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Instructional Design of Automatic Fire Alarm System

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Abstract

Introduced teaching exploration of some chapters of building automation courses from teaching ideas, teaching content and teaching methods. A series of practical engineering problems is used as clues in the course to guide students to learn knowledge in related fields and improve their ability to solve practical engineering problems by deep interlocking teaching cycle.

Keywords: building automation, firefighting, teaching, course construction

1. Introduction

Fire is the greatest catastrophe of buildings except for some irresistible natural disasters such as earthquakes, floods and the electrical fire incidence has accounted for a large proportion of the total incidence of fire.

"Building automation" and "Intelligent Building" course are opened in three specialties: automation, electronic information engineering, building environment and equipment engineering in author's university, wherein one of the focus and difficulties of teaching is "automatic fire alarm system" (Hereinafter referred to as fire-fighting system). We can say that this part has direct impact on the teaching quality of this course.

Students of above majors have different electrical knowledge and engineering backgrounds after graduation are not the same, so one of the difficulties of this course is how to Individualize, how to combine the knowledge of control theory, information processing and construction equipment together organically, make full description of the fire protection system in a limited class and highlight key issues facing the actual project.

The author wrote a book named "Building Automation" (The book has been selected for the colleges and universities in Jiangsu Province key textbook) which used practical engineering problems as the main line, and with the target of cultivating students' ability of engineering practice as teaching basis. In this paper, the chapter of fire protection system in the book is taken as an example to introduce experience in teaching practice from three aspects: teaching ideas, teaching content and teaching methods.

2. Teaching ideas

Fire-system related knowledge transfer is one of the aims of this course. Fire system involves control, information processing, construction equipment and many other subjects. According to the traditional teaching ideas (basics first, then apply the knowledge, final engineering practice), starting from the abstract theory, then introducing knowledge of related fields in turn, it is difficult to learn deeply in related fields in short time by this method and it will easily detach from the real problems; or directly describes the application knowledge and special technical of various related fields, but this can not

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highlight common ideas of solving the problem, also it is difficult for students to digest, when facing practical engineering problems, students are still unable to start. When students go to work and contact practical engineering problems, they may face obsolete technology. Thus, with respect to the transfer of knowledge, training the ability of students to solve practical engineering problems is more important.

So how to arrange the teaching content in order to achieve the target of improving the ability of students in the process of imparting knowledge?

In accordance with the law of recognizing things and revealing the nature, fire prevention system teaching can organize teaching content with a series of specific practical project case as clues. A variety of typical fire accidents and current common practical problems are selected as engineering cases, in order from the simple local to system integration, from shallow to deep. Learning process of this part is to solve process of exploration of a series of practical engineering problems: in order to solve engineering problems, students need to understand the difficulties and restrictions of actual engineering need to learn the knowledge in the relevant field, so to acquire knowledge of information processing, automatic control and other related fields. Since the settlement is a practical engineering problem, students will understand the relevant fire protection products market, and exercise practical ability. More important, The progress of learning this course is a training for students to solve practical engineering problems, Allow students to experience all aspects and all kinds of difficulties and problems to solve practical engineering problems, and exercise the ability of students to solve practical problems.

3. Teaching content

Starting from the above idea, fire prevention system teaching should take people-oriented, protection of life and property as a concept, take effectively protection of the system operational stability, reliability and implement effective regulation and reliable control of fire safety facilities of building as principle, take the promotion of new fire protection technologies, new product promotion, application, effectively guide the engineering practice as ideas.

Fig 1. shows the whole system, this chapter describes the choice of the form of fire protection system, dividing alarm zones and detection zone, control to start &. stop an auto-matlc equipment, choice of fire detectors, setting of fire protection system equipment, electrical fire monitoring system etc. However, the above three professional have different emphases, which show as follows:

For automation specialty, on the basis of describing the system, the key is to explain the linkage control functions of the system(Fig.2 shows the linkage control block diagram), and require students to combine knowledge already learned of automatic control, computer control, fieldbus, PLC programmable logic controller to comb logic of each module and put forward reasonable control strategy. To make students to understand the basic structure and basic problems of the automatic control system and contacting relevant hardware, learn the basic principles controllers, sensors and actuators by simple engineering problems.

For electronic information engineering specialty, while describing the basic knowledge of fire protection system, work principle of fire detector is still the key point (Categories is shown in Fig.3). Students are required to analyze the working mechanism of the fire detector(For example, to start with detecting smoke and flame shape image probe), develop new sensor technology and research on new fire signal processing algorithms by combining the knowledge of electronic technology, digital signal processing, digital image processing, computer network. To make students understand application background of detector and work objects by a number of objects.

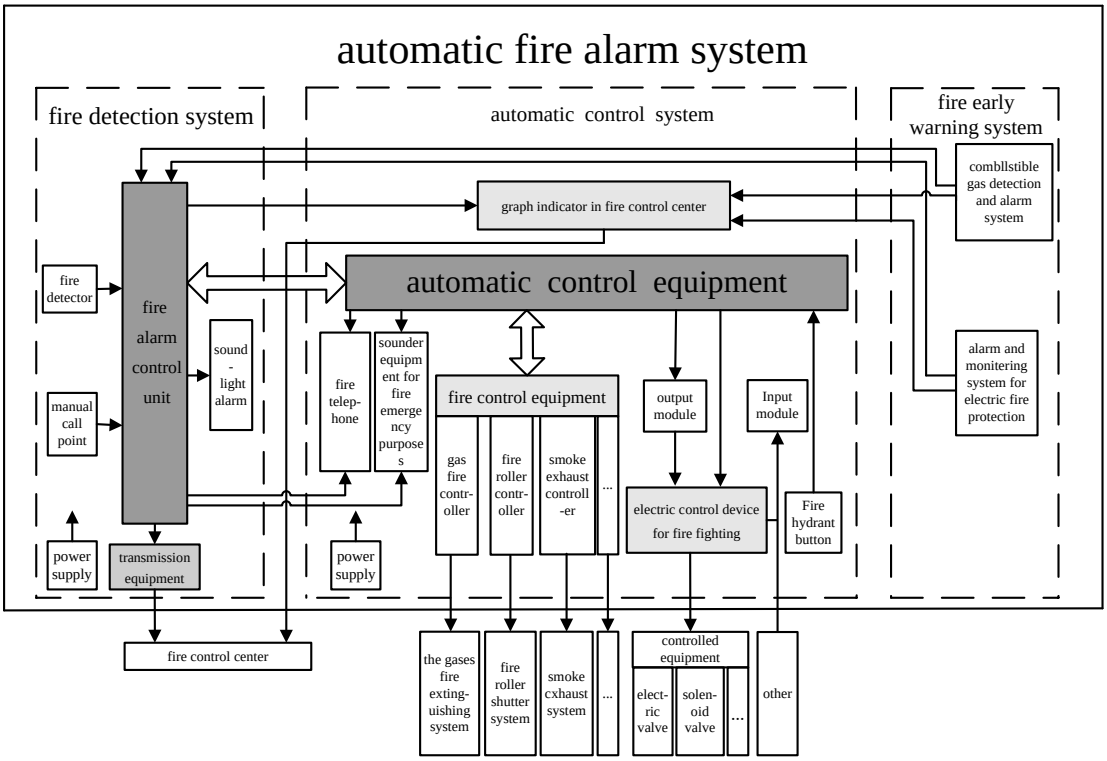

Fig.1 Composition of automatic fire alarm system

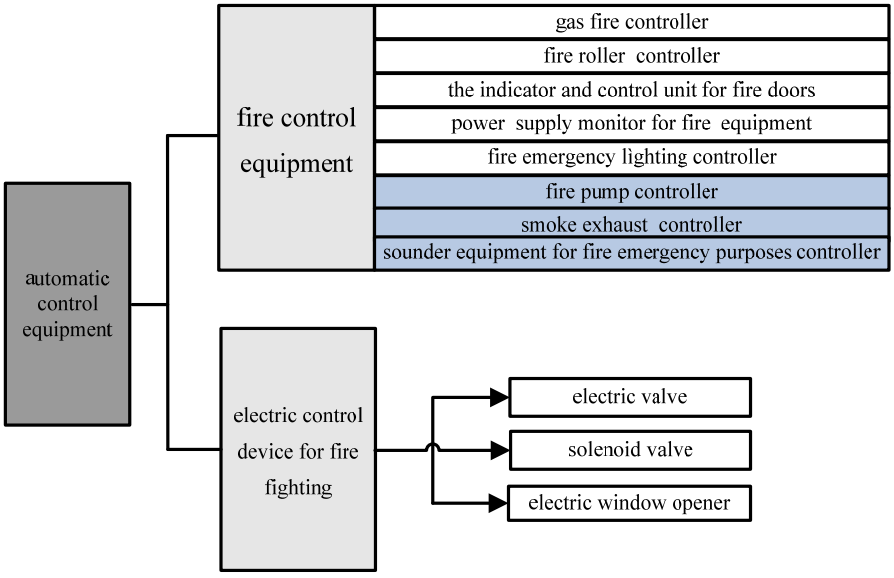

Fig.2 Fire linkage control block diagram

While for the building environment and equipment engineering specialty, as relatively little electrical knowledge is learned, after they finished learning the knowledge of fire protection system, students are required to discuss how to connect with electrical specialty on the system by combining the knowledge of plumbing and air conditioning.

By introducing and discussing the overall architecture of fire protection system, students can fully understand the function, requirements, design methods and common form of system, so that they can

form a preliminary understanding of the whole picture of the fire protection system. Through an actual system design, installation and commissioning, students will be competent with basic engineering task.

There is different emphasis in this teaching method, which helps guide students to get used to practical engineering problems, gradually deepened understanding of fire protection systems and master the key question and related knowledge of fire control system.

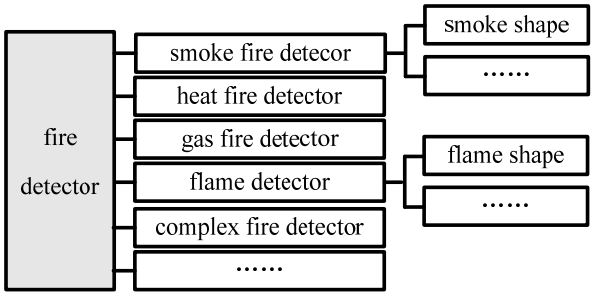

Fig.3 Fire detection classification

4. Teaching methods

Practice makes perfect. Teaching content should use actual project case as clues, each practical engineering problems involved in teaching is designed with appropriate engineering practice. Students are required to examine all possible operating conditions, get real solutions applied to actual engineering. To various engineering problems, teaching is carried out as following steps "lecture→practice engineering problems→discussing in class".

1) In class, after a brief introduction to the required basic knowledge to solve similar problems of typical engineering, author combines actual engineering case to illustrate common and difficulties of such engineering problems, and on the basis of only describing some common scenarios to point out other related research field, encourages and guides students to study in their interesting direction in-depth, arouses interest of students in engineering problems, lays the foundation for later teaching.

2) After class, students should complete system hardware of engineering problems corresponding with content in class. Students form a group and form a complete solution in a limited time by discussion, exchanges between groups, consult the relevant literature in the field of knowledge, etc.

3) Discussion class is the platform for students and teachers to communicate about the program. During class discussion, each group introduces their own programs, experience and knowledge in turn, and compare with other groups, question each other, confirm each other. While listening to the student reporting, teacher timely corrects misunderstanding of principle questions of students, adds and corrects research achievements in related fields mentioned by students, give supplementary answer to common problem of students, make a summary of the common of similar engineering problems on the basis of students have a deep perceptual understanding of engineering problems.

Take electronic information major for an example; require students to make a fire alarm circuit (Fig. 4) on the basis of mastering sensors, actuators, controllers and other electronic circuit hardware to process information. Due to the clue of case, students will be more easily to understand the relevant technology, and generate interest. Instructor should extracurricular guide students who are interested, and guide them make related circuit in hand. These measures deepen students understanding of feasibility and limitations of the measurement and adjustment in the actual project so that to design a feasible project plan.

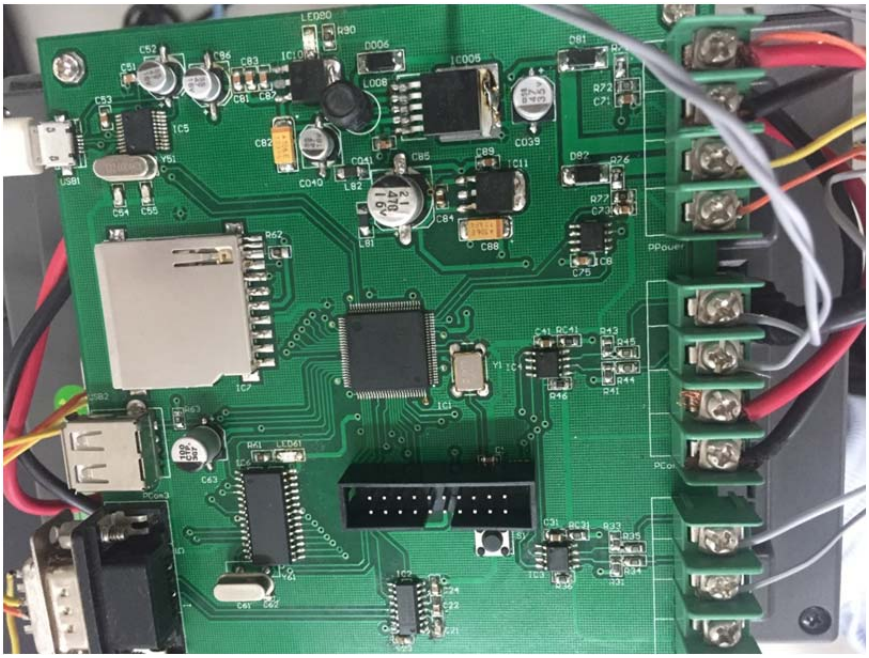

Fig.4 System Circuit diagram

In above mode, lectures completed half of teaching work, "Practice → discuss" is a very important part of teaching, which not only to expand the knowledge taught in class, but also to exercise the ability of students. Students complete their work by team, which exercise their teamwork ability and class discussion exercises expression and their ability to communicate with people. More importantly, this process simulates the situation when facing the actual project, from the analyzing the problem to proposing solutions, and then reporting all aspects which are recognized to Party A. Through several engineering exercise, students can be familiar, induction and mastering design method of fire protection system, which lays the foundation for solving practical engineering problems in future.

5. Epilogue

This article describes the exploration of author of "Building Automation" course teaching. Author thinks for different professional, "building automation" teaching should be based on engineering case and aims at training the ability of students to solve engineering problems.

Improve the quality of teaching is an important way to improve our institutions of higher to train engineering talents. With the development of computer technology, information technology, teaching methods of "Building Automation" courses have continued to emerge. I hope this article can play a valuable role in promoting the study of engineering course.

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