colleges and universities are concerned, targeted enrollment can be conducted for school-enterprise cooperation projects, so that students and parents can intuitively understand the situation of learning major or employment, and also help students set their own learning goals when entering. At the same time, it can also reduce the uncertainty of students in graduation and employment. At the educational level, schools should jointly formulate educational plans and goals with enterprises, take students as the center, improve students' competitiveness in employment, and make them adapted for enterprises. For students, the talent training mode of school-enterprise cooperation ensures that the learning content meets the needs of the enterprise so that their students can better grasp the development prospects and job requirements of the enterprise, enhance their professional ability, and improve their employment ability.

2.3. The problem of school-enterprise cooperation

School-enterprise cooperation refers to the mode of schools and enterprises to jointly train students and meet the needs of modern companies. It is an important means to cultivate talents with a solid theoretical foundation and applied skills. The cooperation between enterprises and schools is developed based on modern society and economy. The education method of combining schools and enterprises enables students to not only learn the theoretical knowledge of training in schools but also enter enterprises to participate in production practice and improve their professional ability.

2.3.1. The imperfection of policies, systems, and regulations

First, the policy and financial support is inadequate. At present, the government's supporting fund support for enterprise-school cooperation is not strong, which cannot meet its actual needs, which limits the follow-up development of enterprise-school cooperation.

Secondly, there is a lack of relevant policies, laws, and regulations to protect it. Countries such as the United Kingdom and the United States support and develop cooperative education through legislation and other means. However, at present, the government has no special regulations and implementation plans on enterprise-school cooperation, which hinders the development of enterprise-school cooperation to some extent.

2.3.2. The imperfection of evaluation and supervision mechanism

The basic goal of university-enterprise cooperation is to transform scientific research results into specific productivity, and thus obtain greater profits. As the main body of interests, universities and enterprises will inevitably involve the division of interests in the cooperation, which will inevitably lead to the conflict between the two sides due to the interests, and finally the breakdown of the cooperative relationship between the two sides. At present, China has not established a perfect cooperation system and a matching evaluation standard to achieve this goal. The lack of a fair and mutually beneficial system between schools and enterprises will inevitably affect the long-term cooperation between both sides.

3. The solutions of the Internet of Things engineering major to carry out school-enterprise cooperation

3.1. The school-enterprise cooperation formulation

To accelerate the development of school-enterprise cooperation and cultivate practical talents, scholars have studied the educational practice and significance of vocational schools and summed up the five best modes of cooperation between enterprises and schools. Talent is one of the key points of development of the service outsourcing industry, as the shortage of service outsourcing talent has been the bottleneck restricting the development of the service outsourcing industry in the country. Colleges and universities should follow the national strategic plan, develop the service outsourcing industry from both sides of the employment of graduates, and train the service outsourcing talents. Therefore, universities need to outsource the training of students in research services [5].

3.1.1. The "order-type" personnel training mode

The order model is based on the contractual spirit of the contract, It is the deep school-enterprise cooperation, where schools, enterprises, and students are the main participants. The basis of the cooperation is also based on the contract terms. Schools and businesses based on the terms of the contract, jointly formulate talent training programs, and project-based teaching, jointly undertake the task of talent training, and ensure that practical operation skills are developed. At the same time, based on the terms of the contract for the corresponding jobs, students sign an agreement with the school to undertake their respective responsibilities and obligations. For different and non-order students, enrollment is a clear direction of employment to develop special skills and effectively solve the problems of enterprises facing difficulty in recruiting people, students being unable to find jobs, and low employment rates in schools, to achieve a win-win situation between the school, enterprises, and students.

3.1.2. The "in-post internship" training method

This method means that after obtaining theoretical knowledge in school, students should participate in the last year of the enterprise, participate in the specific production activities of the enterprise, and obtain relevant professional practical abilities.

3.1.3. The "work change" model

This model means that students alternate between studying in school and working in specific enterprises, combining the theoretical learning of engineering majors with specific work.

3.1.4. The talent training model of "combination of school and factory"

This model includes building school-run processing plants, organizing the production and manufacturing of students with the educational requirements of the Internet of Things engineering, and conducting professional training for students so that students can learn professional skills and improve their practical ability in the production of school-run processing plants.

3.1.5. "Jointly build" talent training model

Enterprise experts and colleges of professional teachers in the "professional special guidance federation" can accurately locate professional training targets, professional training plans, curriculum standards, construction of a professional training base, and the development of curriculum and teaching content, to improve the talent training plan, training education personnel, and enterprise to provide students with training places and equipment and share its results.

3.2. Define the content of school-enterprise cooperation in China

The specific contents of the cooperation between enterprises and schools include education, teaching, research, training, production, and the sharing of human and material resources.

3.2.1. Cooperative education

The school gives full play to its function of teaching and educating people, and cultivates high-quality talents that meet its needs for enterprises. At the same time, the enterprise signs cooperation agreements with the school and organizes various activities conducive to the comprehensive development of student's abilities through mutual integration.

3.2.2. Joint teaching

Schools and enterprises discuss together to determine the talent training program, curriculum content, and methods, and establish an education system that combines student training and development.

3.2.3. Implement cooperative training

Schools are important places for students to learn. Vocational training centers can be set up in colleges and universities to organize teachers to learn and train, and to train teachers in different ways. Enterprises can also set up special training bases for teachers and students or invite experts and scholars in the field to give lectures and exchange, to improve the professional ability and quality of teachers.

3.2.4. Cooperation in scientific research

Enterprises and schools should jointly establish research and experimental industry bases and product development centers to carry out joint technical research and scientific cooperation.

3.2.5. Joint production and joint manufacturing

Colleges, universities, and enterprises create and operate professional production factories, providing opportunities and stages for teachers and students to put theories into practice.

3.2.6. Sharing of talent resources

In schools, professional and technical personnel of enterprises can teach lessons to students and impart practical professional knowledge to students. At the same time, schools should allow their students to practice and work in enterprises, and help enterprises to carry out production and operation activities

3.2.7. Sharing of material resources

Through the establishment of training centers in the enterprise, classroom learning can be brought to the specific practice training center, and the full use of the resources provided by the enterprise for teaching and experiments, to improve students' practical ability. At the same time, enterprises can also make use of the school's strong technical support and advanced high-tech research, promote the development of enterprise innovation ability, and take the road of sustainable development. In addition, both schools and enterprises can jointly build an information exchange platform to achieve the goal of resource sharing.

4. Conclusion

University-enterprise cooperation is an important way to train professionals in Internet of Things engineering.

By developing appropriate models and content, students can effectively improve their practical ability and employment competitiveness. In the future, with the continuous development of new engineering, university-enterprise cooperation will certainly usher in more opportunities and challenges. It is expected that more scholars and practitioners can conduct in-depth research and practice of school-enterprise cooperation, to cultivate more high-quality people. This paper analyzes many problems existing at present, such as the lack of depth of school-enterprise cooperation, and the inability of graduates to meet the needs of employers. Based on establishing morality and cultivating people, and taking the ideological and political education courses as the starting point, a series of practical solutions are proposed, such as deepening the implementation of school-enterprise cooperation, strengthening the training of practical skills, meeting the needs of enterprises, and establishing a software curriculum system [6].

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