Construction of Robot Practical Basic Training Module in Engineering Training

I. INTRODUCTION

The development of robot technology was an important symbol and embodiment of the high-tech level and the degree of industrial automation in a country [1]. As a student of engineering colleges, it was necessary to grasp the latest trends of robot in time to meet the requirement of the future industry production and the robot technology development. With the gradual recognition of robot concept, many universities had offered the courses related to the robot and set up the robot specialty and even robotic colleges, which increased the attention to the robot undoubtedly and met the needs of relevant professionals in this field. However, there were also some problems.

The related textbooks were emerging with the establishment of robot theory courses. However, the corresponding problems were also gradually highlighted. At present, the course content of robot theory was updated slowly, which was difficult to meet the rapid development of robot technology, so that the students could only learn the most basic theoretical knowledge[2]. Sometimes it was more embarrassing for students to find their junior knowledge outdated after graduation. At the same time, the number of students majoring in robot was relatively small which was difficult to meet the increasing demand of related talents.

Many universities were also strengthening the construction of robot practice teaching while offering the theoretical courses. However, the existing robot practice teaching was less popular[3]. The robot project itself was particularly suitable for practical teaching, but it was subjected to objective factors such as experimental equipment, funds, venues, etc. Meanwhile, the development concepts of industrial training centers were different. Many robot practical courses were carried out in the form of elective courses or competition items[4]. These courses had many disadvantages, such as strong purpose, focus on results and small audience, which could not benefit more students[5].

With the rapid development of modern industry, the requirements for engineering practice ability were higher and higher. However, students learnt about concepts only from books without knowing the true value of these technologies[6]. Therefore, engineering training, as a compulsory practical teaching link, played an important role in cultivating the practical ability of engineers. The training center of Jilin university put forward a new scheme to construct a new system of modern engineering training. On the basis of original traditional engineering training projects, the proportion of advanced manufacturing technology training projects should be continuously strengthened[7]. With the advantages of its own practical teaching experience and site, the training center of Jilin university explored new teaching modules and established robot practical teaching modules in accordance with the development of the times[8-9].

II. THE CONSTRUCTION OF ROBOT TRAINING COURSE

The training center of Jilin university had been committed to the construction of engineering training courses under the background of large engineering to highlight practical functions. Taking the combination of school and enterprise as an opportunity, the construction of Robot training course was improved[10]. The students learning independently was guided through understanding, expanding contact filed and interest. And the students leaning actively was driven through problems.

A. The Construction Processing of Robot Training Center of Jilin University

In June 2014, the center began to cooperate with China Robot motion working committee and Shenzhen communications group to try to set up a robot training teaching courses in Jilin university engineering training center, which included Robot practice training into the academic credit system. As a compulsory course, the course was designed for all the students of engineering, near engineering, electrical science and so on to make the more students to contact and know the Robot.

Keywords—Robot practical training, Practical training module, Innovation and entrepreneurship
After more than three years of teaching experience, our center had carried out Robot training courses completely independently at the present stage. The teaching contents combined with Robot teaching in colleges and universities, the development ideas of practical training, and their own characteristics opened to the lower grade undergraduates based on the related items of industrial production and Robot competition.

B. Teaching Method

(1) Wide teaching coverage

Robot is an extremely comprehensive subject, and the engineers in the Robot industry may come from various specialties. Therefore, it is necessary to carry out general education on Robot for the students of various specialties at the lower undergraduate level in order to arouse students’ interest in the Robot industry and prepare for the next learning stage of senior students. Robot training course is open to all students in engineering training of class A, B and C to meet

(2) Group teaching

In order to train the students team sense and organization-coordination ability in learning Robot knowledge, Robot training courses are conducted in groups with 4 to 5 as one group. In practice, the students organize and divide labor by themselves to coordinate with each other to complete the requirements of the training project. Each group competes and the test result after class is based on the group scores. Each student course will be graded according to group score and ranking combined with individual performance, which could fully motivate the enthusiasm of the students.

The contents of daily examination are close to the real industrial production characteristics and Robot competition contents, so that the students can understand the working characteristics of industrial Robot and the process of industrial production. At the same time, they can experience the basic forms and contents of Robot competition in advance to provide a basis for the follow-up competition.

C. Teaching Content

The original intention of robot training is to let students understand the basic situation and trend of robot development in the world. So, it is necessary to introduce the basic history and present situation of Robot development to students before operation. Due to the rapid development of Robot field at present, teachers will add the latest progress to students in the course of teaching, which is difficult to achieve in the traditional theoretical curriculum.

Based on the basic teaching method of "playing in learning and doing in play", this paper aims at opening up practical training objectives, arousing students' imagination and increasing the proportion of students' actual operation, so that students are more interested in Robot training.

(1) Industrial Robot

The most widely used industrial robots in industrial production should be mechanical arms. In order to let the students know the working state of mechanical arms in industrial production in advance, the primary content of robot training courses is to let students operate simple mechanical arms to complete related action tasks. All the movements are designed and programmed by the students according to the mechanical arm characteristics. The teacher provides the students with the relevant props to enable the students to complete the given action. In the process of operation, the students not only understand the working characteristics of the mechanical arm, but also the composition and control mode of the mechanical arm. The simple mechanical arm is controlled by graphic programming, which is easy to learn, shortens the study period and avoids the problem of short course time.

(2) Obstacle avoidance robot platform

With the development of robot education, all kinds of robot competitions are in full swing. Obstacle avoidance robot belong to the traditional program of Robot competition. In the past, the students who participated in this kind of competition were selected among the senior students, and the coverage was relatively small, while more junior students did not understand the related contents of the Robot competition. Therefore, we introduce the obstacle avoidance Robot platform into the engineering training course to let more students understand and open up a new way for students' interest in the future. The operation of the students is carried out in the way of Robot competition, and it is necessary to debug the track-avoiding vehicle. The sensors, parameters and procedures of the track-seeking vehicle can be adjusted accordingly in order to achieve the best results and successful completion of the game.

(3) Underwater Robot

Underwater Robot is the latest course introduced in the course of Robot training. By means of experiential operation, the basic principle, technical characteristics and related application fields, underwater Robot is understood in the course. The Kenfish underwater Robot Innovation Suite, which is developed by Shenzhen Yuezhi and Peking University, can meet all the needs of students in learning and practice at the same time. It is also suitable for students to carry out after-class development and innovative competition.

(4) UAV

Unmanned aerial vehicle (UAV) is a hot robot project in recent years. The course adopts experiential teaching method to let students understand the basic working principle and operation method of UAV to stimulate students' interest in UAV and combine with the following UAV club to further promote UAV practical teaching depth, which pave the way for students to
participate in all kinds of competitions.

III. RESULTS

Robot training course has been widely praised by students since it was set up for four years. It is one of the most popular courses in engineering training series.

Through the development of robot training courses, more students can learn about robots through robot training courses, so that more students choose robot projects to participate in the innovative and entrepreneurial project plan of senior students, which effectively plays the role of inspiration and guidance to the students. At the same time, the students in engineering, near engineering and electrical are covered.

In the first Robot competition of Jilin University in 2017, the student team led by the teachers of the engineering training center won the second prize of the track avoidance Robot competition.

IV. PROSPECT

A. Basic Teaching Content Upgrading

2018 will be a year of rapid development for the Engineering training Center of Jilin University. Taking the completion of the new teaching building as an opportunity, the center will enrich the teaching content and formulate a cooperative teaching plan for robots in the "land, sea and air". New robots, such as underwater detection robot, unmanned aerial vehicle system and waterway system control system, which have been introduced, will enrich the practical connotation of robot training course. Combined with the truss Robot and industrial manipulator purchased in the next stage, the present teaching project of mechanical arm will be more abundant and closer to the actual production, and strive to achieve the full coverage of the basic teaching robot.

At the same time, the center has made great efforts to incorporate robot training into the open experiment project, so that the senior students will have a certain degree of robot innovation ability on the basis of mastering the basic principles of the robot, and then they will be interested in selecting. Outstanding students with potential will participate in University Robot Competition[11-12]. Robot training courses in the future will be open to all grades of students with full coverage.

B. Establishment of Robot Innovation and Entrepreneurial Platform

The Engineering training Center will build an innovative and entrepreneurial platform on the basis of robotics training courses and robot competitions[13], and provide all teachers and students with the resources for Robot-related mass entrepreneurship and innovation projects, such as venues, equipment, materials, etc. At the same time, the students will be guided by related teachers[14-15]

V. CONCLUSION

Robot practice teaching is a new practical teaching content which is gradually explored and established under the background of the rapid development of robot technology. The Engineering training center of Jilin University will continue to explore, innovate and set up a series of Robot training courses that meet the needs of discipline development and students' development.

REFERENCES