Research and Practice of Course Design on Microcomputer Principle and Interface Technology

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Abstract

It is urgent to strengthen student’s ability of practice and innovation according to demand for talent and development of computer education. Course design on microcomputer principle and interface technology can reinforce student comprehension for computer system through some design instances, and promote student’s practice ability and innovation ability. This paper introduces design objective, design demand and design scheme of course design on microcomputer principle and interface technology, some design topics are given, which can help students grasp general knowledge and strengthen manipulative ability. The practice shows that this course design has flexible ways and positive effect on training student’s ability of system design and practice.

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1. Introduction

Microcomputer principle and interface technology is a base hardware course with stronger comprehension and practice in computer education [1]. The content of this course includes microcomputer principle, assemble language and interface technology, and it is difficult for student to mastery and apply these knowledge. In order to deepen student’s comprehension and strengthen student’s ability of practice and innovation according to demand for talent and development of computer education, course design of

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microcomputer principle and interface technology is set. The course design examines whether or not students have mastery basic theory of microcomputer principle and interface technology and trains their practical abilities. Through a series of design and development, students can strength the comprehension on microcomputer system, instruction system, assemble language and interface technology, and learn design methods, then they can obtain the ability of analyzing problem, solving problem, and innovation.

In the literature, some researches have discussed course design of microcomputer principle and interface technology. Zamov [2] introduces course design for a computer-aided instruction system using assembler language macro tools. Chen [3] emphasizes student-centered pedagogy in computer technology application course design. In [4] a microcomputer-dependent statistics and design course is given, author proposed student understanding of the logic of the material and its application is enhanced through this design course. In [5] the exploration of course design of parallel computing in information and computer science specialty is introduced. In URL [6], which is the link of MIT free online course, faculty advisers emphasize the course design is helpful for studying of principles of computer system.

The organization of the paper is as follows. In section 2, design objective, design demand is given. In section 3, design scheme is introduced, which includes time arrangement, organization mode, design tasks and examination means. In section 4, a concrete design instances is given, associated hardware design and soft design are introduced. Finally, section 5 gives conclusions.

2. Objective and Demands of Course Design

2.1. Design Objective

After completing the course of microcomputer principle and interface technology, students have learned the basal knowledge and hold associated practical ability in designing simple applied system. In the course design, some comprehensive design topics are given. Students select one of the design topics. They confirm design scheme, choose appropriate equipment, design system circuit, and then build hardware system, compile and debug assemble language program, until completing design topics.

Through the course design, students learn to solve practical problem of microcomputer system using associated knowledge, student’s ability of analyzing problem and solving problem in comprehensive application of microcomputer system should be emphasized, then they can improved their ability of practice and innovation, which are very important for their following study and work.

2.2. Design Demands

Students are required to design a comprehensive microcomputer system with definite practicability using associated knowledge in microcomputer principle and interface technology. Some design topics are given, students can select one of them, and also they can select other topics which satisfy the demands of this course design.

In the process of course design, concrete design demands are as follows:

- After selecting one design topic, students put forward design scheme, study associated function module, give design steps, and compose design instruction manual.
- Every group design hardware circuit for design topic, and protract principle drawings of microcomputer system using PROTEL software.
- Every group build hardware system, compile and debug assemble language program.
- The work of course design can be completed in the experiment equipment, or in simulation software, such as PROTEUS, PSPICE, MULTISIM, etc.
After completing design tasks, every group should compose design report and give a speech on their design work.

3. Scheme of Course Design

3.1. Time Arrangement

The course design of microcomputer principle and interface technology can be arranged after completing the course of microcomputer principle and interface technology. Usually, an individual week is appropriate, total period is 40 hours, which including 20 hours in class and 20 hours out class.

3.2. Organization mode

The course design of microcomputer principle and interface technology is mainly processed by students independently. Items of organization mode are listed as follows:

- Students select design topic and constitute group independently. Every group includes 2 or 3 students, and chooses a group leader who coordinates the process schedule of the design.
- Every 10 groups need a faculty adviser who guide the design process and give some required help to student’s problem.
- Students spent 20 hours in classroom or laboratory, and extra 20 hours can be used in searching datum at library or having discussion at other place.
- All students should participate report meeting. Group leader report associated problem of design course and answer questions proposed by faculty adviser.
- Faculty advisers give estimations to every group according to their performance at design work and design report.

3.3. Design topics

Students are required to design a comprehensive microcomputer system with definite practicability. Controller module of microcomputer system can select 8086 CPU, single chip, PC104, programmable logic controller, etc. Interface module includes digital interface unit, analog input unit, analog output unit, timer and counter unit, display unit, driver unit, etc.

Selecting given design topics or optional topics are both permitted. Given design topics include motor control, traffic lamp control, temperature control, elevator control, charge measure of taxi, etc. Optional topics should satisfy the demands of this course design and be acknowledged by faculty adviser.

4. Instance of Course Design

This section introduces an instance of course design of microcomputer principle and interface technology, associated system scheme and soft design are given.

4.1. Design Topic and Demands

Design a DC motor control system, the demands and functions include: DC motor can be started and stopped by computer, the rotation direction and speed of DC motor can be set, the actual value and the set value of rotation speed of DC motor can be displayed on LCD.
4.2. Design Scheme

PC104 CPU is used as the core of this microcomputer system, and other interface modules include 8255 unit, switch unit, LED unit, AD unit, DA unit, DC motor unit, LCD unit.

Design scheme is given as follows and fig.1 is the principle drawing of designed system.
- The signal of starting, stopping, positive rotation and reversal rotation of DC motor is provided by switch unit. These signals enter PC104 through A gate of 8255 unit, and then are sent to LED unit for displaying through B gate of 8255 unit, to DC motor for controlling through C gate of 8255 unit.
- The set value of rotation speed of DC motor is given by resistor and is sent to PC104 through AD unit. After range switching in PC104, the rotation speed is sent to DC motor through DA unit. The actual value of rotation speed of DC motor enters PC/104 through AD unit and display on LCD unit.

4.3. Soft Design

Control soft is programmed by assemble language, and fig.2 is the flow chart of designed system. The following assemble language program is main program of code segment.

```
MY_PROC PROC FAR
MAIN: MOV AX, MY_DATA
      MOV DS, AX
      MOV DX,M8255
      MOV AL,90H
      OUT DX,AL ;work mode
      OUT DX,AL ;select channel
      OUT DX,AL ;start ADC
      MOV CX,DELAY_SET
      LOOP $ ;loop and wait
      IN AL,DX ;read control signal
      MOV DX,B8255
      OUT DX,AL ;output for display
      MOV DX,C8255
      OUT DX,AL ;output to DC motor
      OUT DX,AL
      MOV AL,01H ; select channel
      MOV DX,AD0832
      IN AL,DX ;read actual value
      CALL DSUP ;call LCD display
      CALL BREAK ;call program end
      MOV BL,AL
      MOV DX,DA0832
      OUT DX,AL ;export set value
      JMP STAR
MY_PROC ENDP
```

Fig. 1. The principle drawing of designed system
5. Conclusions

Facing to modern society with acute competition, the ability of practice and innovation is very important for the student of computer specialty. The course design of microcomputer principle and interface technology is practice course with stronger comprehension, it can consolidate student’s basal knowledge, help them form the realistic work style, and cultivate ability of application, design, practice and innovation. In the process course design, traditional mode, which usually give fixed design topic, is been changed. Students have more freedom in selecting design topic, design thought and design scheme.

Since this course design implementing, students participated in this course generally give good evaluation, and the practice shows that this course design has flexible ways and positive effect on training student’s ability of system design and practice.

References