Journal of Computing and Electronic Information Management
ISSN: 2413-1660 | Vol. 13, No. 3, 2024

Design of microcomputer principle virtual experiment teaching platform and study on teaching mode

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Abstract: In view of the characteristics of "Microcomputer Principle and Interface Technology" experiment course, such as complex abstraction, easy damage of experimental instruments and poor reuse, this paper proposes to use virtual simulation technology to digitize the microcomputer principle experiment circuit and experiment process, so that students can complete the relevant experiment content on the virtual experiment platform. The virtual experiment platform provides students with an efficient, flexible, open and free experiment environment, enhances students' interest in experiment, improves experiment efficiency and experiment quality, and is of great help to improving students' independent innovation practice ability.

Keywords: Microcomputer principle; Virtual simulation; Experimental platform.

1. Introduction

The course 'Microcomputer Principles and Interface Technology is a practical basic course for electronic and computer majors. The main content of Microcomputer Principles and Interface Technology is the operation of microcomputer processors and their interaction with input/output devices. Through this course, students are trained in the design of microcomputer system circuits and interfaces, as well as software programming abilities [1]. The traditional experimental teaching mode is limited by time and place, lack of flexibility, mechanical solidification of experimental Settings [2], lack of inspiration, too much emphasis on function realization [3], lack of innovation, limited improvement of students' innovation ability, defects in the equipment itself or high damage rate in normal use. It has seriously affected the teaching quality of microcomputer experiment courses and the cultivation of students' innovative practical ability [4]. Therefore, introducing virtual simulation technology in microcomputer principles laboratory teaching to establish a virtual experimental teaching platform can effectively improve the means of experimental teaching, reduce duplicate investment in equipment, compensate for insufficient quantities and losses of equipment instruments, alleviate financial pressure caused by shortages, promote curriculum reform, and have significant importance in improving the quality of curriculum instruction and talent development.

2. Design Ideas and Target Positioning

(1) Provide a platform that breaks through time and space, as well as traditional methods

The virtual experiment platform is based on the park network and the Internet, supporting the application environment of win10 (32/64-bit). Student users can log in to this experimental platform with their account and password. The platform will save students' experimental records on the server and continuously update and upgrade services. This platform breaks through time and space limitations, as well as the constraints of traditional teaching models, providing support for implementing an 'information-based, diversified' teaching model reform.

(2) Ensure the classroom to carry out "practical integration of teaching"

When teaching in a classroom, teachers use a large screen to explain relevant content or demonstrate virtual simulations and conduct 'integration of theory and practice' teaching.

(3) Help carry out "personalized independent learning" after class

Students utilize personal computers to engage in independent learning and experimental operations anytime, anywhere, and have extended their learning from the classroom to the campus. The system includes experiment guidance for laboratory projects and establishes a resource library for microcomputer principles courses, providing a foundation for students' online learning, experimentation, design, and research.

(4) Promote the implementation of the curriculum "three-dimensional teaching mode"

The platform provides 12 typical circuits and open experimental platforms, which can arrange experimental content of verification, design and research, so that the experimental teaching planning is no longer limited to the practice teaching of traditional laboratories, and it can facilitate the organic integration of theory, experiment, practice and network teaching activities, strengthen practical teaching links, and carry out "multiple three-dimensional" teaching. Accelerate the process of students' internalization and externalization of curriculum knowledge, and improve the teaching efficiency.

3. Virtual experiment platform system architecture

Based on computer simulation technology, multimedia technology and network technology, the virtual experiment teaching platform adopts service-oriented software architecture development [5] and integrates hardware circuit simulation, software innovation design, digital teaching resources and virtual experiment teaching management. It is a virtual experiment teaching platform with good autonomy,

interactivity and scalability. The platform includes data layer, support layer, service layer and application layer. The overall architecture of the system is shown in Figure 1.

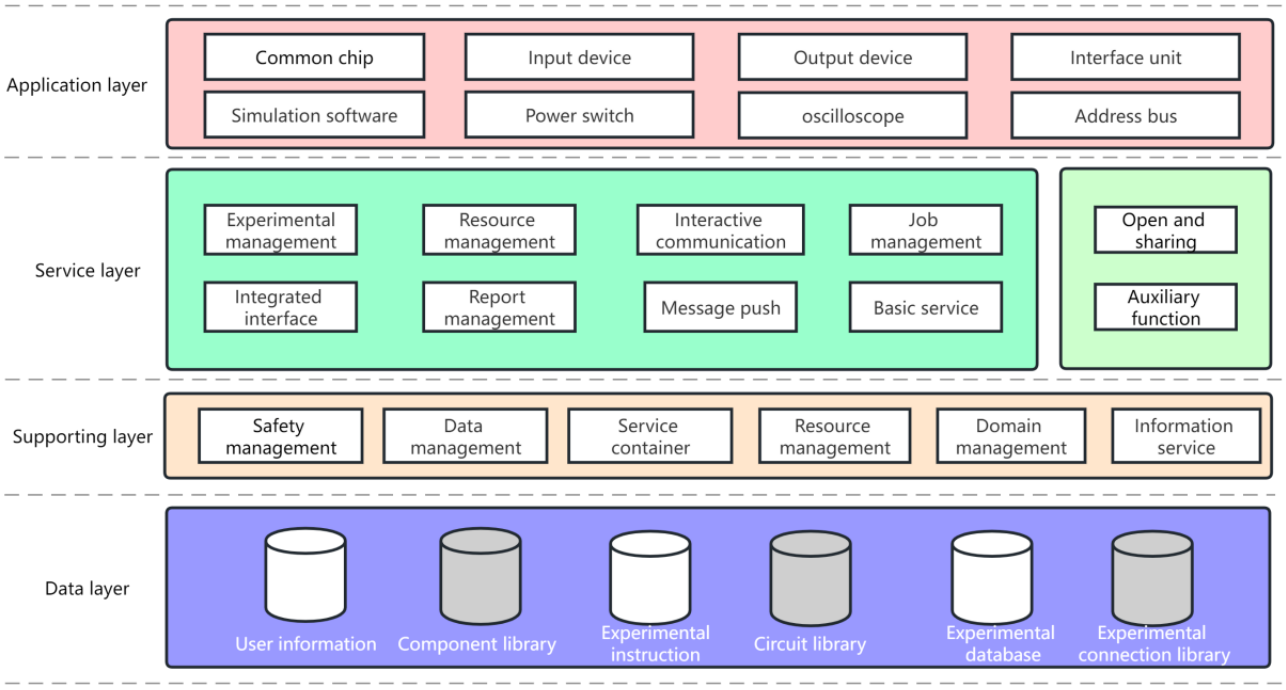

Fig.1 Overall architecture of the system

4. Functional design of virtual experiment platform

The microcomputer principle virtual experiment platform consists of three parts: experiment resource area, hardware experiment platform and software experiment platform [6]. The function diagram of the virtual experiment platform is shown in Figure 2.

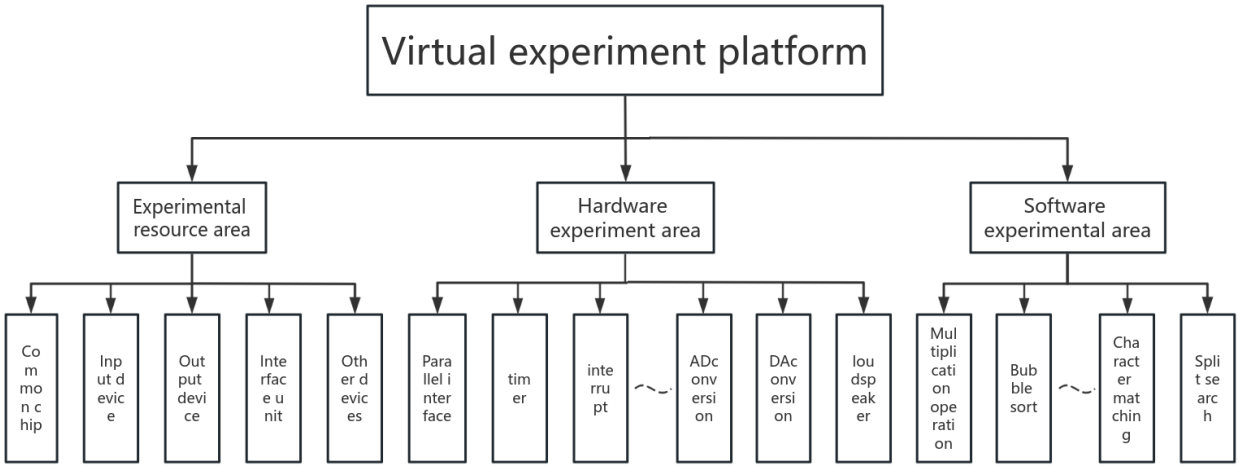

Fig.2 Functional structure diagram of virtual experiment platform

4.1. Experimental Resource area

The experimental resource area realizes the highly sharing of teaching resources and promotes the optimal allocation of teaching resources. Mainly through the experimental teaching platform interface selection. The main contents include:

(1) Common chips

For example :8255, 8254, 8251, 8259, ADC0809, DAC0832, 74LS138, 74LS373, 74LS245, 74LS74 AND gate, NAND gate, OR gate.

(2) Input device

Data strobe input device, temperature sensor, clock pulse signal generator, positive and negative pulse button, key, toggle switch.

(3) Output device

LED light emitting diode, LED 8-segment digital tube, buzzer, horn (speaker), stepper motor, LCD LCD screen, traffic lights, neon lights, data receiving device.

(4) Interface unit

IO address decoding circuit, IO input port, IO output port, query output port, 8255 parallel interface, 8254 timing counter interface, 8251 serial communication interface, 8259

interrupt controller interface, A/D analog-to-digital conversion interface, D/A digital-to-analog conversion interface, indicator output unit, eight-segment digital tube display unit, keypad unit, Yang Sound circuit, traffic light circuit, neon light unit, sensor unit, indoor environment temperature monitoring analog unit, stepper motor interface, LCD interface, data gating input unit, data gating output unit.

(5) Other devices

Address bus, terminal, cable, bar, power switch.

4.2. Hardware virtual experiment platform

The virtual experiments of hardware components mainly include the internal functions and external pin characteristics of chips and components such as 8255, 8253, 8251, 8259, A/D, D/A, LCD1602, LS138, loudspeaker, stepper motor, potentiometer, temperature sensor, etc.

4.3. Software virtual experiment platform

The software virtual experiment mainly includes the experiment items such as multiplication operation, split half search, bubble sort, character matching, computer piano, as well as the external characteristics, display and operation of data input and output devices, and virtual oscilloscope and other test instruments are also provided.

5. Summary

The computer principle virtual experiment platform builds a virtual experiment platform which can be used anytime and anywhere for schools and students. This platform promotes the innovation and development of traditional teaching mode, makes up for many shortcomings of traditional experimental teaching, realizes a high degree of resource sharing, enables students to learn independently, and is of great significance for improving students' practical ability and engineering ability and promoting experimental teaching reform.

Acknowledgements

The authors gratefully acknowledge the financial support from Teaching Reform Project of Sichuan University of Science and Engineering (JG-24026).

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