

New Engineering Construction of Internet of Things With Prominent Safety Features ——Based on Computer Network Security

Juan Wang*, Luqiao Zhang, Liyun Ren and Yan Jiang

College of Cyberspace Security Chengdu University of Information Technology Chengdu, Sichuan, 610225

**Corresponding author. Email: wangjuan@cuit.edu.cn*

ABSTRACT

New industry 4.0 needs the cooperation of new engineering education to cultivate new talents with multiple core abilities. The Internet of things project is an important specialty of new engineering and the next 10 billion industry. However, its personnel training does not meet the requirements of the new engineering, and the homogenization is serious. In view of these problems, combining with the advantages and characteristics of the college, this major explores the Internet of things engineering curriculum system, talent training mode, school enterprise cooperation, industry university research cooperation mode, which meets the requirements of new engineering. Preliminary results have been achieved, the employment rate has increased steadily, and the students and employers are satisfied with the professional training.

Keywords: *Internet of things, New engineering, Curriculum system, Personnel training.*

1. INTRODUCTION

Internet of things (IoT) engineering major of Chengdu University of Information Technology is a new industry specialty approved to recruit students in 2010 according to the development needs of the Internet of things industry and integrating the advantages of Internet of things major. Since 2011, it has enrolled 9 grades and graduated for 5 years from 2011 to 2015. A total of 366 undergraduates majoring in Internet of things have been trained for the society. In 2011, the Internet of things major was awarded the title of strategic emerging industry in Sichuan Province.

After years of construction, this major has a relatively complete talent training program, curriculum system, professional teaching staff, practical conditions and student team. However, these are based on the traditional teaching system, and the whole course is still mainly taught by professors. The new engineering requires the cultivation of students' practicality, comprehensiveness and innovation [1]. There are some problems in the specific curriculum setting, curriculum implementation, in and out of class practice, innovation and entrepreneurship implementation, which need to be studied and reformed. Moreover, the Internet of things major is a sunrise industry. There are more than 500

colleges and universities offering Internet of things engineering specialty in China. Many schools' personnel trainings are homogenized, and even not differentiated from computer science, which is not conducive to students' employment [2]. The Internet of things major needs to highlight its own characteristics, so that students not only have the basic knowledge of the Internet of things, but also have the characteristics of employment technology different from other colleges and universities, and cultivate students' comprehensive quality and ability to meet the new engineering

2. PROFESSIONAL FEATURES: INTERNET OF THINGS ENGINEERING INTEGRATING INFORMATION SECURITY TECHNOLOGY

Cyberspace Security became a national first-class discipline in 2015 [3-4], only three- or four-years development term. Most of the technicians trained in Cyberspace Security in Colleges and universities are Internet security technicians. However, with the landing of 5G technology, it is foreseeable that the Internet extends to the Internet of things connected with everything in the next 5 years. More and more attention has been paid to the security of the Internet of things.

However, there are few schools and majors that train safety technicians in the field of Internet of things in China. As a subordinate specialty of Cyberspace Security College, this major is characterized by Internet of things security. It is the pioneer and explorer in this field, making up for the lack of industry and targeting the future demand of Internet of things security talents.

In the previous teaching research and practice, we successfully introduced the information security theory and technology into the computer network course, which improved students' security awareness and skills, and had a positive effect on students' employment. As an important course of Internet of things, it provides a good reference for the course system of Internet of things.

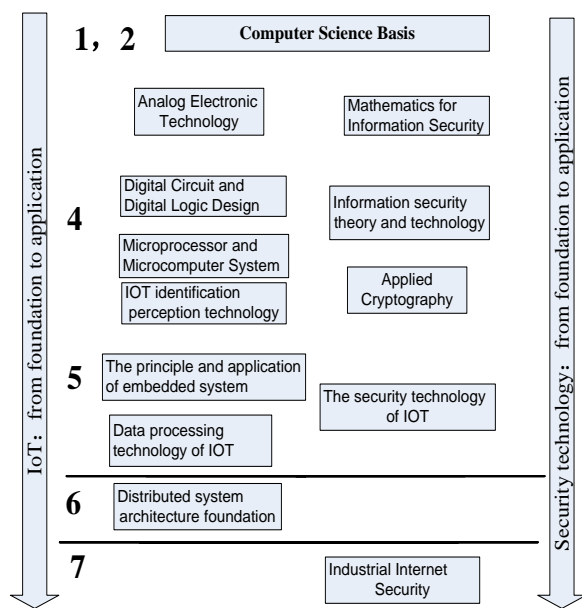


Figure 1 Course system of Internet of things engineering with security features

The Internet of things engineering course system with safety features is shown in Figure 1. The number represents the semester, and the course name is in the box. This major not only teaches Microelectronics technology, Embedded technology, Internet of things identification and perception technology, Distributed system, Industrial Internet of things and other Internet of things courses from basic to application [5]. In addition, it also provides the mathematical basis of information security, information security theory and technology and other information security basic theories, and extends the traditional Internet security to the security of the Internet of things area such as electronic labels and sensors, and finally applies to the field of Industrial Internet of things. This field is extremely important to the country, but there is a shortage of corresponding security technician [6]. In addition to the design, development and operation and maintenance of the Internet of things system, students also have the ability

to strengthen the security of the Internet of things system.

3. PROFESSIONAL TRAINING AND REFORM

On the basis of fully integrating the technology in the field of information security, this section explores measures to meet the requirements of new engineering comprehensive ability training from the aspects of talent training mode, industry university research cooperation, and innovation and practice ability training

3.1 Personnel Training Mode with Enterprise Demand as the Guidance, Students as the Centre, Scientific Research as the Carrier, and Industry-University-Research Cooperation

Under the guidance of engineering education professional certification standards [7], we should implement the construction of a student-centered, continuous improvement and output-oriented [8] talent training system. First of all, actively adapt to the national and regional economic and social development needs of Sichuan Province, combined with the school running orientation and direction, through extensive research on industry enterprises, similar colleges, graduates and alumni, reconstruct the talent training objectives.

Secondly, we have established the "Internet of things innovation laboratory" with relevant enterprises of the Internet of things. The enterprises invest to purchase the experimental equipment of the Internet of things, and jointly send instructors to attract outstanding students to join the innovation team, carry out pre research and development of frontier topics, and apply for large-scale innovation projects or participate in relevant competitions [9]. Enterprise engineers dispatched by enterprises introduce enterprise development management mode and experience, which is helpful to students' practical ability. And the school's tutors give full play to the advantages of scientific research, guide the innovation of the project and control the research direction. Through the combination of production, teaching and research, enterprise engineers, school teachers and students can fully communicate with each other in their daily study, and give immediate feedback on the professional curriculum setting, curriculum implementation effect, teacher guidance effect and training program implementation. According to the general standards in engineering education certification, combined with the suggestions of enterprises, the training scheme is periodically revised.

Since 2015, the professional teacher tutorial system has been implemented. After the students enter the school, they are provided with professional guidance teachers to guide their doubts, personal development

planning, professional knowledge and application prospects, the topic selection and implementation of engineering practice projects. Through the guidance of professional teachers, we can effectively improve the quality of students' training to meet the social needs, and improve the non-unemployment rate and professional awareness of professional graduates. On this basis, professional teachers encourage and guide students to participate in various discipline competitions and innovation and entrepreneurship projects, and cultivate students' scientific research ability and team spirit.

Finally, the enterprise deeply participates in the specialty construction, participates in the teaching outline formulation, the training plan optimization entire process, comprehensively deepens the school enterprise, the school local cooperation.

3.2 Improve the Internet of Things Engineering Curriculum System with Engineering Ability Training as the Core and in the Concept of "New Engineering"

Based on the concept of engineering education in colleges and universities and the training requirements of "new engineering", this paper reconstructs the structure system of the course group of Internet of things, carries out the integrated design of theory and practice course group, and systematically and organically cultivates students' engineering consciousness and engineering ability. The curriculum system of engineering ability and innovation consciousness combined with step-by-step curriculum platform and practice platform is shown in the figure below.

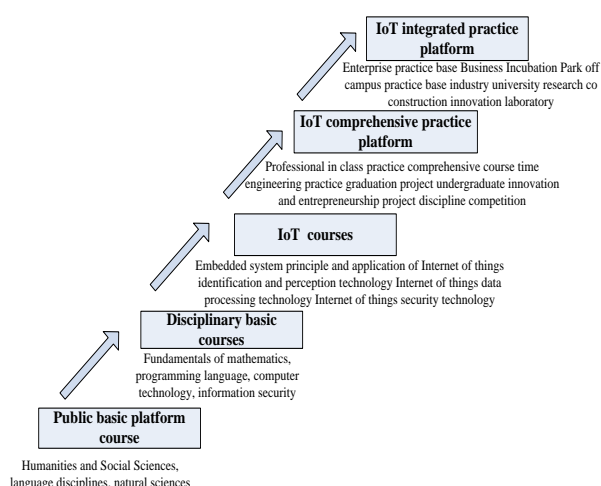


Figure 2 Step by step curriculum group

The course group is composed of public basic platform course, subject basic course and professional direction course. First of all, the humanities and social sciences and natural language disciplines should be used to provide students with the necessary humanities and

natural science quality, which is generally in the first year of university. Then teach students the basic knowledge of computer science, including: computer network, programming language, information security foundation, etc., to lay the foundation for further in-depth and detailed professional direction learning, which is generally in the second year of university. Finally, the third year of university has entered into the study of professional courses. The college and enterprises have jointly built a professional comprehensive practice platform, which comprehensively penetrates the whole curriculum system, and provides practical training at different stages, including experiments in the course and extracurricular competitions, innovation and entrepreneurship projects, etc. Finally, during the senior year, students will be sent to the comprehensive practice base of production, learning and research jointly built by schools, enterprises and research institutes for practical training of real projects.

Finally, it forms: basic theory → simulation design → engineering realization as the main line, realizing the incremental process from theory to practice, from design to implementation, from easy to complex, from book knowledge to practical operation. The practice of the project-oriented engineering practice teaching concept, so that students in this major in solid mathematical and embedded technology, through the "perception layer → transmission layer → application layer" module project and system project training, cultivate students' solid engineering practice and innovation ability.

3.3 Colleges and Enterprises Jointly Build Innovation Laboratory and Training base to Improve Students' Innovative and Practical Ability

In depth cooperation with industry companies, the introduction of enterprise mentors [10] and dispatched teachers to the enterprise for internship is carried out simultaneously. In the ordinary course practice, engineering practice, graduation practice and other processes, the enterprise tutor and the school tutor jointly guide and receive feedback; build innovation laboratory, practice training base and other practical teaching sharing platforms, so as to make students' innovation and entrepreneurship daily.

Vigorously promote the integration of science and education, realize the transformation of scientific research achievements into teaching resources, and help improve the quality of personnel training.

We will continue to promote the construction of college students' science and technology associations, encourage students to participate in teachers' scientific research and participate in various kinds of college

students' science and technology competitions. Make good use of the existing college students' innovation and entrepreneurship laboratory jointly run by the company to promote multi-party communication and achieve the goal of multi-party benign interaction. Finally, a set of collaborative mechanism with extracurricular scientific and technological activities as the carrier, interest as the traction and multi participation to improve the quality of talent training.

In terms of teaching conditions and experimental platform construction, an innovative practice training platform has been formed with the Internet of things Engineering Laboratory (basic technology practice of all links of the Internet of things), Innovation and Entrepreneurship Laboratory of the Internet of things (innovation ability practice with competitions and large-scale innovation projects as the carrier), and on campus / off campus practice base (the practice of complete engineering ability of Internet of things in cooperation with enterprises).

3.4 Taking Various Measures to Strengthen the Teacher's Team

First of all, we should do a good job in training young teachers; secondly, we should encourage teachers to go to first-class universities at home and abroad for further study, visiting or studying for doctoral degree, so as to improve their professional level. Finally, we should vigorously introduce high-level talents and teachers with engineering background. There is a team of teachers with reasonable title, age structure and rich experience in engineering practice, which provides strong support for personnel training.

In the past three years, three of them have obtained doctorate degree through on-the-job study, and successfully introduced one doctor degree teacher and three teachers with rich engineering experience. At present, there are more than 40% teachers with senior professional titles, and there are 14 "double qualification" teachers with rich engineering experience. In 2018, academician Zheng Jianhua, an expert in Internet of things, was successfully employed as the honorary president of the college.

4. CONCLUSION

Through the above measures, the practical ability of graduates of this major is obviously provided for the graduates also master information security and the employment scope and rate are also significantly improved. This specialty entrusts the third party to use the questionnaire survey. According to the survey of the graduates of 2019, the professional relevance of employment is 80.36%, teaching satisfaction is 96.43%, alumni recommendation is 100%, and the average

annual income is 77100. Students and employers are satisfied with the major.

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REFERENCES

- [1] Li Tuoyu Shi Jincheng. Review and Prospect of Emerging Engineering Education Based on "4W1H" Analytical Framework [J]. Research in Higher Education of Engineering, 2018, vol.171(04), pp.35-45.
- [2] Chen Ying-wen, Zhong Ping, Pang De-ming. Capability-oriented education for the Internet of Things engineering majors [J]. Computer Engineering & Science, 2018, vol.40(S1), pp.128-131.
- [3] Cui Guangyao, Feng Xuezhu. Vigorously promoting the first level discipline construction of Cyberspace Security -- an interview with Academician Shen Changxiang [J]. China Information Security, 2015, vol.011, pp.62-65.
- [4] Li Jianhua, Qiu Weidong, Meng Kui, et al. Thinking on connotation construction and talent cultivation of Cyberspace Security first level discipline [J]. Information security research, 2015, vol.001 (002), pp.149-154
- [5] Wang Juan, Zhang Luqiao. The course process and practical reform of introduction to Internet of things technology. The Guide of Science & Education, 2015, vol.11, pp.57-58.
- [6] Chen Zhixiang, ou binna, Tian Qianyi. Discussion on information security personnel training of industrial control system [J]. Computer education, 2019, vol.289 (01), pp.48-51
- [7] Zhang Wenxue, Wang SunYu, Li Wei. Research and suggestions on professional accreditation standards of Higher Engineering Education[J]. Higher engineering education research, 2006, vol.005, pp.22-26.
- [8] Shi Xiaoying, Lin Fei, Gong Xiaojun. Output Oriented Innovation Practice Curriculum Reform [J]. Journal of Hangzhou University of Electronic Science and technology: Social Science Edition, 2018, 014 (001): p.75-78.
- [9] Wang Juan, Zhang Luqiao, Li Fei, Wang Zuli, Jiang Yan. Student centered practical reform of Internet of things[C]. Sichuan Chengdu, 2016, pp.56-59

- [10] Huang Xiaoming, Wang feisheng, he Yuxiang.
Implementation and optimization of enterprise
tutor workstation under school enterprise
cooperation [J]. Southern Vocational Education
Journal, 2018, vol.8 (05), pp.68-73