The Design of Multi-Tier Internet Computer Assisted Instruction System Constructed by the Serial Communication Technology Theory and Practice

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Abstract

In order to promote the goal of web-based education, this paper proposes a multi-tier Internet computer-assisted instruction(CAI) system with distributed computing ability, focusing on serial communication technology course of electronics and electrical engineering. There are twelve units in this research: PLC start/stop unit, PLC state unit, Barcode Reader control unit, temperature sensor module unit, gas sensor module control unit, AC-9002 weighting indicator control unit, RI-5100 weighting indicator control unit, I-7012 analog input module control unit, I-7021 analog output control unit, I-7060 digital input/output control module unit, distributed control unit. The proposed multi-tier Internet CAI system provides the following functions: multimedia interactive teaching, real-time serial communication control practice, animation simulation, random simulated examination, score figuring and weakness analysis, online database maintaining.

The multimedia interactive teaching contains theory teaching, example explaining, hardware control module design explaining, serial communication control program teaching, random simulated examination, score figuring, and weakness analysis. It aims at guiding students to build up theoretical concepts. In order to improve the learners' motivation and learning efficiency on the application of abstract concept, this system provides the interactive learning interface designed by multimedia content and integrates the course contents of theory and practice. The learners can integrate theory and practice by implementing the relative units.

This research is constructed by distributed computing multi-tier network architecture, TCP/IP communication technology, DCOM technology, ActiveX component, and SQL database design, which provide Internet learners to learn serial communication control technology course. In addition, the purpose is to make the system more friendly and interactive.

1. Introduction

There are lots of new teaching methods which innovating traditional instructional design in education field in recent years. For example, CAI, multimedia, and virtual reality. CAE Computer Assisted Education is a new education technology, including CAI and CAL. Researcher can link virtual reality up with CAI and CAL to make students feel real in learning situation, encourage self-orientation learning, and promote learning efficiency. Wu, 1995 Bates, A.W. 1996 Benson, G.M. Jr. 1994 . The way of using computer-assisted instruction through multimedia technology will not only promote learning motivation, but also improve learning efficiency on the application of abstract concept. At the present, there are few electronics and electrical engineering computer-assisted instruction systems in Taiwan. Most CAI systems are only provided single user to use. In order to improve learning performance of vocational-technical college students, to promote education technology, and to apply Web education, this paper proposes this multi-tier Internet interactive computer-assisted instruction system.

The proposed computer-assisted instruction system contains multimedia interactive teaching, real-time serial communication control practice, animation simulation, random simulated examination, score figuring and weakness analysis, online database maintaining. The proposed multi-tier Internet network is constructed by user layer, middle layer and server layer. The user layer provides users to carry on related theoretical and practice teaching, middle layer contains Web Server which provides related ActiveX practice objects and multimedia theoretical teaching material , TCP/IP Program and related SQL database driver, server layer offers the management of SQL database. Internet learners proceed the learning of Web's ActiveX practice objects installed from middle layer, and simulated examination from SQL Server which provides examination questions by the technology of TCP/IP communication. It's supported by Visual Basic constructing interactive multimedia interface, managed with Cool 3D, Director, PhotoShop constructing text, animated files, and image. The program languages used here are VB, HTML, and JAVA, which are set in WWW browser.

Aside from this, the characteristic of this research is about digital books database. The functions of this electronic books database are heightening learners' motivation and improving learning effectiveness. It uses virtual reality technology to create an amusement site and thus offers a more convenient environment for our learners.

2. Multimedia designing

The teaching material in this system is constructed by multimedia technology. By the application of Cool 3D, Director, and PhotoShop, AVI and GIF image plus the text

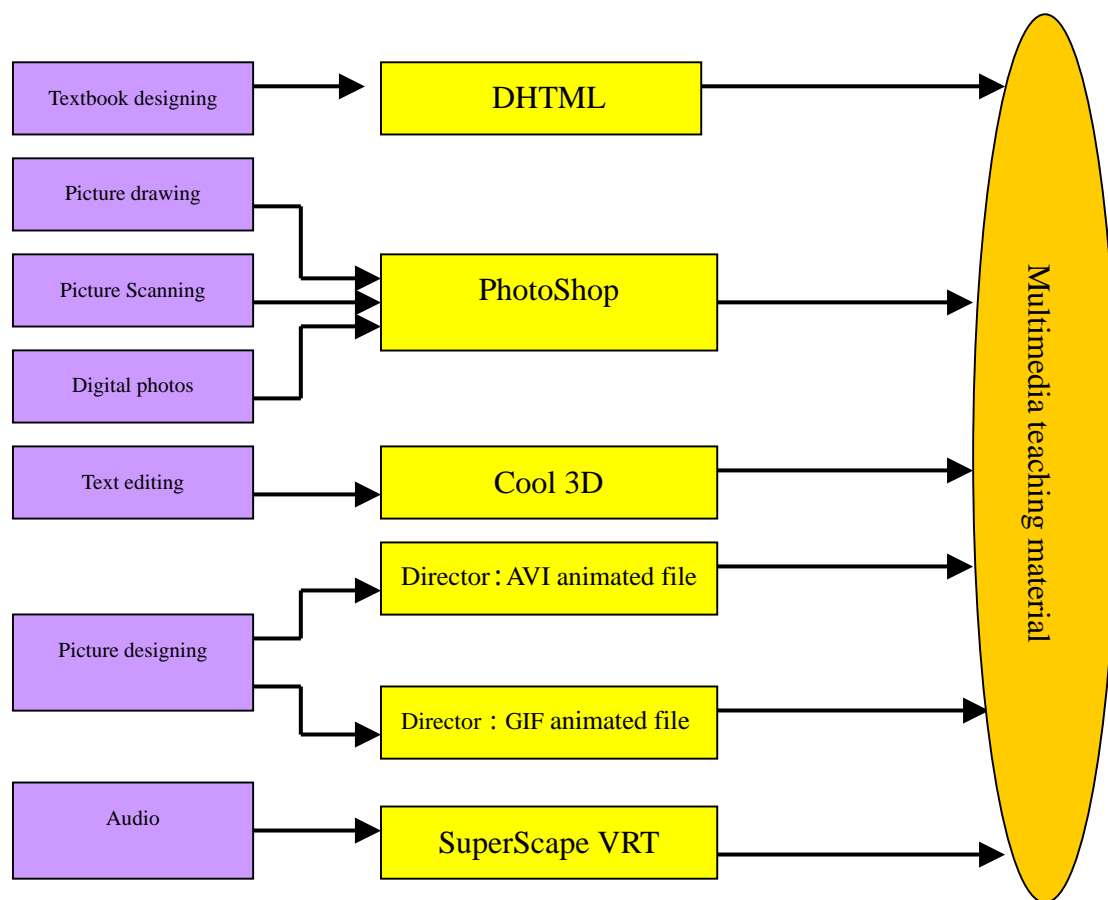are therefore produced, as shown in figure 1.

Figure1. The design of multimedia teaching material

3. Computer- assisted Instruction System architecture and functions

This system contains five functions as animation simulation, random simulation examination and score figuring, real-time control practice, multimedia teaching, and online database maintaining, as shown in figure 2. Every teaching unit in CAI system provides the functions of animation simulation, real-time control practice module(as shown in figure 3~8), and multimedia theoretical teaching(as shown in figure 9). The real-time control practice offers users to proceed related practice of serial communication control modules, random simulation examination provides the users in user layer carry on random simulation examination, online database maintaining provides the management of SQL database, and multimedia teaching function offers the related theoretical and practical teaching. The multimedia teaching function also contains four subfunctions: computer-assisted theoretical instruction, example explaining, serial communication control program design, and hardware practice module design, as shown in figure 2.
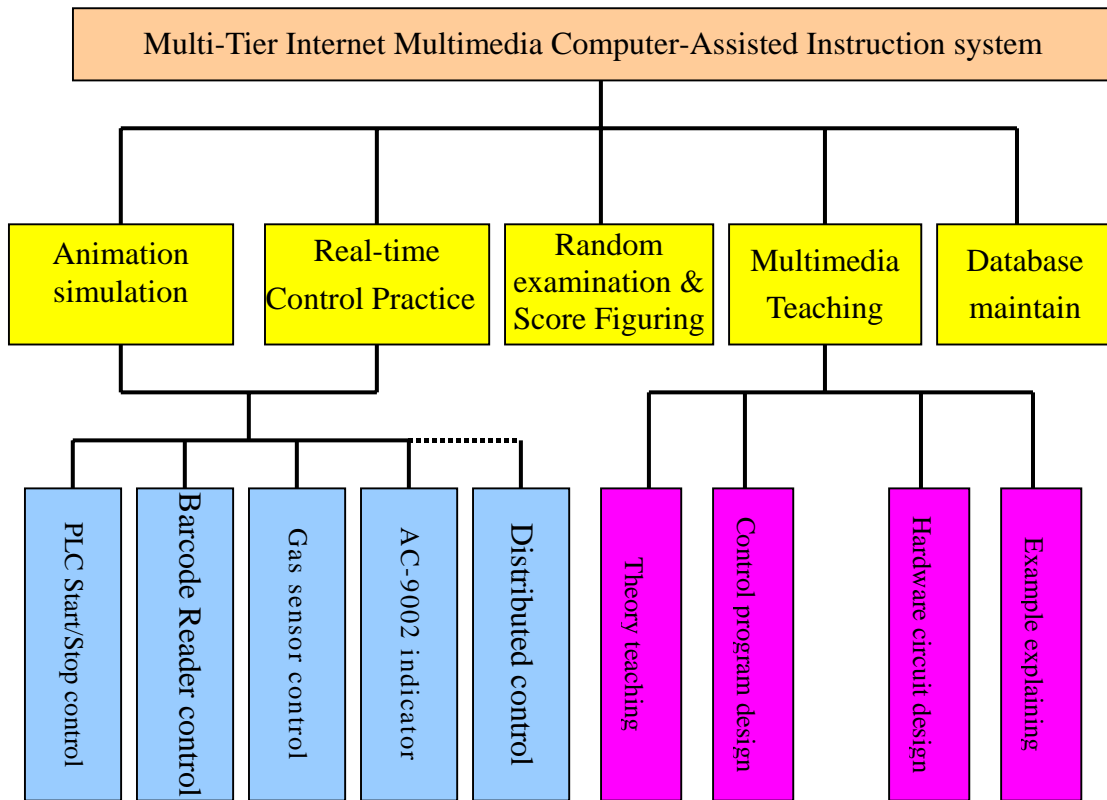
Multi-Tier Internet Multimedia Computer-Assisted Instruction system

Animation simulation

Real-time Control Practice

Random examination & Score Figuring

Multimedia Teaching

Database maintain

PLC Start/Stop control

Barcode Reader control

Gas sensor control

AC-9002 indicator

Distributed control

Theory teaching

Control program design

Hardware circuit design

Example explaining

Figure 2. computer-assisted instruction system architecture

Figure 3.　PLC state control module

Figure 4. RI5100 control module

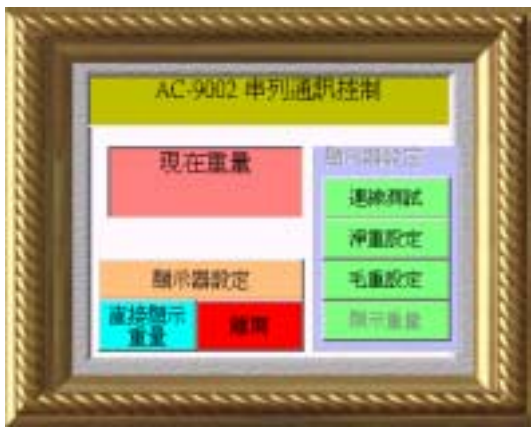Figure 5. I-7012 analog input module

Figure 6. Barcode Reader module

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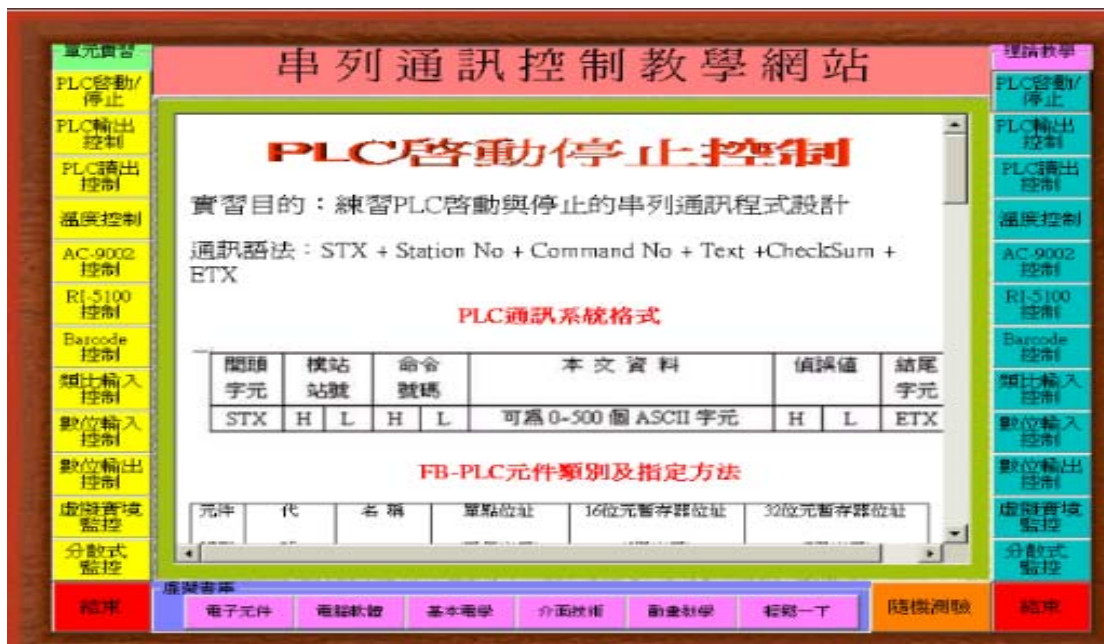Figure 7. AC-9002 control module

Figure 8. PLC input control module

Figure 9. multimedia teaching material

4. Proposed Multi-Tier Internet Network CAI System Architecture

This paper proposes a multi-tier internet network CAI system architecture so as to provide internet learners to proceed serial communication control course teaching. This CAI system is constructed by distributed computing multi-tier network architecture, TCP/IP communication technology, DCOM technology, ActiveX component, and SQL database design, which provide Internet learners to learn serial communication control technology course. The multi-tier internet network architecture is divided into three layers. The user layer contains ActiveX practice objects, database maintaining object, and random simulated examination object, the middle layer contain Web server and ActiveX application program server, and the SQL server is responsible to the management of database. The operational steps of proposed multi-tier system architecture(as shown in figure 10) as follows:

(1) Users connect to Web Server by web browser and carry on the instruction of

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multimedia CAI system.

(2) User's web browser check whether have downloaded the related ActiceX embedded programs(including ActiveX practice object, random simulated examination object, online database maintaining object, and related serial communication control driver) or not. If not, then download again.

(3) ActiveX embedded program at the user layer connect to the server of middle layer through TCP/IP communication, and carry on random simulated examination(as shown in figure 11) or maintaining of database.

(4) TCP/IP program connect to other ActiveX objects(ADO and SQL Server driver) by DCOM technology in the middle layer Server.

(5) TCP/IP program at the user layer access the SQL Server database through the ActiveX application program Server in the middle layer.
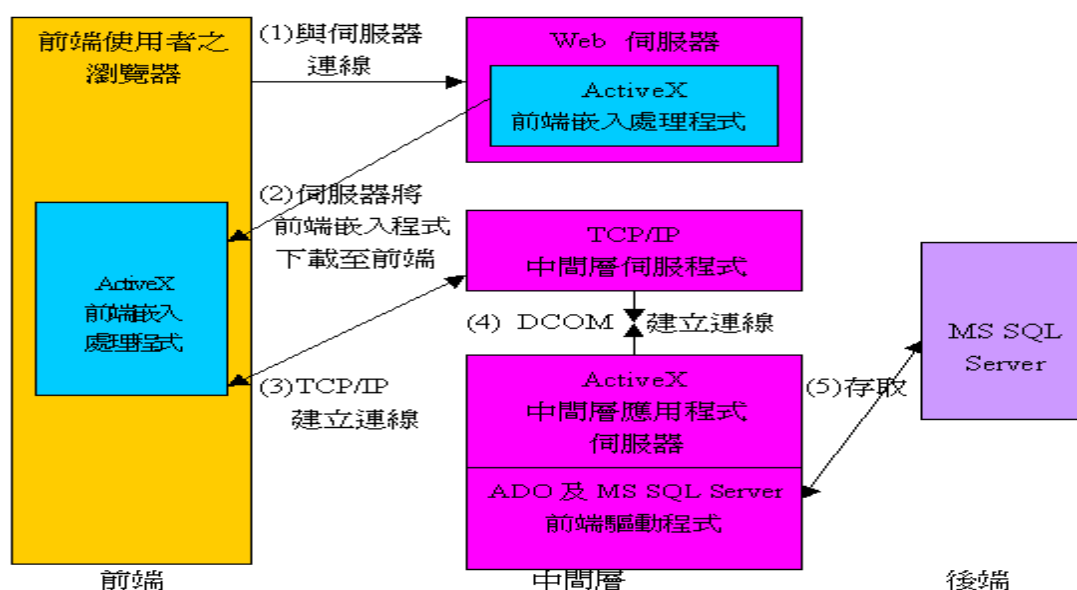

Figure 10. multi-tier Internet network system structure

Figure 11. Random simulated examination ActiveX Object

Figure 12. Middle-layer TCP/IP ActiveX Object

5. Proposed multi-tier internet network ActiveX module design

This paper proposes related ActiveX modules design, so as to attain the goal of interactivity. In order to get the goal of interactivity, the user layer(client) downloads ActiveX practice objects, random simulated object, and SQL database maintaining object from Web server in the middle layer. The proposed ActiveX objects have the following merits:

(1) Provide internet users to carry on real-time practice of serial communication control course.

(2) Attain the goal of thin client/server.

(3) Provide internet learners to carry on real random simulated examination, and system administrator to maintain the SQL database on line.

(4) Support the specification of distributed object, and the development of multi-tier architecture.

6. Conclusion

This paper proposes a multi-tier internet network CAI system, which is constructed by distributed computing multi-tier network architecture, DCOM technology, and ActiveX component, so as to provide Internet learners to learn serial communication control course. The proposed related ActiveX objects design can attain the interactivity of client/server and thin client/server. The system function of real-time practice provide internet learners to carry on the related teaching practice. In order to promote education technology, this paper discusses the design of electronic engineering serial communication control course computer-assisted instruction system. This system contains five functions as animation simulation, random simulation examination and score figuring, real-time control practice, multimedia teaching, and online database maintaining. For innovating education technology, this system will heighten learners' learning motivation and improve learning effectiveness.

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