

Application of PLC in the Teaching of Industrial Configuration Control Technology

Songzhe Pan, Lusiming Wang, Xiao Xing and Shimeng Wu

Wenzhou Polytechnic, Zhejiang, 325200, China

Abstract

Industrial configuration software solves the problem of universality of industrial control system by using its flexible configuration mode. At present, colleges and universities have carried out relevant courses, but the teaching effect is not ideal due to the influence of traditional teaching and equipment. Introduce PLC control technology, apply PLC technology to the teaching of industrial configuration control technology, let students master the comprehensive application method of configuration control and PLC control, enhance students' interest, improve teaching effect, and let students truly master the R & D and application ability of configuration control technology.

Keywords

Industrial configuration control; Industrial control; PLC; Course teaching.

1. Introduction

Industrial configuration software is a special software for data acquisition and process control. Configuration software uses its flexible configuration mode to provide users with good user development interface and simple use method. In the future, the integration and intelligence of sensors, data acquisition devices and controllers will be higher and higher [1, 2]. The existence of configuration software solves the problem of universality of industrial control system. Mastering configuration software can avoid the software and hardware problems of complex industrial system, concentrate on solving the engineering problem itself, and according to the needs and characteristics of industrial control, In the case of cost saving, it can realize high-performance, high reliability and high professional industrial control and monitoring. Therefore, the courses used in industrial configuration control teaching have been paid attention to by the majors of intelligent control, electromechanical and automation in vocational colleges, and have become compulsory courses for these majors [3, 4]. As a teaching course of configuration control, industrial configuration control technology provides systematic configuration control teaching for students engaged in intelligent control, automatic control and other industries, so as to enable students to master the application of configuration software in engineering design [5].

Industrial configuration control technology is an important part of industrial control, but the actual teaching effect is not ideal [6, 7]. After graduation, it is difficult for students to directly apply configuration software to engineering design. The reasons are as follows:

1) Reference books have a lot of theoretical knowledge and lax teaching content. At present, most of the reference books for learning industrial configuration software start from the aspects of configuration software management, variable definition, script writing, animation design, etc., and cooperate with the expansion of control contents such as curve, report and alarm. The teaching content has no focus, and there is no targeted learning for industrial application. Students' learning only stays at the surface of teaching, and the teaching effect is poor.

2) The traditional teaching mode can not stimulate students' interest in learning. The course of industrial configuration control technology is based on configuration software, which is highly comprehensive and abstract. A large part of the course is still studied in the classroom. Teachers explain the course with PPT, and students complete the interface design of the software according to the teaching content. Because of the use of virtual simulation design, students feel abstract and boring, difficult to understand and obscure, which leads to many students' weariness, so the teaching effect of the course is poor.

3) Teaching is separated from practical engineering application. As we all know, industrial control system includes upper computer control system and lower computer control system. The upper computer control system includes configuration, PC, etc., and the lower computer control system includes PLC, single chip microcomputer, industrial computer, etc. Only the combination of upper computer and lower computer is the way to solve industrial control.

Therefore, aiming at the problems existing in the teaching of industrial configuration control technology, this paper studies the teaching mode of the combination of PLC and configuration software. Apply PLC technology to the teaching of industrial configuration control technology, develop and complete the comprehensive training equipment of PLC and configuration software, so that students can master the project development ability of cooperation between upper computer system and lower computer system in industrial control. At the same time, through the combination of virtual and real, that is, the phenomenon analysis and observation of simulation design and PLC training equipment implementation by using configuration software, Help students better understand the comprehensive use of configuration software, PLC and electrical components and other related knowledge, enhance students' interest and improve teaching effect, enable students to "learn by doing and learn by doing", and enable students to truly master the R & D and application ability of configuration control technology.

2. Research Content

This topic mainly studies the application of PLC in the teaching of industrial configuration control technology. Its research content includes the following aspects:

1) Teaching course construction of PLC and configuration software. The course research includes PLC training and configuration software training. In the configuration training part, the subject takes MCGS configuration software as the teaching software object, designs different simulation interfaces and compiles relevant auxiliary scripts to complete the teaching and learning of configuration software. PLC adopts the current mainstream brand. The subject takes Mitsubishi FX series PLC as the lower computer control object, and constructs appropriate teaching courses by selecting appropriate PLC training equipment.

2) Teaching content design. Combined with the talent training scheme of intelligent control technology specialty and local industrial characteristics, select the appropriate PLC training module, and let students master the industrial control method from the project practice through the simulation design of configuration software and the cooperation of PLC training module. At the same time, by observing the real controlled object, the control results of configuration program and PLC program are displayed vividly and intuitively, which not only arouse their curiosity, but also improve their learning enthusiasm, realize the purpose of training practical ability, and help students deeply understand the integrity of industrial control and learn the principle of control circuit.

3. Research Program

This subject relies on the project for teaching, takes MCGS as the upper computer control system, Mitsubishi PLC as the lower computer control core, takes the improvement of

professional quality and ability as the teaching goal, takes the talent training scheme and regional industrial demand as the guidance, and formulates the appropriate course content.

The first step is to start with the simulation engineering project, make students clear the teaching objectives and requirements of MCGS industrial configuration software, avoid the blindness of general software teaching, stimulate students' interest in learning, make students truly master the use methods and skills of industrial control configuration software, and lay a good foundation for the development of factual engineering projects.

The second step is to create a "Scene" close to the engineering practice through the training link and the independently developed training system, so that students can master the communication method between the lower computer and the control object in the background industrial control configuration software and the control system, as well as the connection method between the lower computer and the controlled object, so as to cultivate students' practical ability and engineering consciousness.

The third step is to further cultivate students' practical engineering development and system integration ability through scheme design, equipment selection, engineering development, operation commissioning, analysis and problem-solving, so as to realize the connection between school education and engineering practice.

In the teaching process, we will also evaluate, reflect and summarize the teaching effects of students' basic knowledge and comprehensive application ability by means of survey and questionnaire. The whole program research process fully reflects the characteristics of "clear objectives", "step-by-step implementation", "combined with practice" and the teaching concept of "learning for application", so as to develop courses that are more in line with the training program of professional talents and the needs of regional industrial talents.

4. Project Teaching Plan Design

The configuration of the electronic control directly affects the slitting efficiency and the slitting quality of the slitter. This paper proposes the electronic control system of a three-motor slitter that uses Mitsubishi PLC and MCGS as controlling core. Moreover, introducing the tension control、Calculation of the winding diameter and the transmission control of the electronic control system respectively.This high-speed slitting electronic control system has wide applicability and high slitting efficiency, cooperating with the excellent tension control algorithm, which is generalized and marketable.

Based on the project-based teaching plan design, including the task arrangement of teachers and students before, during and after class, the mixed teaching mode of "students as the main body and teachers as the leading" is applied to the curriculum. According to the characteristics of students' unclear learning objectives and unclear project contents, a new teaching plan design is proposed to clarify the learning objectives, Fully mobilize students' learning initiative and enthusiasm. The teaching plan design is shown in Figure 1.

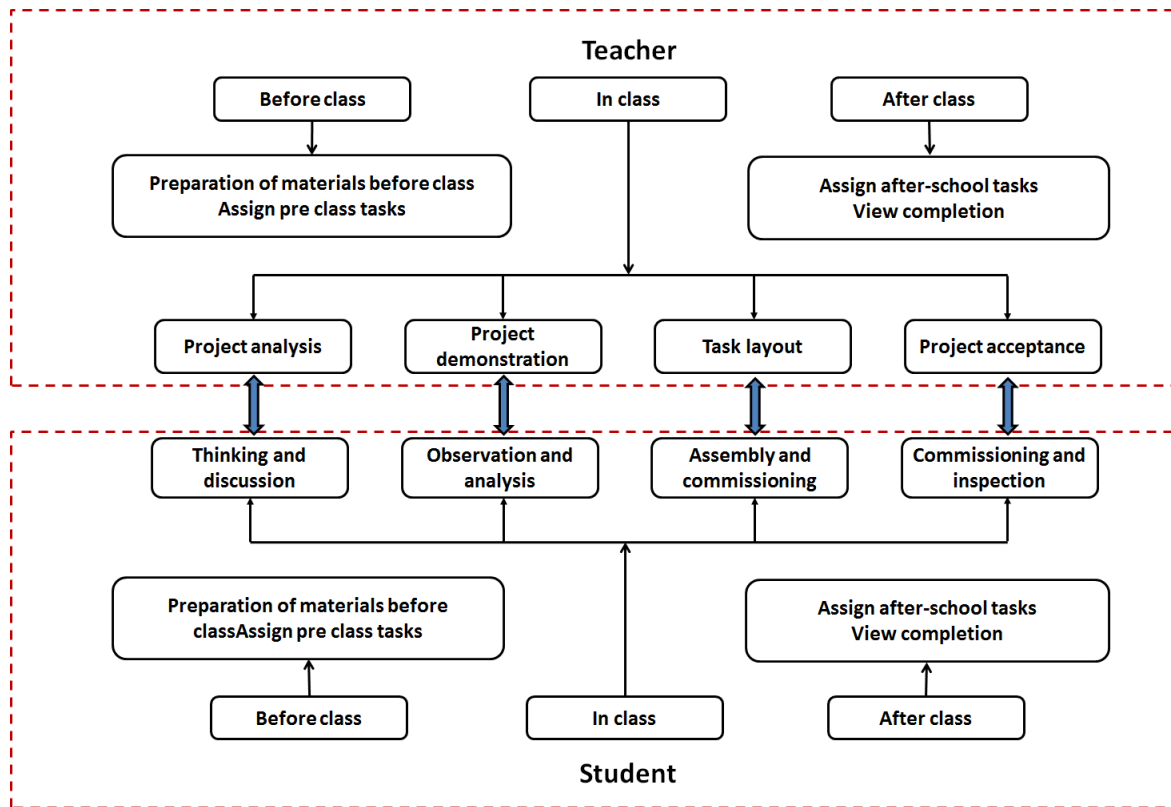


Figure 1. Teaching plan design process

5. Task based Teaching

If you follow the “checklist” your paper will conform to the requirements of the publisher and facilitate a problem-free publication process.

The course takes the task driven teaching method as the main line. By analyzing the working principle of the project, the circuit area is divided into power module, PLC module, control box module and touch screen module. Students complete the design of simple circuit schematic diagram through AutoCAD electrical software, and complete the circuit assembly according to the circuit schematic diagram. After the circuit installation is completed, the PLC control system and industrial configuration control system are compiled, and the project is completed through the whole machine system commissioning. The main teaching line is shown in Figure 2.

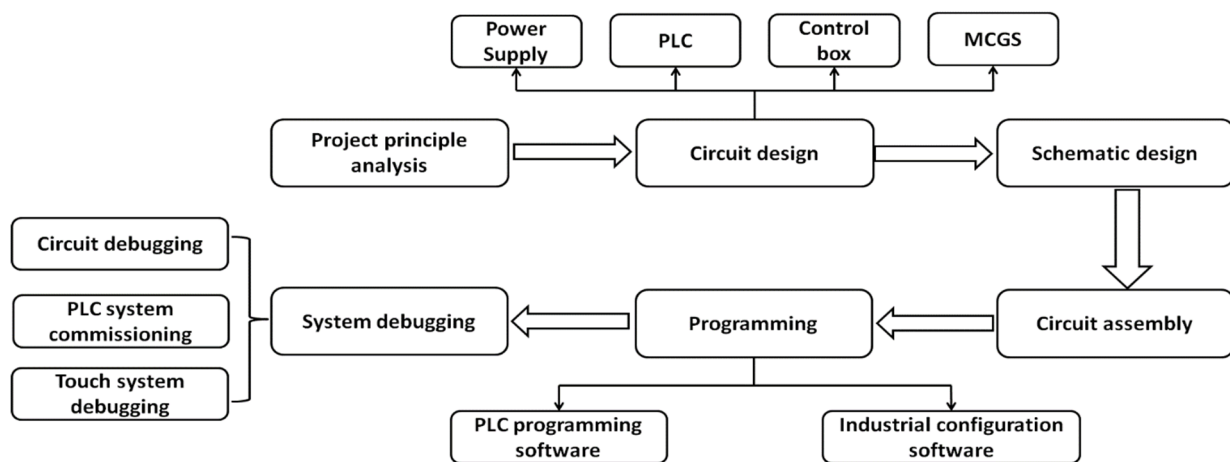


Figure 2. Teaching line

6. Task Based Teaching

Taking the project application as the evaluation teaching evaluation standard, it is evaluated from four dimensions: the standardization of schematic design, the safety of circuit installation, the logic of PLC control and the practicability of industrial configuration. On the basis of traditional teacher evaluation, students' mutual evaluation is added, so that students can find mistakes, point out problems and solve problems in the process of commenting on others' projects. The teaching evaluation process is shown in Figure 3.

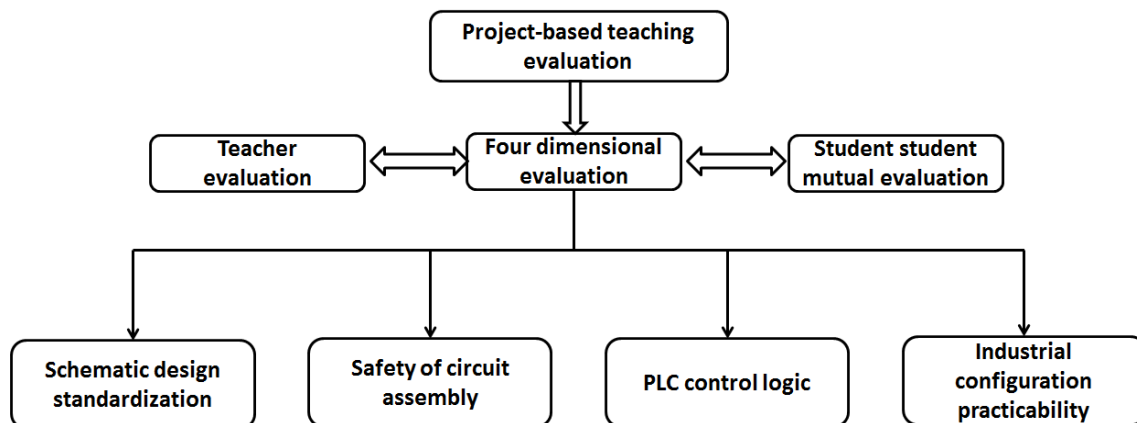


Figure 3. Project-based teaching evaluation

7. Conclusion

Higher vocational professional teachers need to teach according to the characteristics of students in order to gain better teaching results. Apply PLC technology to the teaching of industrial configuration control technology, so that students can master the comprehensive application method of configuration control and PLC control, optimize the teaching design content from the perspective of practical projects, combined with "post, course, competition and certificate", fully mobilize students' enthusiasm, initiative and initiative, let students get out of virtual simulation and collect practical projects, Complete the development process of the whole project system.

Acknowledgments

Research project on school teaching construction and teaching reform of Wenzhou Polytechnic (No. WZYYB202113).

References

- [1] Song Ke, Luo Jie, Zheng Zhijun Research and Exploration on the design of music fountain control system based on PLC and MCGS [J] Automation and instrumentation, 2021,36 (11): 21-26 DOI:10.19557/j.cnki.1001-9944.2021.11.005.
- [2] Jin Lei, Xue Shaoye PLC virtual monitoring system platform based on MCGS [J] Electric drive automation, 2021,43 (03): 33-36.
- [3] Li Wurong Application of MCGS Configuration Technology in PLC training teaching in secondary vocational school [J] Electronic world, 2021 (03): 23-24 DOI:10.19353/j.cnki.dzsj.2021.03.010
- [4] Wu Qi, Yang Tian Application of PLC technology in industrial control configuration software course [J] Hebei agricultural machinery, 2021 (02): 84-85 DOI:10.15989/j.cnki.hbnjzss.2021.02.047.

- [5] Zhao Xinhua Application Research of PLC practical teaching monitoring system based on MCGS [J] Journal of Chuzhou University, 2018,20 (02): 128-130.
- [6] Sun Shiyun, Yang Qingzhi Application of MCGS configuration control technology in PLC Project Teaching [J] Journal of Liaoning University of science and technology, 2017,19 (05): 43-45.
- [7] Wang Dalei, Tang Yonggang, Wang Caiyin, Huang Fei Research on MCGS configuration software course teaching based on innovation and Entrepreneurship Project [J] Yinshan Journal (NATURAL SCIENCE EDITION), 2017,31 (04): 132-134 DOI:10.13388/j.cnki.ysajs.20170628.014.