Embedded Comprehensive Training Teaching Reform Based on OBE

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Abstract: In order to effectively improve the students' ability of embedded engineering practice and technology. Based on the concept of OBE education, taking the student as the center and the engineering practice project as the carrier, a multi-level, progressive and innovative practice teaching system is constructed by introducing intelligent robot technology into the practice teaching of embedded system. The embedded comprehensive training teaching is divided into three levels: robot bottom design, upper design and comprehensive innovative design. The establishment of a systematic training teaching system, teaching content and implementation plan is conducive to the cultivation of students' engineering practice ability, comprehensive application ability and innovation ability. Practice has proved that the embedded comprehensive training teaching reform based on OBE has achieved good teaching results.

1. Introduction

OBE (Out-comes-based Education) education concept is widely used in the education process of engineering professionals. OBE education concept attaches importance to students' subjective initiative in the learning process, students' learning results and learning situation. Teaching result-oriented is the core of OBE teaching philosophy [1-2]. Engineering training course is the link between theoretical knowledge and practical application, and it is an important part of practical teaching [3]. For engineering students majoring in electronics and embedded technology, engineering training is a means to obtain engineering experience and an important way to cultivate students' practical ability, improve their comprehensive quality and develop innovative consciousness [4].

2. Problems Existing in Traditional Practice Teaching

The core idea of engineering education professional certification is student-centered, goal-oriented and continuous improvement.Practical teaching is an important link in the training of engineering innovative talents, and it is the most intuitive embodiment of the evaluation of the degree of achievement of output goals. The main problems in the current embedded comprehensive training teaching are as follows: (1) the lack of combination of curriculum design with engineering practice makes it difficult to realize comprehensive engineering practice training, resulting in

students' lack of engineering practice ability; (2) different courses are relatively independent and the whole practical teaching system is not systematic, which leads to the fragmentation of students' professional knowledge and students' lack of system-level training. (3) in the process of practical teaching, "teachers tell students to do", ignoring students' subjectivity and initiative. In view of the lack of combination of curriculum design with engineering practice, it is difficult to achieve comprehensive engineering practice training, resulting in students' lack of engineering practice ability.

3. Content Design of Embedded Comprehensive Training Course

Combined with the employment demand standard and professional training goal of enterprises and institutions, the teaching goal of embedded comprehensive training is determined, the teaching requirements are determined according to the teaching goal, and the knowledge system of embedded comprehensive training course is systematically constructed, driven and guided by project achievements. hierarchical, innovative design of practical teaching content and student-centered teaching implementation process. The design and development process of a complete "embedded project product" runs through the practice teaching all the time, which aims to improve students' systematic mastery of subject knowledge, the improvement of engineering practice training ability and the cultivation of innovative spirit, and after the students' work, conduct a survey of students and enterprises and employers, and constantly adjust and iteratively improve the teaching content of the training project according to the feedback of students and employers.

Robot technology involves many disciplines, such as computer, electronics, machinery and so on. Because it often needs to have mobile function, it has certain requirements on volume and power consumption, while embedded system is a special computer system with software and hardware tailored and centered on application, which has strict requirements on function, reliability, cost, volume, power consumption and so on. Therefore, the embedded platform is the main platform for the robot to achieve various functions, and the two are closely related. By introducing the robot development process into the embedded curriculum system and comprehensively designing and completing an engineering practice project, we can run through the knowledge content of the main courses of electronic information major and embedded specialty. avoid the relative independence between different courses and the lack of systematicness of the whole practical teaching system, students lack of system-level training, and systematically train students' engineering practical ability and comprehensive application ability.

Embedded comprehensive training is a very important practical course in the curriculum system of electronic information and embedded specialty. The core spirit of OBE is to cultivate students' ability and realize the transfer of educational activities from "teacher center" to "student center" by setting the expected output. The embedded comprehensive training takes the engineering practice project as the carrier, and constructs a multi-level, progressive and innovative practice teaching system by introducing intelligent robot technology into the practice teaching of embedded system. The embedded comprehensive practice teaching is divided into three levels: robot bottom design, upper design and comprehensive innovative design. The design idea is: according to the embedded development process, using embedded system knowledge, from system requirement analysis, hardware design, software design to system integration and debugging, complete a mobile and working intelligent robot including upper computer and lower computer. The upper computer adopts ARM Cortex-A9 core processor hardware platform and carries embedded Linux operating system. The lower computer uses STM32 single chip microcomputer as the main controller. It includes at least the following six functional parts: sensor data acquisition, switch control, user setting, display output, motor drive and wireless communication. The single-chip microcomputer of

the lower computer is designed for the bottom of the robot, which mainly includes motor drive, steering gear drive, sensor data acquisition, wireless communication and so on. In the aspect of hardware design, students design temperature acquisition, relay control, alarm, gas concentration collection, light intensity detection, robot mobile walking, manipulator handling, LCD display and power supply circuit. Draw circuit diagram and PCB layout, make PCB board, purchase components, welding and debugging circuit board, and complete the development of the underlying driver of the robot.

The upper computer is designed for the upper layer of the robot, including embedded Linux transplantation, serial communication, GUI design, Linux driver development and so on. The bottom design is highly integrated with the upper design, and after synthesis, the innovative high-level design is added to achieve the results of the intelligent working robot project. Through the multi-level and progressive practical training from the bottom design, the upper design to the high-order innovative design, it is beneficial to cultivate students' engineering technology practice and comprehensive application ability. it can also realize the cultivation of students' comprehensive engineering qualities such as engineering consciousness and innovation ability.

4. Practical Process of Embedded Comprehensive Training Teaching

In view of the fact that "teachers tell students to do" in traditional practical teaching, the subjectivity and initiative of students are ignored. According to the concept of OBE and the needs of applied universities for talent training, the process of teaching practice has changed as follows: from teaching to learning, from traditional teacher-centered to student-centered, teachers to guidance, guidance and guidance, and from traditional instillation classroom to dialogic and interactive classroom in line with the characteristics of the times. From imparting knowledge to cultivating ability, paying attention to the application of theory to practice and stimulating innovation ability.

In the process of practical training, each group of students (a group of 2-3 students) will go through several stages, such as "innovative project topic-requirement analysis-project scheme-software and hardware design-system integration-project report, achievement data archiving-inspection and evaluation". In the process of teaching, a variety of teaching methods such as presentation, discussion, cooperation, group discussion and case analysis are adopted to improve students' interest in learning, and a large number of engineering application cases are added to the courseware. Case-based teaching can sublimate boring theoretical knowledge. In the course of practical training, the members of each group communicate and cooperate with each other.

5. Effectiveness of Teaching Reform and Improvement of Students' Innovative Ability

Based on the educational concept of OBE, after two rounds of teaching practice, more than 90% of the students have designed and realized the innovative works of multi-functional mobile intelligent robot, and achieved certain teaching results. Students design and develop project products according to their interests and specialties, which greatly stimulate students' interest in learning and enthusiasm for innovation, and enhance students' practical ability. Some of the students' practical training works are shown in figure 1-figure 2. Figure 1 shows the hardware circuit PCB layout and the welded PCB physical board. Figure 2 shows the innovative achievements of practical training, in which the GUI interface of the upper computer on the left and the intelligent working robot designed and made on the right are shown. The practical works of the course are also displayed as excellent practical works and graduation design achievements.

The whole training process is student-centered, supplemented by teacher guidance, guidance and guidance, and uses team cooperation to complete the design, development and debugging of the

whole project product. In the process, students learn the methods of analyzing and solving problems, and cultivate their ability to solve practical engineering problems, comprehensive application and innovation.
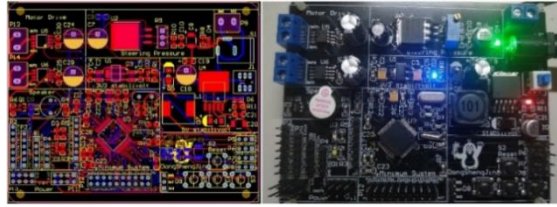
Fig.1 Circuit Pcb Layout and Pcb Board

Fig.2 Intelligent Operating Robot

6. Conclusion

From the perspective of the current practical training effect, based on the concept of OBE education, through systematic, hierarchical and progressive practical teaching, the comprehensive application ability and practical ability of students' knowledge can be cultivated and improved, and then lay a good foundation for innovative practical content, until students have the practical ability to solve problems and the ability to explore and innovate. Effectively stimulate students' interest in learning, the practice process is more student-centered, and improve students' comprehensive application ability and innovation ability.

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