

# Research on Training Mode for Majors of Internet of Things Application Technology in Higher Vocational Colleges

Yan Tan

Suzhou Polytechnic Institute of Agriculture, Suzhou 215008, China

187132946@qq.com

**Abstract.** As a new strategic industry in China, the Internet of Things has been widely used in many fields such as intelligent city, transportation, logistics, power grid, medical treatment, industry, agriculture and so on in recent years. The rapid development of the Internet of Things industry has put forward higher requirements for the quantity and quality of professionals. Taking job position as the orientation and the training of application type talents as the goal, this paper explores the training mode of application-type talents majoring in the applied technology of Internet of Things in higher vocational colleges in terms of the social demand for talents, training objectives, curriculum system and teaching system construction, and puts forward relevant methods and suggestions around the training of such talents.

**Keywords:** Application technology of Internet of Things; Talent training; Curriculum System; Working competence.

## 1. Introduction

The Internet of Things (IOT) is an important part of the new generation of information technology and a new growth point of national economic development. As a new strategic industry in China, since the development strategy was put forward in 2009, the IOT has been widely used in many fields such as intelligent city, transportation, logistics, power grid, medical treatment, industry, agriculture and so on. Its rapid development has made supply of the talents in the related industries fall short of demand. Although there are more than 1000 schools, including more than 200 higher vocational colleges, that have been established the major of the IOT in China at present, the quantity and quality of talent supply still cannot keep up with the development of the IOT industry. This has posed not only a big challenge to current higher education but one of the difficulties in the teaching reform of the specialty in China as well. Therefore, it is necessary to explore the training mode for the IOT majors, to formulate a scientific curriculum system and teaching system to ensure the realization of talent training objectives and specifications.

## 2. An Analysis of the Demand for IOT Talents

The IOT major is an interdisciplinary subject involving computer, communication technology, electronic technology, measurement and control technology, management and other professional knowledge. As a new strategic industry advocated by the State, IOT has attracted much attention from all walks of life. It is predicted that the scale of the IOT industry in China will exceed 1.5 trillion Yuan in 2020, and the demand for talents will exceed 200,000 in the next few years. In contrast to the booming industry, the graduates of the IOT major are less than 100,000 every year, and the talent gap is huge in the IOT industry. From the perspective of talent level, the most wanted are not top-notch talents, but application and service talents of the IOT. This demand is in line with the orientation for talent training of higher vocational colleges, i.e., focusing on application, service, innovation and other aspects [1]. The specialty of the IOT at higher vocational level is oriented for the application technology of the IOT.

Due to the pan-professional characteristics of the IOT, many higher vocational colleges are confronted with the following challenges in the process of professional training practice [2]. (1) The major of IOT application technology is so multi-disciplinary that it is difficult for the students to learn. It requires them both to learn many courses and to have a wide range of knowledge. (2) Some colleges lack research on industry enterprises before formulating talent training programs and have not

established a scientific curriculum system. The major of IOT in some colleges only adds some relevant courses on the basis of the original computer specialty, which leads to the confusion of the curriculum system. (3) Higher vocational college students have weak theoretical basis, relatively inadequate learning ability and low learning autonomy. (4) Most teachers of IOT are transformed from their original specialty through training and self-study. Although they have some theoretical basis, they lack practical experience in IOT. The above causes may result in a situation that the graduates of IOT trained by higher vocational colleges can neither be skilled enough to match the practical requirement nor be competent for the enterprise posts.

### 3. Objectives of IOT Talents Training

From the investigation of the industry and enterprises of IOT and according to the characteristics of IOT, the technology fields of IOT can be divided into three levels: perception, network and application, and different levels correspond to different occupational positions. After graduation, students majoring in IOT application technology can engage in IOT project design, application and implementation of IOT technology, integration of IOT project system, pre-sale technical support and after-sale technical service of IOT system, management and maintenance of IOT system, etc. This paper classifies all kinds of occupational posts into typical tasks, and refines the skill requirements of each task to determine the requirements of each post and working competence, as shown in Table 1.

Table 1. Post and Working Competency Requirements

Professional Post	Working Competency Requirements
IOT Engineering Technology Support	Able to install, wiring, debug and maintain the equipment of IOT, to analyze and deal with the common faults of the equipment of IOT, to supervise the progress of IOT project and to evaluate project quality.
IOT Product Marketing and Service	Skillful use of IOT related products, equipped with IOT product promotion and sales capabilities, to provide after-sales technical support for IOT products, having a good sense of service.
IOT Product Development	Equipped with capabilities of circuit design, embedded system development, program development, IOT product development and intelligent terminal development.
IOT Project Integration	Having abilities to design IOT project plan, to integrate IOT project system and to implement IOT project application.

### 4. IOT Curriculum System

The curriculum system should be based on the objectives of talent training and take these objectives as the ultimate goal. Scientific construction of the specialized curriculum system of IOT application major in higher vocational colleges plays an important role in improving the quality of education and teaching. Being employment-oriented, this paper takes professional competence training as the main line, adopts the “platform & post” model is to integrate the curriculum to design and to build the curriculum system according to the industry standards of IOT and the professional competence requirements of IOT application technology posts. Four kinds of courses are identified in the curriculum system. The platform course corresponds to the general platform course and the professional platform course, and the post course corresponds to the vocational ability course and the career development course. This mode is helpful to the higher vocational college students to start with the basic knowledge of IOT, to find the professional direction, to consolidate the foundation for the post, and to improve their practical and operational abilities.

(1) General platform courses. They are designed to cultivate students' ideological and moral quality, humanistic quality, professional quality and communication ability, including ideological and political education, English, computer application foundation, entrepreneurship and employment, mental health and so on.

(2) Professional platform courses. They are designed to teach students basic theories, technologies and application methods of IOT, so that they can have the basic application, installation, maintenance and career development ability of IOT. The courses included are listed in Table 2.

(3) Vocational competence courses. They are designed for the work the students are to do according to the career development plan. They are set on the basis of the knowledge and ability needed to complete the tasks of each post, which more professional than the previous course. The courses included are listed in Table 2.

(4) Career development courses. These courses are developed around the professional ability of IOT application major on the basis of vocational competence courses, including IOT planning and implementation, IOT practice development, post practice, graduation field work, etc.

**Table 2. Specialized Curriculum System**

Course Type		Course Title	
Professional Platform Courses		Computer Network Basics	
		C/JAVA Language Programming	
		Electrical Engineering and Electronics	
		An Introduction to IOT	
		Technology and Application of Single Chip Microcomputer	
Vocational Competence Courses	IOT Engineering Technology Support	Sensor Technology and Application	
		IOT Integrated Wiring	
		Application Technology of Wireless Sensor Networks	
		Application Technology of RFID	
	IOT Product Marketing Service	Website Development and Application	
		Marketing Management	
		Electronic Commerce	
	Research and Development of IOT Products	Development of IOT Application Software	
		ANDROID Mobile Development	
		Development of Embedded System	
	IOT Project Integration	IOT System Integration and Management	
		IOT Project Practice	
			Smart Home Applications

## **5. Teaching System Building**

Starting from course teaching, faculty building and practical training room construction, this paper designs a three-dimensional teaching system to provide guarantee for effective implementation of talent training mode of IOT application major in Higher Vocational colleges.

### **5.1 Course Teaching.**

Whether the goal of talent training can be achieved depends on whether the curriculum teaching system can be effectively implemented. In view that IOT major focuses on application and practice, the project-based teaching method can be used in the teaching of professional courses. Students' learning is a process of completing a project. The main basis of assessment is the quality and level of project completion [3]. Fully understanding the needs of enterprises for talents is helpful for the development of students' professional ability. Therefore, vocational colleges can introduce in some production projects from enterprises through cooperation between schools and enterprises combining with in-school training conditions so that in-school teachers and enterprise engineers can jointly design a series of teaching simulation projects. The skill points in each project should be guided by the actual working process and set according to the same or similar skill points in a single task.

## **5.2 Faculty Building.**

IOT is a new specialty. There is great insufficiency of skilled talents and professional teachers. The shortage of the teachers has become one of the factors restricting the development of IOT major in higher vocational colleges. In the aspect of teacher training, it is suggested to perfecting teacher training mechanism, which will enable the teachers to complete the transformation from original specialty to IOT specialty through improving teacher training and self-study after class. On the other hand, higher vocational colleges should actively promote the deep cooperation between schools and enterprises and establish cooperative relations with industry and enterprises. They should introduce out-of-school experts to teach part-time courses, to encourage cadre teachers to go deep into enterprises' social practice and to participate in the cooperative development of enterprise projects. Thus, a direct link can be established between the profession and the industry while the quality of personnel training will be improved through the establishment of a high-quality professional teaching staff.

## **5.3 Practical Training Room Construction.**

Practical training is an important link in the teaching system of higher vocational colleges. The development of high-skilled talents cannot be separated from good conditions of practice. Therefore, the construction of in-school practical training rooms is particularly important. As IOT is a new specialty, it is expensive for a higher vocational college to build a new IOT practical training room from the beginning. The college can use its existing training resources of computer specialty to carry out the training of common courses, which can effectively reduce the construction cost. The construction of the training room should meet the market demand. Purchasing modules with high application rate and project equipment that can reflect the application prospects of IOT will enable the students to gradually accumulate the most advanced IOT engineering application and development experience in the training process.

## **6. Summary**

Starting from the demand for IOT talents and the training objectives, the building of curriculum system and teaching system for IOT students, this paper has explored the training mode of IOT application technology major, and puts forward some methods and suggestions around IOT students' training. The rapid development of the IOT industry is both an opportunity and a challenge. Higher vocational colleges need to do further in-depth research to understand the needs of enterprises in the industry, and to adjust the personnel training mode with an orientation to post so as to cultivate skilled IOT talents in higher vocational colleges that meet the requirements of enterprises.

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