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Based on creative and practical ability teaching reform in the course of Microcomputer Technology for Non-Computer Major

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Abstract: The course of Microcomputer Technology is difficult to master duo to lack of relevant computer thinking for non-computer major students which leads them to be less interested in learning this course. In order to make the computer minds and promote non-computer major students' creative and practical ability ,this paper comes up with the new teaching contents to the practical design reformation. In this paper, several practice training reformation schemes of microcomputer course are proposed , several years of practice results show that the proposed teaching mode can improve students' creative and practical ability.

Keywords: Microcomputer technology ; practice training ;Non-computer major

I. INTRODUCTION

The course of Microcomputer Technology is a compulsory course in computer science and technology major. This course is not only one of the major professional basic course of computer majors, but also is an important professional basic course in the related majors, such as automatic control, industrial automation, electronic information and communication engineering, mechanical and electrical engineering.

In our school we have set up this course for the non-computer major students the purpose is to make students master organization of X86 microcomputer, working principle, interface circuit and hardware connection from theory and practice, and set up the whole concept of microcomputer system work based on X86 to enable students have the initial ability of computer application system hardware and software development. But the contents of this course are relatively abstract and difficult to understand and memorize. X86 assembly language is not as clear and clear as advanced languages. Students of non-computer major probably lack some knowledge of the necessary prerequisites such as computer hardware design and programming design. They often are easy to fall into the analysis of some complicated circuits, which leads to the failure to grasp the key points in the learning process and easily lead to fear and boredom.

We have arranged a professional experimental design to improve students' practical ability to further understand the working characteristics of the X86 series of computers, in-depth understanding of the assembly language and the performance of the chips, improve the ability of students to comprehensively use microcomputer technology. The process of practice trainings complete a small computer hardware applications within two weeks.

II. THE CURRENT SHORTAGES IN TEACHING

In the past, the Intel 8086/8088 microcomputer system was mainly taught in the class. These microprocessors are very confusing to current students because they have not used 8086/8088 machines at all. They use Pentium, 32-bit or 64-bit computers such as Pentium, Core and AMD. The microcomputer they have learned is so far away from the microcomputer age and performance they are currently using that it is easy for them to lose interest in what they have learned. It is precisely because of the shorter and shorter time period for

the upgrading of microcomputers, which makes the content setting of the microcomputer technology course often unstable, which brings certain difficulties to teachers' teaching and students' learning. Therefore, it is very important to reform the teaching content.

In practical teaching, we use 8086 microprocessors as the basis for teaching, so that students can deeply understand the working characteristics of microprocessors, enable students to establish the basic concepts of microcomputer work, and focus on the internal principles of 32-bit microprocessors. The composition and function of the structure and basic register sets have focused on analyzing the real mode, protection mode, and virtual 8086 mode of the Pentium microprocessor. The system architecture and interface technology of the 32-bit machine have been described in detail, and the contemporary microcomputer system has been described in detail. Mainstream support technologies such as caching, superscalar pipeline, and virtual memory management. Through the change of teaching content, students will have some understanding of high-end microcomputers and grasp the working characteristics of 32-bit processors, laying the foundation for further learning. Such a teaching arrangement can guarantee stability, practicality and advancement.

III. PRACTICE TRAININGS

Microcomputer technology is a practical course and the course of the experiment is divided into two categories： one kind is the verification experiment, the experiment is finished after the theory of consolidate knowledge, it can complete verification of knowledge and help to improve the students' practical ability;another kind is the open experiment, firstly it is put forward by the teacher, then teachers assign students to complete the task, only directional guidance is provided by the teachers ,other specific work is done by students themselves. Such experiments have greatly improved students' learning interest and enthusiasm. We have two weeks of course design to complete the open experiment. Course design can make the student to do real some system design, let the students design a small system and complete the task closely related to professional, students can use their own knowledge of professional knowledge and microcomputer technology. Students carry out program design, programming, installation and debugging independently to complete hard, software design and debugging. During the debugging process, the students analyze and solve the problems in the experiment by themselves. In the process of solving the problem, student further deepen the understanding of the hardware circuit and software design of the microcomputer application system. We use microcomputers training platform, which is in view of the course design and development of colleges to make a full open experiment system, the platform high openness, open the PCI out all of the bus, and platform design is compact, easy to carry and are available for students back to the dormitory to build their own design, the experiment time and students' spare time within the class to use.

The open experiment instead of the traditional experiment "mechanical" imitation, combined with the professional background of non-computer majors, students must fully prepare, thinking, to complete the design of experiment. Such experiments purposefully to cultivate the students' ability to use comprehensive, independent ability and design ability, guarantee the students' personalized development, meet the needs of the students' interest in students' initiative is greatly increased. By strengthening the open experiment, the students have the ability of comprehensive development and application of software and hardware, which lays a good foundation for future work and study.

In practice teaching, we take the computer mind cultivation as fundamental task,practical teaching principle and practical programs are designed and all of the non-major computer science students’ practical courses are integrated. From the characteristic of automation and abstraction of computing mind, formalize the partial results of practice teaching reform, so as to gets a model course for comprehensive educational reform.

IV. SCHEMES OF PRACTICE TRAININGSFOR NON-COMPUTER MAJOR

4.1 Classification of practice trainings

4.1.1 According to the different time length of classes

① A/D, D/A conversion: Typical issues such as single-channel analog voltage acquisition circuit.

② Data display (including digital tube, dot matrix display, diode): typical issues such as elevator control system, Traffic signal system design by microcomputer control.

③ Sensor: typical issues such as temperature display system.

④ Motor: typical issues stepping motor control.

4.1.2 According to the different professional objects

① Major of Computer science and technology, students are mainly in programming design (8086 assembly language or C language).

② Major of Network engineering, Internet of Things engineering, students are mainly based on the system architecture design, understanding the application characteristics of the chip.

③ Major of Mechanical engineering, students are mainly in the electrical motor application research.

4.2Design of time-query lights circuit and program

4.2.1Contents of design

The contents of this subject is limited to one week to complete. The programmable interface chip 8253 is adopted to design a 1-second timing circuit, the timing signal connects one bit of the 8255A port C ,the program queries the status of this bit, if it is low level, then the output of different values from the Port A of 8255A would change the status of LED (Light Emitting Diodes)connected with the Port A to achieve the effect of the time-query lights. Press Esc to end the program.

4.2.2Ideasfor design

① Using 74LS138 design address decoding circuit, 8255A port address: 300H ~ 303H, 8253 port address: 304H ~ 307H.

② 74LS245 for bus and the two-way transmission and isolation between 8253 and 8255A

③Using breadboard clock (1MHz or 2MHz) and 8253 to design a 1-second timing circuit, the timing signal will connect 8255 of Port C4, programming query status of Port C4, if the low level, then the output of different values from the Port A of 8255A would change the status of LED connected with the Port A to achieve the effect of the time-query lights. Press Esc to end the program. Press Esc to end the program.

④ Each 74LS06 contains six NOT gates, its inputs from one bit of Port A, the output connects to the negative pole of the LED.

⑤Each of the LEDs' positive pole is connected with pins of resistor chain from 2 to 9, and the resistor chain pin 1 is connected to the VCC(+5V).

4.3Design of temperature sensing system

4.3.1 Contents of design

The contents of this subject is limited to two weeks to complete. A temperature sensing system based on microcomputer control is design by using programmable interface chip 8253, 8255A and 8259.

The initial state of the temperature sensing system after startup

The menu appears on the computer monitor:

Temperature sensing system operating status

Press S to set the maximum temperature alarm value.

Press T to set the lowest temperature alarm value.

Press C key to get the current temperature and display, and according to set the high temperature and low temperature alarm value when out of range with light-emitting diode alarm.

End program running status

Press Esc to end the temperature sensing system.

Basic design requirements: 1-minute countdown system based on 8253, 8255A, 8259.

4.3.2Ideas for design

①The address decoding circuit is designed by using 74LS138, 8255 port address: 300H ~ 303H, 8253 port address: 304H ~ 307H.

②The 74LS245 is used for bidirectional transmission and isolation between the bus and 8253、8255A.

③ Using a breadboard clock (1MHz or 2MHz) and 8253 design a 40-milliseconds timing circuit, the timing signal (40 milliseconds square wave) connected to the bus IRQ2 or IRQ10 to 8259 control two digital tube rotation refresh and display. The system starts the temperature sensor every 0.8 seconds to collect the current temperature, that isthe current temperature is collected once every 20 interruptions.

④The temperature sensor values input into one of bits in the Port A, Port B or Port C of 8255.

⑤Two of bits in the 8255 Port A, Port B or Port C control high temperature and low temperature alarm signal.

⑥One of bits in the Port A, Port B or Port Cof 8255is selected for connected two bits digital tube.

⑦Two of bits in the 8255 Port A, Port B or Port C of 8255 is as strobe signals of two bits digital tube.

Limited to the length of the article, only a part of the typical topics are listed. In the actual process, we can also use the existing chips and equipment in the lab to allow them to make their own subjects according to the students' own interest. C language and assembly language both can be used in the design process. Non-computer major students usually do not have an assembly language programming course, it is best to use C language to write programs.

V. CONCLUSION

This paper analyzes the shortcomings of traditional teaching mode and the serious crises faced by microcomputer technology course for non-computer majors. The subjects of these practice trainings closely related to the daily lives and the contents are generally not difficult. One-year practice result shows that the teaching reform proposals presented in this paper can improve the students' creative and practical ability after the completion of the practice trainings. Most students can finish in about 8 days.

The curriculum reform of the practice trainings can improve Non-computer major students' initiative to help them understand the working principle of microcomputer, and achieve the aim of improving the practical ability and creative spirit for Non-Computer Major students.

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