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Case Design of Electromechanical Control Technology Course Practical Teaching for the Ability Training of Solving Complex Engineering Problems[1]

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Abstract: Cultivating students' ability to solve complex engineering problems is the basic requirement of engineering education professional certification. Focusing on the problem of how to cultivate the innovative ability of intelligent manufacturing engineering and similar professional talents, a practical teaching case of electromechanical control technology course suitable for cultivating students' ability to solve complex engineering problems is designed. This paper describes the project background, design objectives, project organization and implementation, and project design scheme. From the perspective of actual teaching effect, the teaching cases designed to cultivate students' ability to solve complex problems can not only deepen students' understanding and mastery of single-chip technology, but also improve students' ability to design, debug and develop systems.

Keywords: Practical teaching; Complex engineering problems; Teaching reform; Electromechanical control Technology

The Washington Agreement advocates the education concept of student-centered, output-oriented and continuous improvement. In June 2016, China officially became a member of the Washington Accord, and the professional certification of engineering education rapidly expanded in China. However, among the 12 standards of engineering certification education, 8 are related to the cultivation of the ability to solve complex engineering problems. Therefore, the cultivation of students' ability to solve complex engineering problems is the most core issue in the graduation requirements of intelligent manufacturing specialty, while practical teaching is the most effective teaching method to improve students' ability. This paper takes complex engineering problems as the starting point, carries out the reform of the practical teaching course of electromechanical control technology, designs teaching cases based on actual engineering projects, strengthens the support of the course for graduation requirements, and trains students into application-oriented talents with engineering awareness, engineering practice ability and team cooperation ability.

1. Necessity of teaching design reform of electromechanical control technology practice course under the background of engineering certification

Electromechanical control technology course is an important core course of intelligent manufacturing engineering specialty. The course aims to improve students' practical ability, system comprehensive design ability, engineering application ability and ability to solve complex engineering problems. In the process of implementation, this course is based on the electromechanical control technology, combined with the actual complex engineering problems, and finally solves the more complex design and implementation problems of the single-chip microcomputer system. Through the practice of this course, students will have a deeper understanding of practical problems. This course pays more attention to improving students' ability to solve problems, develop software and hardware applications, cultivate students' rigorous and realistic scientific research attitude, and

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lay a solid foundation for their future engineering applications and scientific research.

According to the requirements of professional certification of engineering education, elaborately designing teaching cases with practical engineering background is an important way to construct courses combining the characteristics of complex engineering problems. At present, there are several problems in the traditional course construction and teaching process.

(1) The disjunction between theory and application results in students' lack of ability to solve practical problems.

(2) The course content design stays at the cognitive level and has little relevance to the characteristics of complex engineering problems, which is difficult to cultivate students' ability.

(3) Students' practical ability, systematic analysis ability and autonomous learning ability have not been well developed in the practical courses. The ability of knowledge association is poor, and the learned knowledge cannot be comprehensively used to solve practical engineering problems.

(4) The single assessment method of the course is not enough to effectively reflect the evaluation of the degree of achievement of the course objectives and the ability to focus on solving complex engineering problems.

Therefore, it is particularly necessary to carry out reasonable teaching design reform and design teaching cases with complex engineering background to support engineering professional certification and train students' ability.

2. Design and implementation of practical teaching cases

2.1 Design of practical teaching cases

PLC is a digital operation electronic device specially designed for application in industrial environment. It can be programmed with a simple ladder diagram. It uses a programmable memory to store instructions for performing logic operations, sequential operations, timing, counting and arithmetic operations, and can control various types of machinery or production processes through digital or analog inputs and outputs. The system structure block diagram is shown in Figure 1.

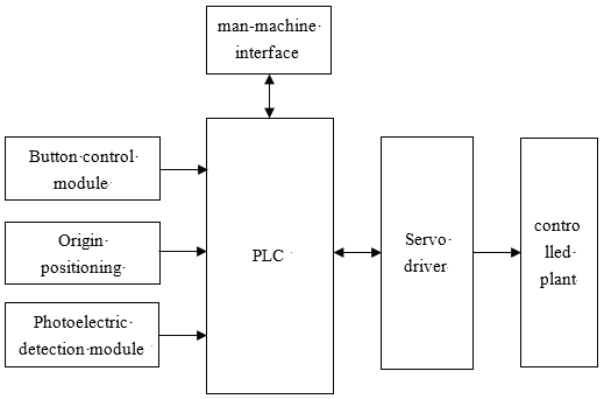

Figure 1 System structure block diagram

After the system selection is completed, the system hardware design, including the main circuit design, I/O distribution table, etc. Redundancy in the design has more scalable functions that can play a powerful role in the automation system. Three-loop control system is adopted for motion servo control, which is followed by current loop, speed loop and position loop from inside to outside.

2.2 I/O distribution table of paper cutter control system

In this system, only 15 input points and 5 output points are used. The output points are not directly contacted with the motor drive circuit according to the electrical wiring requirements, but indirectly controlled by using AC contactor. The I/O distribution table of the paper cutter control system is shown in Table 1.

Table 1 I/O distribution table of paper cutter control system

INPUT	OUTPUT
Inching	M101. 5
to zero	M101. 6
location	M101. 7
synchronization	M101. 8

DI is the control panel on the right side of HMI, and DQ is the output point. Each point is directly connected to the extension terminal strip on the controller, and shielded wire is used to transmit signals.

3. System software design

In terms of software design, the more advanced Siemens Botu programming software is adopted, which has a very good processing scheme for dynamic data distribution. The system software is designed from the main program flow chart and program ladder diagram of the paper cutter control system.

3.1 Design of main program flow chart of paper cutter control system

The main program flow chart of the paper cutter control system is shown in Figure 2.

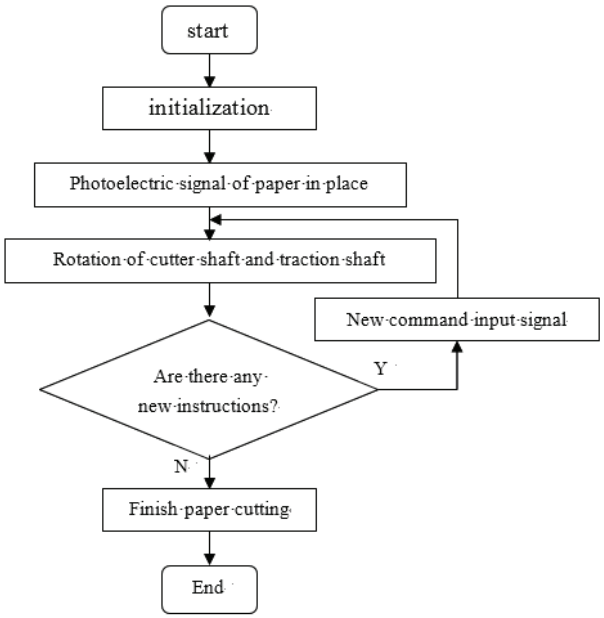

Figure 2 Flow chart

3.2 Ladder diagram design of paper cutter control system

The equipment presses the start button, the servo motor is enabled, and waits for the corresponding control signal of PLC. When the photoelectric detection module detects the arrival of paper, the cutter shaft and the traction shaft start to work. Data processing is mainly aimed at converting the input paper length and production speed into speed signals through data to control the working speed of traction shaft and cutter shaft. The ladder diagram of button control module program is shown in Figure 3.

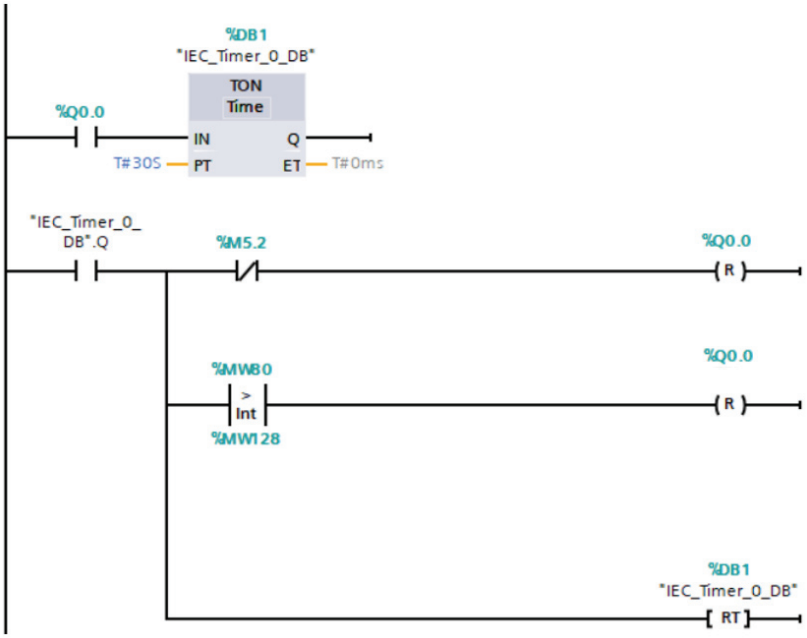

Figure 3 Ladder diagram

4. Implementation effect

From the perspective of implementation effect, the single chip computer class conducted through this case With the implementation of the design, students' practical ability has been improved Liter.

5. Conclusions

Cultivating students' ability to solve complex problems is the major of engineering education One of the core tasks of certification is not only professional engineering certification Need is the key to improve students' ability and quality.

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