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Research on the Training of Engineering Applied Talents in the Direction of "Internet of Things Engineering" in the Context of Strategic Emerging Industries

Zixiu Zou

Fuzhou Institute of Technology, Fuzhou, China

Abstract

This paper first analyzes the background of the Internet of Vehicles and the training of applied talents in this direction, and then sorts out the relevant research at home and abroad. Ideas, processes and methods, and construction suggestions are given.

Keywords

IoT Engineering; Internet of Vehicles; Talent Development.

1. Research Background

The Internet of Vehicles refers to the use of advanced sensor detection, vehicle communication control, wireless communication, navigation and positioning, cloud computing, big data and other comprehensive technologies to collect vehicle, road, environment and other information. The information perception, interaction and sharing with the infrastructure enables the internal and external networks of the car to function at the same time, thereby realizing the integrated network of intelligent traffic management control, vehicle intelligent control and intelligent dynamic information service. The social and economic benefits brought by the Internet of Vehicles will definitely play an important role in the process of my country's economic transformation and the cultivation of new industries. The Internet of Vehicles is an important direction for the future development of the Internet of Things in my country. According to the 2021 China Internet of Vehicles Industry Tracking and Overall Demand Market Tracking Analysis Report, the size of my country's Internet of Vehicles market reached US$7.67 billion in 2016. According to estimates, the market size of the Internet of Vehicles in 2017 was about US$11.44 billion. According to relevant surveys and estimates, the scale of my country's Internet of Vehicles market is expected to reach US$216.2 billion in 2025, accounting for the global market share.1/4 of the market, and the 5-year average compound growth rate will reach 44.92%. From 2005 to 2014, the number of connected car users increased from 50,000 to 9.1 million. Since 2016, the Internet of Vehicles in China has entered a stage of rapid development, and the penetration rate of the Internet of Vehicles has gradually increased. According to the survey and calculation of China Industry Research Report Network, the scale of China's Internet of Vehicles users will increase to 2020.There are about 44.1 million households in 2016, with an average annual compound growth rate of 27.67%; the penetration rate of China's Internet of Vehicles will increase from 4.8% in 2016 to 18.1% in 2020. In the next two decades, the intelligent network will completely change the way people travel and subvert people's way of life. With the rapid development of automotive electronics, network, and information technology, intelligent networked vehicles Cars have become the general trend of automotive technology development, and intelligent networked vehicle technology will lead a new round of development of future automobiles. Since the development of the Internet of Vehicles industry in my country started relatively late compared to other European and American countries, there are problems such as the backwardness of cutting-edge core technologies related to automotive electronics and the lack of relevant technical talents.

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The development and maintenance of network technology products requires a large number of high-quality talents. According to estimates by authoritative departments, my country's current automotive intelligent technology talent gap is about 100,000 people per year. At present, my country's implementation of talent training in the direction of the Internet of Things and the Internet of Vehicles is basically 0, and there is a huge gap in the demand for Internet of Vehicles R&D and application talents.

2. Research Status at Home and Abroad

2.1. Current Status of Engineering Education Research Abroad

2.1.1. The OBE Education Model and the Washington Accord

Outcomes-based education (OBE) originated from the reform of the basic education model in the United States. It refers to an education model that is student-centered, oriented to learning outcomes, and that academic evaluation methods correspond to learning outcomes[1]. The biggest difference between OBE and CBE is that they emphasize different goals. The former focuses on the acquisition of learning outcomes, while the latter emphasizes the improvement of knowledge and skills. Outcome-oriented education pays attention to the achievement of target results in each process of education and teaching. specific work that can be done. The Washington Accord is an international agreement on the accreditation of undergraduate engineering professional education signed by civil engineering groups in six English-speaking countries including the United Kingdom and the United States[2]. The prerequisite for becoming a full member of the international mutual recognition agreement for undergraduate engineering degrees is that the OBE education model is adopted in the engineering education model of the country[3].

2.1.2. Research by the American Association for Accreditation of Engineering and Technology (ABET)

ABET's certification standards are divided into three parts: taking engineering majors as an example, they are divided into general standards for Basic Level Programs, which are applicable to undergraduate majors in all engineering fields. Common criteria for Advanced Level Programs, applicable to graduate majors in all fields of engineering[4].

2.1.3. Other Related Research Papers on Foreign Engineering Education

The development trend chart of engineering education in the United States clearly shows that engineering education in the United States has evolved from a development track that focuses on practice, combining practice and theory, focusing on science, and returning to both theory and practice. Correspondingly, American engineering education has evolved into three types of engineering. Educational Paradigms—Technical Paradigm, Scientific Paradigm, and Engineering Paradigm[5].

Competency-based Education (CBE) was first proposed by Professor McClelland of the United States. He believes that the quality of a student's employment after graduation, whether they perform well at work, and whether their career is successful or not are related to the student's core competencies, and the student's class attendance rate and academic performance cannot be a good predictor of the student. Sustainable development and successful employment in the future.

2.2. Status Quo of Internet of Things Engineering Majors in China

2.2.1. Research Monographs Related to the Internet of Things Engineering Professional Knowledge System and Curriculum Planning

(1) "Internet of Things Engineering Professional Knowledge System and Curriculum Planning in Ordinary Colleges and Universities"

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In August 2011, the book "Internet of Things Engineering Professional Knowledge System and Curriculum Planning in Ordinary Colleges and Universities" edited by Wang Zhiliang and Yan Jizheng and reviewed by Yao Jianquan was published by Xidian University Press[6]. This book is mainly for the Internet of Things engineering in colleges and universities. It is written according to the professional curriculum setting, and the content arrangement is based on professional discipline classification and knowledge content decomposition to form four levels of knowledge field, knowledge module, knowledge unit and knowledge point. Among them, the custom knowledge unit is closely combined with the university's own disciplinary advantages and industry characteristics, which reflects the great flexibility of the training of the Internet of Things engineering.

(2) "Guiding Opinions on Cultivating Applied Talents for Undergraduate Internet of Things Engineering Majors in Colleges and Universities"

In 2016, the Computer Science Teaching Steering Committee of the Ministry of Education issued the "Guiding Opinions on the Training of Applied Talents for Undergraduate Internet of Things Engineering in Colleges and Universities", and pointed out that 1. It is necessary to guide the transformation of the concept of talent training; 2. It is necessary to strengthen the standard meaning of talent training; 3. Strengthen the quality awareness of personnel training; 4. Pay attention to the things of international engineering education.

2.2.2. Related Research Papers on the Construction of Internet of Things Engineering

(1) Xu Xiaolong, Lu Weifeng, and Yang Geng put forward a set of IoT professional talent training strategies oriented by innovation and compound ability; the IoT specialty is divided into sensors and embedded systems, IoT transmission networks, There are four professional directions: IoT data management and information processing and IoT application and information services[7].

(2) Wang Qi, Liu Qingshan, Qian Chengshan, and Chen Weifeng believe that the curriculum system of the Internet of Things major mainly adopts the concept of through-course curriculum design, and optimizes the curriculum structure as a whole; strengthens the teaching of basic courses, and pays attention to the cultivation of students' basic quality; Innovate course teaching, improve the talent training system[8]; improve the practical teaching system, strengthen the cultivation of students' hands-on ability to promote teaching reform, cultivate engineering application-oriented Internet of Things talents, and achieve the training goal of engineering innovative talents[9].

3. Study Design

3.1. Objective, Content and Focus of the Research

3.1.1. Objectives of the Study

Through the research of this project, the existing problems in the existing training system are found, the effective ways of talent training for the Internet of Things engineering (direction of the Internet of Vehicles) are explored, and the planning of talent training according to the "employment-oriented, quality-focused, dual-subject" talent training model is studied and practiced. curriculum structure. To meet the needs of enterprises in the industry, integrate into the corporate culture, and cultivate talents in a more targeted manner. Improve the talent training plan, curriculum system, teacher mutual employment system, evaluation and assessment mechanism, etc. for the Internet of Things engineering major, complete the formulation of the core curriculum standards for the Internet of Things engineering major and the development of teaching resources, and conduct curriculum development and teaching design based on the complete work process. The dual-tutor system is represented by various forms of course learning modes.

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Adhere to the professional construction concept of "based on the industry, serve the industry, highlight features, and integrate development", focus on the development of information technology in the Internet of Vehicles industry, promote the integration of production and education, and drive the construction and development of professional groups. Form research results that can be used for reference, replication, and promotion in similar universities in China, and promote the research on the professional construction of the Internet of Things Engineering (Internet of Vehicles) in Fujian Province.

3.2. Research Ideas, Processes and Methods

3.2.1. Research Ideas And Process

Based on the analysis of the training rules of applied talents and the existing research and practice, this research adopts the method of combining theory and practice, and deep integration of school and enterprise. details as follows:

1. Focus on the integration of industry and education

Relying on the integration of production and education, a collaborative education and innovation system based on information integration and resource sharing between industries and universities can be established.

(1) Establish an information exchange and sharing mechanism between the Internet of Vehicles industry and universities.

(2) Build a dynamic adjustment and training target adaptation mechanism for professional settings based on the development needs of the Internet of Vehicles industry. Recruit industry and enterprise personnel, establish a professional setting review and consultation mechanism, conduct decision-making consultation on new professional setting, integration and transformation of existing majors, evaluate and evaluate the rationality and continuous improvement of training objectives, and realize professional setting and structural adjustment. The synchronization of industrial development and its structural adjustment can realize the connection between the training goals of professional talents and the needs of industrial talents, and avoid the disconnection between talent training and industry needs from the source.

(3) Establish a collaborative education system of deep cooperation between schools and enterprises. Recruit industry and enterprise personnel to participate in the preparation of professional personnel training programs, and jointly plan and design professional courses and practical teaching systems; make full use of the high-quality engineering education resources of enterprises, including technology and standards, products and solutions, engineering projects and cases, production and Service environment, engineering technology and management personnel, etc., carry out the co-construction of teaching resources, teaching platform, teaching environment and teaching staff; establish a training quality evaluation mechanism for talent training needs and output orientation, and industry and enterprise participation.

(4) Establish a technological innovation community that serves the development of the industry. Universities and enterprises complement each other's advantages and share resources. Through the joint construction of engineering innovation centers, technology research and development centers, and technology innovation research institutes, they will collaborate to carry out research on industrial and enterprise development strategies, connect to the frontiers of industrial development, and conduct applied basic research. The technological innovation and development of the bottleneck link, the industrial incubation of technological innovation, the establishment of fast and seamless achievement transformation channels and mechanisms, and the formation of a collaborative innovation platform for win-win development.

2. Guaranteed by the integration of disciplines

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Supporting the cultivation of talents in the Internet of Things engineering (the direction of the Internet of Vehicles) not only involves the cross-integration of different engineering disciplines, but also requires the cross-border integration of engineering and science, as well as the large-scale cross, cross-border and Facility. Disciplinary integration is the basic guarantee of the Internet of Things engineering major. Not only the cultivation of Internet of Things engineering professionals is inseparable from it, but also the innovation and entrepreneurial practice of teachers and students under the Internet of Things engineering professional system. It is also inseparable from its support. The integration of innovation and entrepreneurship, the lubricant and adhesive for the deep integration of production and education. Disciplinary integration must be guided by the needs of IoT engineering professionals, driven by the needs of technological innovation for new industries, and implement on-demand cross and dynamic integration.

3. Take the integration of science and education as a breakthrough

The integration of science and education is a breakthrough in the construction of the Internet of Things engineering major, and it is also a catalyst for the integration of production and education. The integration of science and education should include two levels of integration: one is the integration of scientific research and teachers' "teaching", and the other is the integration of scientific research and students' "learning" , the latter is based on the former.

Adhering to the policy of "combining training and introduction, and collaboration between on-campus and off-campus", teachers continuously update and improve their own knowledge, ability and quality in the process of providing services for the industrial innovation and development through continuous scientific research activities for the Internet of Vehicles industry. Realize the support for teaching and personnel training.

3.2.2. Methods of Research

(1) Document Law.

Collect and organize relevant documents and materials, read domestic and foreign papers, works and standards on cutting-edge technologies of the Internet of Vehicles, engineering professional certification, Internet of Things engineering professional construction, and Internet of Things engineering teaching reform research; Certification requirements and industry or enterprise qualifications, so as to understand and grasp the existing research results, research trends and the latest ideas.

(2) Questionnaire survey method.

In the early stage of the project, surveys and research methods such as questionnaires and interviews will be used to investigate the employment situation of enterprises in the Internet of Vehicles industry and the professional construction of each brother college. Clarify the knowledge and ability requirements of different positions, and clarify the impact of engineering practice on teaching reform.

(3) Expert consultation method.

According to research needs, experts from colleges and universities, enterprise engineers, and enterprise directors will be invited to participate in the discussion in a timely manner, and members of the research group will be selected to conduct research and study in enterprises or related industries. Through the method of "coming in and going out", we understand the market demand and employment norms, and study the way of engineering practice to lead the teaching reform, so as to formulate more targeted talent training programs.

(4) Comprehensive evaluation method.

Through pilot practice, verify the effect of the reform plan, talent training plan and curriculum system construction in improving the quality of actual talent training, and improve and improve it in a timely manner.

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3.2.3. Content of the Study

(1) The new concept of the construction of the Internet of Things engineering specialty, emphasizing the research on the connotation and extension of the engineering specialty

Research on connotation construction: train students to lay a solid foundation and ability-oriented. Research on the development and application capabilities of key technologies of the Internet of Vehicles, research on innovation and entrepreneurial awareness, competition and teamwork quality.

Epitaxy construction research: train students to cross-border integration and engineering orientation. Research on the application and development capabilities of the Internet of Vehicles, on the basis of hardware and software capability training, attaches great importance to the research on comprehensive capabilities at the system level.

(2) Research on the construction of innovative talent training model of "employment orientation, quality core, dual main body"

Career-oriented, design curriculum system. According to the job requirements of the Internet of Vehicles, the school and enterprise jointly formulate the talent training plan, determine the curriculum system according to the talent training plan, and jointly participate in the curriculum development and teaching implementation. Inferring ability needs from social needs, summarizing knowledge points from ability needs, summarizing the curriculum system from knowledge points, combining the requirements of professional knowledge system, general curriculum requirements, and basic requirements of arts and sciences, schools and enterprises jointly formulate relevant professional personnel training programs and professional teaching quality. standard.

With quality as the core and the orientation of adapting to the needs of occupational positions, a vocational ability training teaching mode aiming at "zero" distance employment is implemented. Through theoretical teaching, experimental teaching, course design, and post-job practice, the learning content, research and development skills, innovation and entrepreneurship awareness, professional quality, etc. are run through it. Grasp the quality of talent training.

Dual subject, full participation. The school determines professional teachers as mentors to guide students in theoretical study; the internship unit selects technical personnel as corporate mentors, responsible for teaching interns post skills. The teaching process takes the real project tasks of the enterprise as the carrier, selects the students to form the project team with the enterprise tutor as the main body, and the teachers and students participate in the project implementation together.

(3) Research on the new system of engineering practice

Research on the ability development of students to solve complex engineering problems. An outstanding performance of the ability to solve complex engineering problems is that when engineers are engaged in research, design, development, and evaluation, they can comprehensively consider other constraints and understand their responsibilities. This topic takes the application research and development of the Internet of Vehicles project as the starting point, and studies the process of students from mastering basic skills, possessing hands-on ability and practical ability, possessing innovation ability, and finally forming the ability to solve complex engineering problems, which is in line with the law of excellent results.

(4) Research on new methods of quality evaluation

Research the output-oriented ability evaluation standard, which can reflect the level-by-level cultivation of students' ability to solve complex engineering problems. The level of ability includes: memorization, understanding, application, analysis, synthesis, and evaluation.

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