# Curriculum System Optimization of Internet of Things Engineering Major Based on Engineering Education Accreditation

**Shuyan Zhang, Changming Li, Yong Zhang**

Changchun Guanghua University, Changchun, China

**Keywords:** Engineering education accreditation; Internet of things engineering; Curriculum system; Optimization strategy

**Abstract:** Although engineering education has a high evaluation of general ability and obvious traditional advantages, it is not enough to keep up with the needs of the times, cultivate engineering ability, and participate in the training of engineering talents. Engineering education lacks the initiative to adapt to industrial development and it is urgent to improve the awareness and ability of industrial development. The Internet of things engineering is expected to take the opportunity of engineering education accreditation, find its own problems by comparing the accreditation standards, and carry out in-depth reform of student-centered engineering education. Based on the authors' learning and practical experience, this study first analyzed the engineering education accreditation and the change of education teaching concept, and then put forward the optimization countermeasures for the curriculum system of Internet of things engineering under the background of engineering education accreditation. The research results of this study would offer some references for the professional education of the Internet of things.

## 1. Introduction

Accreditation is the formal recognition made by non-governmental and non-profit third-party organizations to educational institutions or professions that meet or exceed established educational quality standards. As an essential part of higher education accreditation, engineering education accreditation belongs to professional accreditation. It is a process in which academic experts in the field of engineering technology and technical experts in related industries are organized by professional accreditation institutions (associations) to evaluate, recognize and put forward improvement suggestions for the engineering education quality of relevant specialties in the field of engineering technology according to the requirements of professional qualifications of engineering and technical practitioners in the industry. In terms of nature, engineering education accreditation is a kind of qualification evaluation, not selection evaluation, which is the inspection of whether engineering education meets the required minimum standards. Therefore, the result of professional accreditation is binary, only pass and fail, and there is no difference in grade or level, which has nothing to do with professional ranking [1]. Passing the accreditation only means that the accreditation major meets the minimum quality requirements. The optimization of the curriculum system of the Internet of things engineering major of engineering education accreditation aims to rely on dominant disciplines, focus on major construction, pay attention to the objectives and requirements of the pilot project of engineering education accreditation, and achieve the goal of highlighting the professional characteristics, formulating effective policy measures and reform measures, and then cultivating students' ability to solve complex engineering problems [2].

## 2. Engineering Education Accreditation and the Change of Education and Teaching Concept

### 2.1. Establish a student-centered educational concept

Engineering education accreditation emphasizes student-centered, which is embodied in several aspects: major should have measures around students' enrollment, learning guidance, quality assurance, credit recognition and employment, etc.; training objectives are supposed to meet the

  DOI: 10.25236/eeaet.2020.063

needs of economic and social development, including requirements for students' graduation; course teaching contents should be selected and designed according to the requirements of students' graduation; the teaching staff and other supporting conditions are expected to be conducive to the training of students to achieve the desired goals; the core of accreditation lies in the performance of all students.

### 2.2. Emphasize the orientation of training objectives

Engineering education accreditation emphasizes the orientation of engineering talent training objectives, which is embodied in several aspects: the expression of professional training objectives and graduation requirements should be conducive to the evaluation of the realization degree of training objectives and better reflect the international substantial equivalent requirements; the satisfaction of students' graduation requirements should support the realization of professional training objectives; the accreditation major must prove through proof that every qualified graduate can be expected to meet the requirements of the training objectives; the professional training objectives and graduation requirements must guide the education and teaching activities in the whole process of talent cultivation, and be the code of conduct for each teacher who undertakes the teaching task; the evaluation of the realization degree of training objectives and graduation requirements must be decomposed into the whole process tracking and process evaluation of students' whole learning process.

### 2.3. Focus on educational output and actual results

Engineering education accreditation focuses on educational output and practical results. "Education output" refers to the ability of graduates (i.e., "graduation requirements", is the key to ensure the realization of training objectives, and is the concrete embodiment of the international substantial equivalence of engineering education accreditation). In engineering education accreditation, the recognition of education output is extremely strict. To accept the accreditation major, two questions must be answered in the way of "proof": what has been done to ensure that every qualified graduate meets the graduation requirements? How to evaluate that these practices have achieved the expected effect expressed in the graduation requirements?

### 2.4. Adhere to the common standards of all students

Engineering education accreditation adheres to the common standards of all students (i.e., all qualified graduates of the accreditation major should jointly meet the graduation requirements). The "all" here focuses on each student, not a small number of students or top students, so it is not allowed or accepted to use the iconic achievements of a small number of students as "proof" materials for professional accreditation [3]. Thus it can be seen that engineering education accreditation attaches importance to educational resources, including high-quality teacher resources, site equipment resources, book network resources and practice conditions, which can be actually used by all students.

### 2.5. Promote the continuous improvement of quality by incessant modification

Engineering education accreditation not only pays attention to the current situation of the accreditation major, but also emphasizes that the major must have an incessant modification mechanism to continuously improve the quality of education and teaching. The basic concept of incessant modification emphasized by engineering education accreditation mainly includes five aspects: first, the incessant modification should be regarded as the goal to establish a professional teaching management system; second, the normalization of teaching evaluation and assessment are expected to be taken as the basis of incessant modification; third, effective teaching quality monitoring and feedback mechanism should be taken as the necessity of incessant modification; fourth, each staff member is the subject of incessant modification and is responsible for it; fifth, the effect of the incessant modification is expected to be specifically reflected in the performance of students.

## 3. Optimization Countermeasures of Curriculum System of the Internet of Things Engineering Major under the Background of Engineering Education Certification

### 3.1. For the professional curriculum, integrate the course content and optimize the system structure

#### 3.1.1. Improve the practical teaching system and strengthen the cultivation of students' practical ability

According to the training objectives of application-oriented talents with good professional skills and proficient in design, it is essential to focus on training students to master electronic circuit application technology, information processing technology, RFID technology, network technology and computer technology. It is necessary to take the application of the Internet of things as the core training objective and strengthen the ability of system design and programming debugging, so that students can have the core competitiveness of the Internet of things engineering. Universities should adopt the "progressive project driven method" to design the practice link, which is based on the project guidance, from shallow to deep, from simple to complex, and progressive. It is crucial to use experimental assignments, comprehensive exercises, curriculum design, and application and development oriented graduation design to serve practical problems. In the process of "investigation, analysis, synthesis" and "practice, theory and practice", students can practice theoretical knowledge and improve their application ability. Besides, students can independently complete a practical development project of enterprises and institutions (including campus), and combine graduation practice with enterprise production and employment.

#### 3.1.2. The orientation of the Internet of things curriculum system

According to the talent demand of enterprises for the Internet of things, a large number of personnel are needed to produce, manufacture, maintain and use the Internet of things products. The construction of the curriculum system is expected to meet the existing teaching conditions and employment needs of enterprises, stimulate students' enthusiasm and initiative in learning, effectively improve students' application skills and enhance their employment competitiveness. In view of the above objectives, we proposed the following solutions. Based on the existing conditions and teaching level of the university, and according to the talent demand of the enterprise for the Internet of things, a large number of personnel who produce, manufacture, maintain and use the Internet of things products should be trained. In view of the market demand and the characteristics of independent colleges, we need to focus on how to make the curriculum system to strengthen the perception layer as a breakthrough, and focus on building sensor, embedded system, wireless transmission network and large-scale data processing theoretical system. In addition, we also need to consider how to enable students to master the knowledge and skills of the Internet of things to ensure the expertise and advantages of talents.

### 3.2. Construct the ability oriented professional talent training mode

The Internet of things involves many technologies such as perception, transmission, processing and application. The design, assembly, operation, management and maintenance of the Internet of things have different requirements. Therefore, the talents of the Internet of things need to have the knowledge of sensors and embedded systems, the knowledge of transmission network of the Internet of things, the knowledge of data management and information processing of the Internet of things, and the application and information service of the Internet of things. In the cultivation of students' core professional ability, universities should advocate the cultivation of differentiation and individuation, and lower the choice of career direction to individual students [4]. The main course of ability training should have a variety of curriculum forms and learning environments. It should make full use of students' extracurricular time, follow the students' own learning road map, and use various effective teaching and learning modes to promote the cultivation of students' real technical ability.

### 3.3. Construct the curriculum content system of deep integration of theory and practice suitable for the professional training objectives

Curriculum system is the specific implementation point of major construction and personnel training. Therefore, the construction of curriculum system must take the formation of students' professional ability, professional quality and engineering literacy as the starting point, take the construction of professional skills and ability as the main line, deeply study the curriculum system, integrate teaching content, and establish a curriculum content system which is deeply integrated with theory and practice and is suitable for the professional training objectives. First, the university should start from the competency model of industrial talents, decompose the content required by the competency model into a course, and distribute the course to the whole university learning time according to the undertaking relationship of knowledge system. Second, the combination of professional foundation, professional compulsory courses and elective courses should be set up, and the curriculum content system should be constructed. Through the training of course learning and practical ability, the professional skills and abilities of the Internet of things engineering will be gradually formed, and the talent training objectives of the major will also be realized.

## 4. Conclusions

The Internet of things engineering major is an emerging multi-disciplinary major with the same emphasis on theory and practice in the field of cutting-edge technology research. The development of the Internet of things technology is extremely rapid, and the quality and requirements of related talents are increasingly high. Under the new form of engineering education accreditation, it is crucial to follow the requirements of engineering education professional accreditation, vigorously reform the existing education model, train talents guided by the technical needs of the industry, and build engineering education major accreditation system oriented by industrial technology demand. Additionally, it is essential to establish a training mode to support the training objectives, build a training system that can be adjusted in time according to the industry dynamics, and strengthen the training. The teaching quality monitoring and service guarantee system enable graduates to effectively meet the needs of industry and social development and improve their employment competitiveness.

## Acknowledgements

Jilin Province higher education teaching reform research project support project——Research and Practice on the optimization of the curriculum system of Internet of things based on Engineering Education Certification.

## References

[1] Wang, J., Luan, Q., Ding, L., & Wang, Z. (2020, April). Research on the Development of Network Engineering Major Based on the Idea of Engineering Education Accreditation. In 2020 International Conference on Big Data and Informatization Education (ICBDIE) (pp. 255-258). IEEE.

[2] Hodgson, R. M., & Williams, B. R. (2007). Engineering education, accreditation and the Bologna Declaration: a New Zealand view. International Journal of Electrical Engineering Education, 44(2), 124-128.

[3] Mingjun, W., Zhen, Y., Wei, Z., Xishang, D., Xiaofei, Y., Chenggang, S., ... & Jinghai, H. (2012, October). A research on experimental system for Internet of things major and application project. In 2012 3rd International Conference on System Science, Engineering Design and Manufacturing Informatization (Vol. 1, pp. 261-263). IEEE.

[4] Raikar, M. M., Desai, P., Vijayalakshmi, M., & Narayankar, P. (2018, September). Upsurge of IoT (Internet of Things) in engineering education: A case study. In 2018 International Conference on Advances in Computing, Communications and Informatics (ICACCI) (pp. 191-197). IEEE.