

WWW Based Instruction Systems for English Learning : GAIA

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Abstract

I studied a distance education model for English learning on the Internet. Basic WWW files, that contain courseware, are constructed with HTML, and functions, which are required in learning, are implemented with Java. Students and educators can access the preferred unit composed of the appropriate text, voice and image data by using a WWW browser at any time. The education system supports the automatic generation facility of English problems to practice reading and writing by making good use of the courseware data or various English text resources located on the Internet. Our system has functions to manage and control the flow of distance learning and to offer interaction between students and the system in a distributed environment. Educators can manage students' learning and can immediately be aware of who is attending and who is quitting the lesson in virtual space. Also, students and educators in different places can communicate and discuss a topic through the server. I implemented these functions, which are required in a client/server environment of distance education, with the use of Java. The URL for this system is "http://park.taegu-e.ac.kr" in the name of GAIA.

1. Introduction

Computer science is tightly related with education in the sense that education is a wide and powerful field of computer application. Recently, the development of courseware in a distributed environment is attractive and important so that educators and students can share educational resources in different places. Development of educational data in a multiuser environment on a network can increase the productivity of educators.

Nowadays, educators have to be able to navigate rapidly and effectively around the Internet, and to be able to utilize e-mail, Usenet, WWW, and other tools to communicate on the Internet. Furthermore, educators have to be able to use the Internet to enhance the education of their students by preparing detailed lesson plans using Internet resources. Moreover, it is necessary for educators to design and program effective WWW pages that communicate clearly and efficiently. There are many studies concerning distance education

on the Internet. Actual use of super high-speed information networks inspires study and application of distance education on the network. In this respect, studying distance education will bring computer science and education together by researching the latest developments in emerging technologies, for example, Internet, intranet, multimedia.

Distance education, in a comprehensive viewpoint, is a type of education being applied between educators and students using educational tools such as broadcasting, audio systems, video systems, networks, and CAI courseware in separate places. A representative example of distance education is a system that uses a video camera, a microphone, a communication network and televisions to broadcast in different places. But in this paper, I will restrict distance education to educational activities between students and educators using computer systems and communication networks in a distributed environment. Distance education using computer systems and networks is different from other systems in respect to selection, repetition, and interaction of items being studied. Once the educator creates the courseware on the network, students can take as many of the offered classes as they would like to study. Students are allowed to audit a virtual class and/or study at their own pace, so there are really no hard and fast requirements.

Distance education systems have to process various requests from many students. Though it is difficult, it is important to manage and process the actions of remote students involved in distance education on the network[2]. We need educational data, program modules, which are developed by computer experts or educators, which can be run on any platform anywhere. And that kind of courseware in a multiuser environment must offer a powerful interactivity and reality on the network[6]. I studied a distance education model from such viewpoints as are remarked above.

In this paper, I designed and implemented a CAI courseware model for English learning using Java language and HTML as part of a distance education system on the Internet. Java is a powerful object oriented language in a distributed computing environment. One of its strong points is that we, educators, can reuse useful applets that are developed by other educators and programmers. We would be able to gather applets in groups, and access such applets for educational purpose on the Internet at any time. Therefore, Java is a proper solution on the Internet to develop CAI courseware for distance education. I implemented functions using Java to manage and control the various requests of remote students, and to offer interaction between students and the system in

virtual space. And basic WWW files of the courseware are constructed with HTML[1]. I present the system structure of distance education for English learning in Chapter 2. Chapter 3 describes the implemented functions and examples of while the courseware is running. I conclude in Chapter 4.

2. System Structure for Distance Education

The model of distance education system designed and implemented with the use of Java and HTML in this paper provides realtime process, multiuser environment, and interaction on the Internet. Figure 1 indicates the distance education environment applied in this paper. I describe the general structure of the education server and the client system in this chapter.

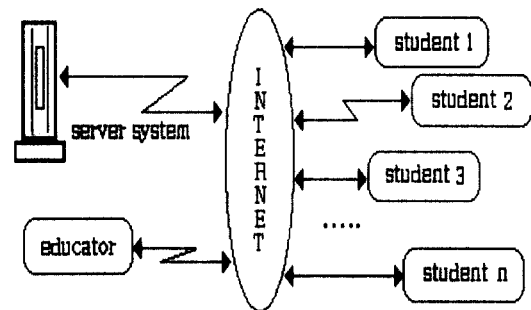


Figure 1. Environment of Distance Education.

2.1. Courseware Configuration for an English Learning System

Figure 2 describes the model of distance education for English learning designed and implemented in this paper. Courseware for English learning consists of texts, voices, images, specific management functions, and communication functions. The courseware's contents, which consist of up to fifteen chapters, are based on the book *GAIA, The Practical Science of Planetary Medicine*, by Jim Lovelock. What is called the GAIA theory is a current idea concerning the evolution of Earth that combines all of the different fields of science to form a very interesting concept. This has been edited by Fred Myers, with the kind permission of Jim Lovelock. Courseware data of GAIA, which are composed of text, voice and image, are maintained in the WWW server system. Students and educators can

access the preferred unit composed of the appropriate text, voice and image data by using of WWW browser at any time. Students also may take a test and can check the test results in each chapter when they finished the chapter. All tests of each chapter are sampled from the chapter's content. The system can be accessed on "http://park.taegu-e.ac.kr/" in the name of GAIA.

The education system in this paper supports the automatic generation facility of English problems to practice reading and writing from GAIA or various English text resources located on the Internet. It is also possible for a student to request his test results from the server system. This automatic generation facility of English problems provides infinite studying resources to students on the Internet. Students are able to take the initiative to study English by selecting the preferred resources.

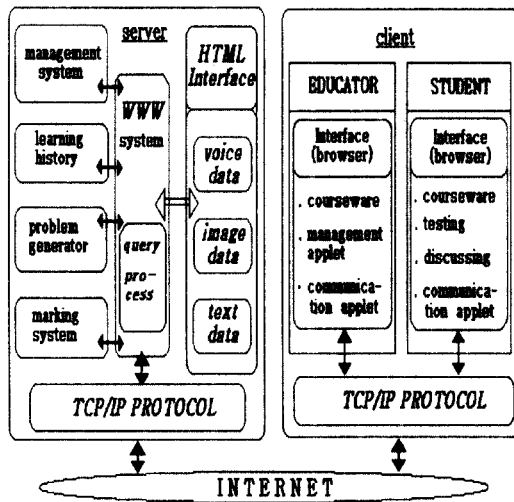


Figure 2. System Configuration.

In addition, our education system has some functions to manage and control the flow of distance learning on the WWW server. An educator can manage the students' learning and can immediately be aware of who is attending and who is quitting the lesson in a distributed environment. Also, the educator can send students specific problems or messages. Students and the educator in different places can communicate and discuss a topic through the server. All of these are executed in a distributed environment composed of a server and clients. I implemented these functions required in client/server environment using Java, which

is a recent popular and powerful object oriented language on the network. The server program must be executed at all times so as to be able to communicate with Java applets of clients, and consequently to be able to run specific management functions described above, thus, performing distance education. The server program is run separately from the WWW server system. If there is a request requiring a special function between a server and clients by educators or students, the corresponding Java applet to complete the requested service is run automatically.

2.2. Server and Client

The system of this paper supports some management functions in order to control the flow of distance learning. I have developed the server and client programs for the management of distance education. The server, in this case, does not mean a WWW server, but is the system that communicates with Java applets of clients to run specific functions. The client requests an action to server, and the server performs the action and returns the results to the client.

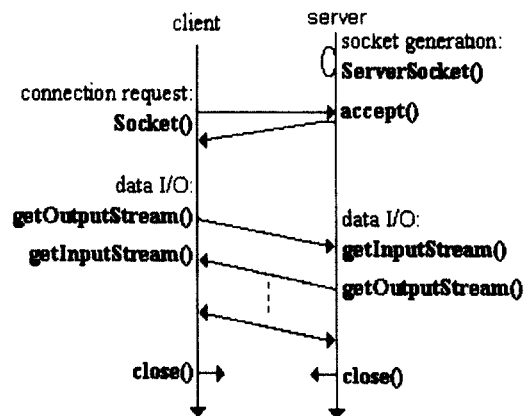


Figure 3. Java's Socket Communication.

The communication of server and clients uses the socket class of the network package. Java's networking capabilities are centralized in the "java.net" package. I used a stream socket for TCP/IP to get high reliability and interaction[3]. There are two sockets in the stream socket, the ServerSocket that is used for the server only, and the Socket that is used not only for the server but for the client as well.

The client that wants to run a distance learning system has to attempt first to establish a connection to the server through an assigned port. The server system can accept or reject the connection request of the client. If the connection is established, then the server and client can communicate through the port of sockets in much the same manner as if they were accomplishing file I/O. Because Java's socket communication enables applications to view networking as if it were file I/O, a program can read data from a socket or write to a socket as simply as reading from a file or writing to a file. When the communication connection is no longer needed, the client and server each close the socket. Figure 3 describes the flow of control between server and client to communicate with each other. I assigned 4444, which is not a well known port, as the port number to the socket. Once the server accepts a client request, the server executes a new thread to listen to another request of client. The server system supports multithread to accept requests of clients in different places at the same time.

There are two types of client system in this paper. One for students, and one for educators. Students can inspect, select and execute the contents of courseware, can discuss some topics with other students, and can communicate with each other including the educator with student's client system through the server on the Internet. It is also possible for the educators to watch the students joining and quitting the system, and to exchange messages between the students with the educator's client through the server system in virtual space.

The system provides three transfer types in this model, namely, unicast, multicast, and broadcast. In case of message transfer, the educator is able to transfer messages to one specific student using the unicast function or to a study group of students using the multicast function, or to all students using the broadcast function respectively. The multicast transfer function is very useful in order to increase the effect of good distance education in communication network[7],[8]. Our system could help enable an educator to transfer some messages to a group that consists of several students. A group can be made up of some students who are in different places according to subject, level and so forth. Figure 4 describes a message format used in this system to communicate with each other. In Figure 4, transfer type can be unicast, multicast or broadcast. Destination is a series of bits representing the member who is expected to receive a message, and can be either a student, a group, or all students. Educational message consists of text messages that are written by a student or educator.

| | | |
|---------------|-------------|---------------------|
| transfer type | Destination | educational message |
|---------------|-------------|---------------------|

Figure 4. A Message Formats.

The server system of this paper manages and controls courseware for English learning in distance education. It receives and analyzes the messages from clients. The server system transfers the message between the clients according to the analysis of client's message to be unicast, multicast or broadcast[4]. And, the server processes the requests of clients such as connection, disconnection, problem generation or test checking requests. A client tries to connect with server system for the first time when client/server environment is needed. Clients communicate with each other through the server system.

Figure 5. Main Menu of Distance Education Systems for English Learning.

3. Implementation and Courseware's Execution

3.1. Authoring of the Courseware

I built basic HTML files of the system on a WWW server that can be accessed by WWW browser. I used various languages, that is, not only Java but also JavaScript, and Perl including HTML. HTML files were made using HTML and JavaScript languages. The

server and client that perform some functions in a distance education environment were implemented with the use of Java language. Perl was also used to process a client's request and to manage some data in the WWW server.

Figure 7. An Example of a Comprehension Checkup Test.

Figure 7 presents an example of a comprehension checkup. If a student wants to take a test of a specific chapter, he can take a checkup test and send it to the WWW server system for marking. Then the WWW server system returns the results to the student's WWW browser.

Figure 6. An Example of Selected Chapter.

Figure 5 shows main picture of our distance education system including courseware, GAIA. All chapters of GAIA have text, image, voice data, and have questions for studying the chapter. When students select a specific item, the corresponding HTML file or applet to complete the requested function is transferred to the WWW browser from the WWW server system. Students can study by listening while simultaneously reading the text and seeing images related to the text. Figure 6 shows a selected chapter of GAIA in courseware.

3.2. Problem Generation System

The automatic generation facility of English problems provides a very useful and attractive service to students who study English in the distance education system on the Internet. This function generates exercise problems with the use of courseware contents, GAIA, and specific URL's HTML file selected by the students. The problem generation system first gets source text from GAIA or a WWW system on the Internet, and analyzes the structure of the source. Then, it chooses the words that will be omitted for blanks. Finally the system generates the problem form with some of the words omitted. When a student completes his answers in the generated problem form, the system checks and returns the results back to the student. Figure 8 presents a generated problem form that is taken from a WWW file on the Internet. This function increases the productivity of educators. Students can take a test by themselves using substantial resources of English text on the Internet any time.

the multicast or the broadcast function that our system provides.

Figure 8. Automatic Generation of Problems.

3.3. Learning Management System

I implemented the server and client program for the purpose of application services in a client/server environment such as learning management, message communication, and group management, etc. Clients communicate messages with the server through a socket connection, and handle several events that occur during the distance learning. The server is an independent program that processes clients' requests and handles the management of connections with clients. The server of this paper can notify other students of a new student's entrance to and exit from the learning group. Also, the server manages the student groups, and watches the state of each socket to maintain optimal network traffic. The server periodically removes those clients who do not respond to its request. Figure 9 shows an example of distance education in our client/server model. A student has information concerning the other students in a learning group and the student can exchange messages with the other members of the learning group. Educators can view a learning group and can send educational messages, including test problems, to any of the students, and can receive questions from the students. Educators are able to use either the unicast,

Figure 9. An Example of Distance Education in Client/Server Environment.

4. Conclusion

We need to develop CAI programs for distance education in distributed environments. Nowadays, it is more effective to develop courseware, which are operated on the Internet or a LAN in school, than to develop CD-ROM titles that are for use of only one student at a time. The reason is because educational resources need to be shared by educators and students in different places. Development of educational data that can be shared on the Internet makes the efforts of educators more productive. The applets, program modules, which are programmed in the Java environment can be run on any platform anywhere, thus, they can be shared by educators on the Internet. Recently Java is a popular and powerful object oriented language on the network.

In this paper, I designed and implemented a distance education system, the CAI courseware model for English learning using HTML and Java language. Our system has some functions to manage and control the flow of distance learning, and to offer interaction between students and systems in virtual space. Basic

WWW files containing contents of the courseware are constructed with HTML. Students and educators can access the preferred unit composed of the appropriate text, voice, and image data by using a WWW browser at any time. The education system in this paper supports the automatic generation facility of English problems to practice reading and writing from *GALA*, or various English text resources located on the Internet. This automatic generation facility of English problems provides infinite studying resources to students on the Internet. And educators can manage students' learning, and can immediately be aware of who is attending and who is quitting the lesson in a distributed environment. Also, students and educators can communicate and discuss a topic through the server from different places. I implemented these functions, which are required in a client/server environment, with the use of Java.

Future work includes the long-term use of this system in a distributed environment. I plan to make up questionnaires related to distance learning, and investigate the change of the learner's attitudes, results, interests and enthusiasm thoroughly.

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