Project Research Based on Electronic Engineering Innovation Practice

Ze Chen¹, Xiaolei Zhong²,*

¹Engineering Practice Innovation Center, Huazhong University of Science and Technology, Wuhan 430074, China
²Yunnan University Dianchi College, Kunming 650228, China

*Corresponding author: zhongxiaolei@hust.edu.cn

Abstract. In this paper, combined with the practical conditions of our university training center, puts forward the project, for traction, on the basis of the module, dominated by technology training, to cultivate students' engineering consciousness and innovation ability as the core of electronic engineering training teaching system, to adapt to the "double top" and innovation personnel training in our university. The teaching system and content, through one year's teaching practice, integrates the design of the project, the design and production of PCB, the testing of electronic components, the assembly and debugging, the writing and defense of the science and technology report, and the teaching effect is very significant and is well received by the students.

Keywords: Electronic project, Electronic engineering training, Curriculum system research, Teaching practice

1. Introduction
In the process of practice teaching, in a single type of work for a long time, single teaching process organization, between each type of work, the craft is isolated, lack of necessary connection link, unfavorable to the cultivation of students' engineering consciousness and comprehensive innovation ability.

In order to change the past training teaching model. Since 2016, our electronic technology teaching team has reformed the previous practical training teaching model. Combined with the practical conditions of our university training center, puts forward the project, for traction, on the basis of the module, dominated by technology training, training students' engineering consciousness and innovation ability as the core of electronic engineering practice teaching system. To meet the requirements of "double first-class" and innovative personnel training in our university. The teaching system and content through one year's teaching practice, the project design, PCB design and production, electronic components, testing, assembly and debugging, report writing and oral defense science and technology into an organic whole. The teaching effect is very remarkable, which comprehensively improves students' ability to analyze problems, solve problems and practice in engineering practice. This teaching mode is very popular among students.
2. Research on electronic engineering training course system based on project

Before developing the electronic engineering, practical training course system based on the project, we studied the main teaching mode and teaching content of electronic practice in the engineering training centers of several major universities in China. Based on the actual teaching situation of the engineering training center of our university, the theoretical system of electronic engineering training based on the project is studied. The main research contents include the research of the project content, the research of the project design tools, the research of the project design method, the research of the equipment and technology contained in the project, and the research of the project evaluation method.

2.1. Research on Project Content

On the design of the electrical engineering practice project, each type of work is not simply be strung together by the project, it is based on project practice teaching of electronic engineering, make the projects throughout the electronics engineering practice of the main type of work and technology, in the process of teaching, can maximize students' own initiative and creativity. Through several rounds of teaching practice, we have gradually explored the topic selection and design principles, design content and evaluation system that can adapt to the project practice of freshmen and sophomores.

In order to carry out project-based practical training teaching, we have prepared project-based comprehensive practical training materials. When selecting and designing project topics, students can refer to the textbooks we have compiled to carry out the design project. When we write a comprehensive practical teaching material mainly considering the electronic technology is developing very quickly, all sorts of new new new circuit device with each passing day, a new type of household electrical appliances, consumer electronics, computers, TV and modern appliances and in people's life, study and work are closely linked. If we want to reveal the secrets of these electronic products and understand their principles and designs, we must start from the foundation.

Since the students who come to the practical training center for internship are freshmen and sophomores. Their relevant basic knowledge has not been learned yet, so we must make the selection of textbook topics realistic and based on the basic knowledge of electronic technology. Because of the complexity of electronic products, they are made up of small electronic components and small circuits. As long as we are starting from the basic knowledge of electronic technology to learn, learning to use the basic electronic circuit design and production of small electronic works, and gradually learn more updated knowledge, master more advanced design techniques and tools, is more meaningful to do bigger and more complex electronic works, to the end, is qualified for the task of electronic design. Therefore, we have prepared a comprehensive practical training course according to the functional modules of electronic components and circuits. Students can choose from the teaching material input signal module (such as sound detection module, the light detection module, the infrared detection module, touch module, etc.), the control module, such as integrated circuit, functional circuit and single-chip microcomputer, etc.), output drive and execution module (such as display circuit, drive circuit), according to their own design requirements, design projects like building blocks.

2.2. Research on Project Design Tools and Applications

In terms of project design tools, we selected the use of Altium Designer development tools through research and comparison, mainly considering the cost performance and universality of design tools. Our teaching team has written a guide to the use of Altium Designer, which students can learn by themselves first. Then, guiding teacher Altium Designer the use of development tools, components symbol design and device packaging design, PCB design method and design principle, production method for generating file and components list. Teachers ask students to master the use and design process of development tools. Students according to the design project, construction project of the key components of schematic symbol and packaging symbol, understand the parameters of the components, specifications and models, to understand encapsulate a corresponding relationship with the physical.
2.3. Research on Project Design Methods
In terms of design methods and practical projects, we put forward the three-stage design principle. The first stage is the project preparation stage, in the first stage, the main design documentation writing, is needed to complete project design project, the key components of the document to consult and sorting, reading literature, library files related to project preparation; The second stage is the project design stage, which is also the most important stage. It mainly completes the schematic design and PCB design of the project. The third stage is the output stage of the project results, mainly producing the manufacturing documents and component list files to prepare for PCB manufacturing.

2.4. Research on Equipment and Technology
In order to promote the project of engineering practice teaching reform smoothly, at the end of 2017, with support from the university, the university more than 1.5-million-yuan investment, set up the PCB design and production practice room, the integrated innovation training room. The PCB design and production workshop consist of one PCB laser making equipment, 15 PCB machine making equipment, one ink printer, one character printer and 55 computers. From the original single PCB chemical production method, gradually expanded to the PCB laser production method and mechanical production method. The comprehensive innovation training room is equipped with 9 sets of common instruments and instruments, 10 sets of electronic tools, various development boards and storage cabinets of electronic components. According to the teaching practice of new equipment and current situation, we take the printed circuit board (PCB) design, PCB, SMT electronic SMT manufacturing process, process, welding detection technology as the research object, write the equipment used and the process procedure, gradually formed a set of course system based on modern electronic technology practice.

After the completion of circuit design, students are encouraged to design the appearance and appearance of products. Students can go to the 3D printing training center of our school's training center for 3D modeling and 3D printing products.

3. Electronic engineering training course system based on project
The Project management system software is implemented under the Android system, and the overall structure basically conforms to the MVC mode. MVC is a design pattern that enforces the separation of application input, processing, and output. The MVC application is divided into three core components: model (M), view (V), controller (C). The application under Android can adopt hierarchical and modular structure design, which is divided into presentation layer, control layer, business layer and data processing. The overall software architecture is shown in the figure below.

![Figure 1 Overall layout of the project management system software](image-url)
4. Implementation of electronic engineering training and teaching based on project

4.1. Preparatory Stage
First of all, the project group, a group of three responsible for a project. After the group is completed, the instructor tells all the students about the basic electronic technology knowledge, functional integrated circuit, unit circuit and relevant debugging methods related to the comprehensive practical training program.

When students choose training programs, the instructors should give specific theoretical guidance. According to the basic conditions of each group, they should give key guidance, so that students should not blindly do it.

Before the design project, students must have the basic knowledge of relevant groundwork, prepare to let the students learn more knowledge of their project to use the basic knowledge of and module circuit, especially the important function of module must make clear the basic principle.

4.2. Project design
After reading the relevant basic knowledge, the student guides the teacher to guide the student to carry out the project function design, and completes the project circuit design with the relevant module knowledge. After the design is completed, the tutor will review the feasibility of the circuit and give guidance on the use of components and PCB board design. Finally, the student will design and complete the schematic diagram of the project.

4.3. PCB design
The schematic diagram is the basis and basis for all subsequent designs. After the completion of the schematic design, students are required to refer to the literature for the key devices used in the schematic diagram and be familiar with their performance indicators and appearance characteristics. Before the design, students are reminded to pay attention to the use of the component library and the packaging library, especially the pins, shapes and other components that are consistent with the actual use. In the process of schematic drawing and PCB design, the tutor mainly guides students' PCB design at this stage, so that students can design the PCB that can be manufactured.

4.4. PCB production
After finishing the PCB board design, students enter the PCB production process. Students are required to be familiar with the whole process of PCB production and the use of equipment. Only by being familiar with the manufacturing process of the equipment can a practical PCB circuit board meet the project requirements. At this stage, the PCB production training room will be on duty by the instructor in turn and open by appointment.

4.5. Project installation and commissioning
After the student makes the PCB board, the component list file is generated according to the designed PCB. Students go to the training room with the list file to get the components.

After receiving the components, the students first measure the performance parameters of the components. Then, the qualified components are installed on the PCB board, and finally the performance indicators of functional modules are measured and tested.

After the above tests are completed, the project is coordinated to complete all the functions of the project. The performance indicators and functions of the work shall be checked and accepted by the instructor. Finally, the student team will write the training report, make PPT and record video, etc.

4.6. Reply
After the completion of the whole project, the three nature classes will conduct the defense together, and the instructor will organize the defense. The score of the defense team will be evaluated by the students themselves. The following is part of the project design of 2017 grade students in the
university of computer science.

Figure. 2 Remote data acquisition and control system

Figure. 3 GPS navigation system based on Android

Figure. 4 Data acquisition system based on uC/OS
5. Summary
The practical training course of electronic engineering based on the project will be prepared from 2016, and the practical training teaching of electronic engineering will be carried out in the way of gradual pilot and gradual roll-out. In 2018, 12 classes of grade 2017 in the university of computer science were piloted, and many group projects were more difficult and creative than we expected, and all of them could successfully complete the design tasks. Such as "Remote data acquisition and control system", "GPS navigation system based on Android", "Data acquisition system based on uC/OS" and so on. Through the practice of project-based practical teaching of electronic engineering, we find that it is more effective to release students' potential by giving them certain pressure. This course for the students' ability and comprehensive quality to cultivate the students' experience is "the production process, we not only do the PCB design and production finished successfully, and we also learned a lot about circuit. The most important thing is that we in the production process to exercise his mind, learned to meditation, and exercise their toughness, constantly challenge to face setbacks, constantly looking for a suitable solution, finally succeeded." Now, our electronic technology teaching team continues to explore, opened up a new way of thinking for the engineering practice teaching in our university and the new content, the implementation of the project type teaching is successful, will drive the whole engineering training teaching reform.

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