

# An Internet-based Self-Learning Educational System for Efficient Learning Process of Java Language

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*Abstract* - This paper presents an internet-based Java self-learning educational system which consists of a management system named Java Web Player (JWP) and creative multimedia contents for Java language. The JWP is a Java application program free from security problems by the Java Web Start technologies that supports an integrated learning environment including three important learning procedures: Java concept learning process, programming practice process and assessment process. This JWP enables the learners to achieve efficient and interesting self-learning since the learning process is designed to enhance the multimedia capabilities on the basis of various educational technologies.

On-line voice presentation and its related texts together with moving images are synchronized for efficiently conveying creative contents to learners. Furthermore, a simple and useful compiler is included in the JWP for providing user-friendly language practice environment enabling such as coding, editing, executing and debugging Java source files on the Web. The assessment process with various items helps the learners not only to increase their academic capability but also to appreciate their current degree of understanding. Finally, simple multiple choices are given suddenly to the learners while they are studying through the JWP and the test results are displayed on the message box. The proposed system can be used for an efficient tool for learning system on the Web.

## I. INTRODUCTION

The importance of an internet-based virtual education increases because the virtual education can be used as an effective tool to convey new technologies and knowledge to people who need to obtain updated information or to be reeducated.

The worldwide web provides new opportunities for distributing all learning materials around the world over the Internet. The worldwide web enables anyone to have easy access to all learning materials over the internet any time and anywhere.

Most of interactive multimedia contents proved to be effective educational assistants. But, this assumes that the multimedia contents are well designed and well managed. The variance of students' learning abilities also makes difficult for the educators to maintain the quality of educational service. Internet-based self-learning system provides new opportunity for solving these problems with paying reasonable cost. There are few self-learning educational systems for Java Language and its programming.

Therefore, this paper presents an internet-based Java self-learning educational system which is designed to effectively convey the concept and programming skill of Java language to learners. The proposed system has also a simple and useful compiler for providing convenient programming practice environment. The implemented three important sequential learning procedures: Java concept learning process, programming practice process and assessment process, enable the learners to achieve academic capability more than the face-to-face education.

## II. DESIGN AND STRUCTURE OF THE PROPOSED SELF-LEARNING EDUCATIONAL SYSTEM

The proposed Java self-learning educational system is a Java application program which can be run on the Web with the help of Java Web Start technology. Java Web Start technology enables Java application programs to be easily distributed through the Web. Fig. 1 serves to demonstrate the execution process of Java Web Player (JWP) on Web with the help of Java Web Start. JWP is stored in Web server and hyper-linked by the text button named "1. Java Applet Course" in the web page shown in Fig. 1. If the text button is clicked by a learner [process 1 in Fig. 1], the Java Web Start is called [process 2 in Fig. 1] and then the Java Web Start downloads the libraries for the JWP from the Web server. When the download of the libraries are completed, JWP is executed [process 3 in Fig. 1]. The Java Web Start must be installed on the local system to execute the Java application program on the Web. Visual Basic Script codes are used to check whether the Java Web Start is installed on the local system or not. If not, the script codes help the Java Web Start to be downloaded from the server.

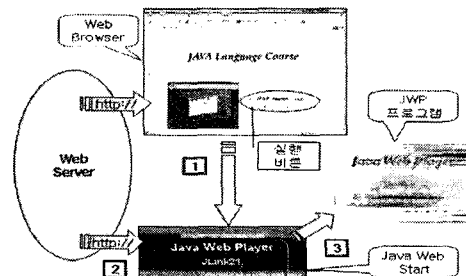


Fig. 1 Execution process of JWP through Java Web Start

### A. Structure of JWP

Fig.2 shows block diagram of the proposed JWP program. If both JWP program and a webpage having a hyperlink to the JWP program are stored on the web server, just clicking to the hyperlink to the JWP program through the web browser starts downloading the JWP program to the client and executing the JWP program. The JWP program provides players for each chapter which consists of sub-chapters. Dialog windows are used for simple quiz during studying each chapter. Assessment process is provided at the end of each chapter.

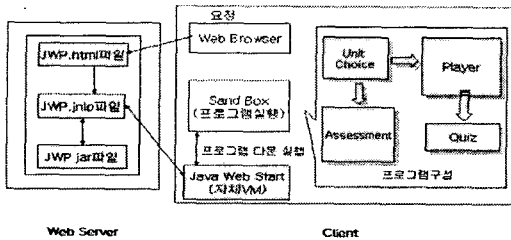


Fig. 2 Block diagram of the proposed JWP program.

### B. Player for Executing Lecture

Fig. 3 shows a captured screen shot containing slide menu and lecture executing menu of the player executing the content related to each chapter. The lecture control menu[Fig 4(a)] have six buttons which enable learners to study the content easily and effectively : button ① is for rewind, button ② for forward, button ③ for play, button ④ for stop, button ⑤ for starting Java compiler and button ⑥ for selecting target chapter. Figure 4(b) shows a window explaining the content of the selected chapter with narration. Figure 4(c) shows a captured screen shot of the content of the selected chapter and menus for backward, forward and skin selection shown in figure 4(d) are popped when clicking the right button of mouse on the content window. The pop-up menu makes it easy to move back and forth through the content. By skin menu users can select one of the three different skins. Lecture executing player mentioned above help learners concentrate on the subject by visual and audio assistance.

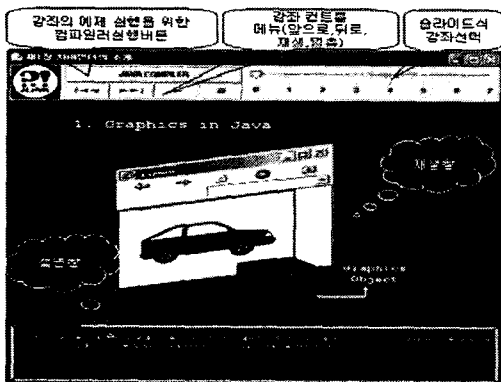


Fig. 3 Structure of lecture executing player

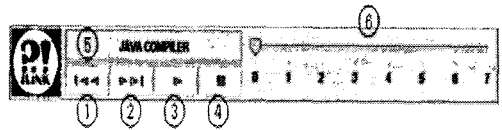


Fig. 4(a) Lecture control menu



Fig. 4(b) Window explaining the content

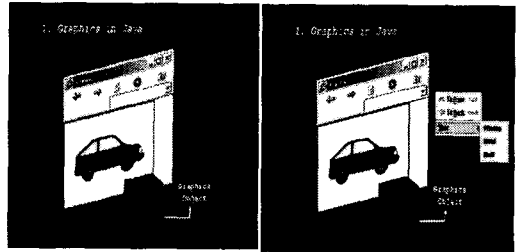


Fig. 4(c) Window showing the content of lecture  
Fig. 4(d) Pop-up menu

### C. Built-in Compiler Helping Practicing Java

To provide simple and convenient practice environment for Java programming, Java compiler is included in the JWP program and learner can compile and execute the java example programs offered by the lecture without their own compiler. Figure 5 serves to demonstrate what functions the compiler contained in JWP program has. The compiler running on the Web server needs to access the local system, which could result in violations of Java security scheme. To overcome this security problem, authentication process of Java Web Start is included in JWP program. Fig.6 shows source code compiling process.

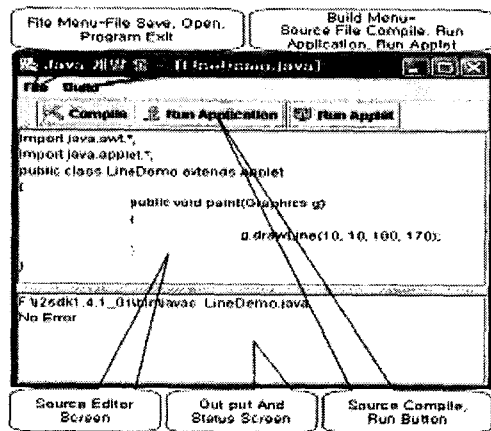


Fig. 5 Built-in compiler for programming practice

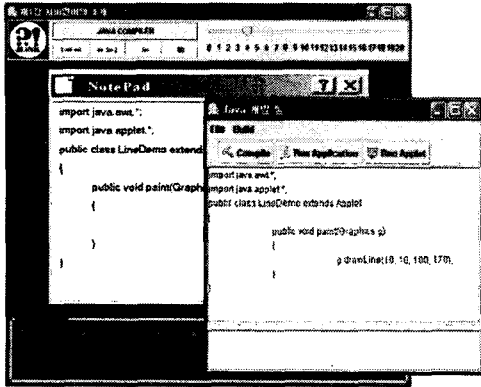


Fig. 6 A captured screen shot of compiling process

### D. Player for Executing Assessment

An assessment player in the JWP estimates how well the learners understand the subject. Figure 7 shows a captured image of assessment player consisting of question part and explanation part. The assessment process helps learners to enhance achievement of their learning because the learners can review their understanding by solving the offered questions. Figure 8 has many windows showing various functions of JWP program.

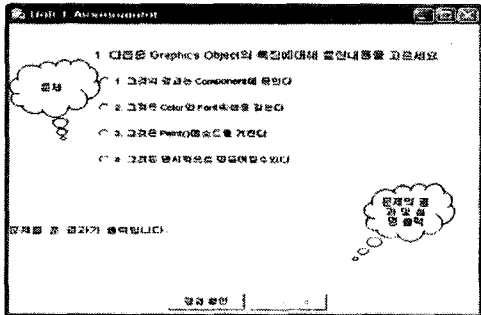


Fig. 7 A captured screen shot of assessment player

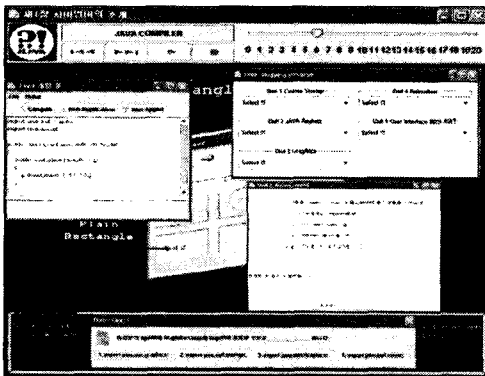


Fig. 8 Various functions of JWP program

### III. EXECUTION OF JAVA SELF-LEARNING EDUCATIONAL SYSTEM

In this section, JWP program proves to be an effective tool for Java self-learning educational system by giving the detailed explanation of implemented learning process of JWP program with creative content. Lecture executing player presents to the learners the content explaining with visual and audio assistance how to write a program code drawing a line in an applet [Fig. 9] and then opens an incomplete source file which encourages learners to fill in the blank by proper codes [Fig. 10].

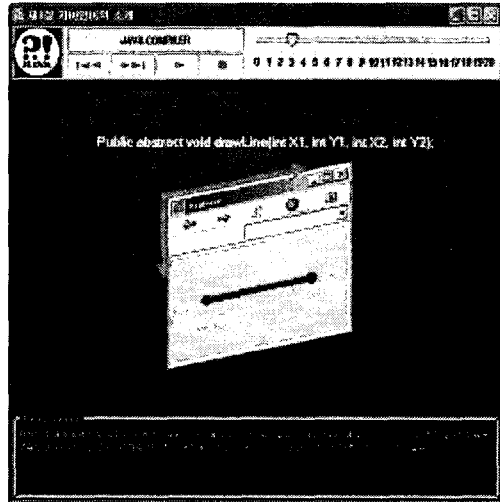


Fig.9 Concept learning for line drawing

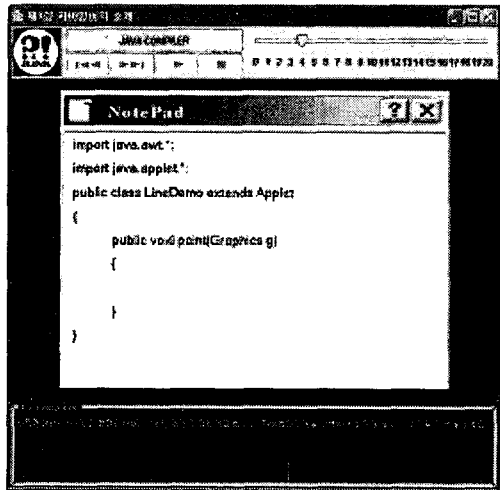


Fig. 10 Incomplete source file for exercise

After finishing concept learning, learners can practice Java programming using built-in Java compiler in JWP program. Fig. 11(a)-Fig. 11(d) shows a whole process of Java programming practice about drawing a line on the screen.

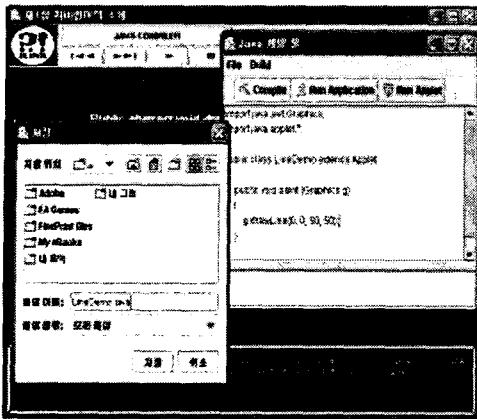


Fig. 11(a) Source coding and storing

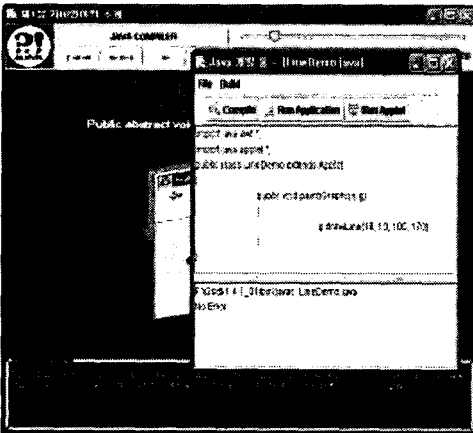


Fig. 11(b) Compiling

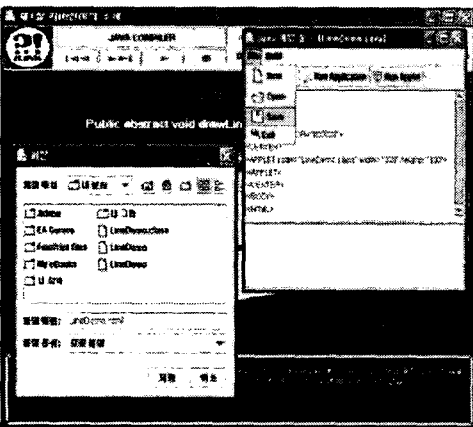


Fig. 11(c) Html source storing

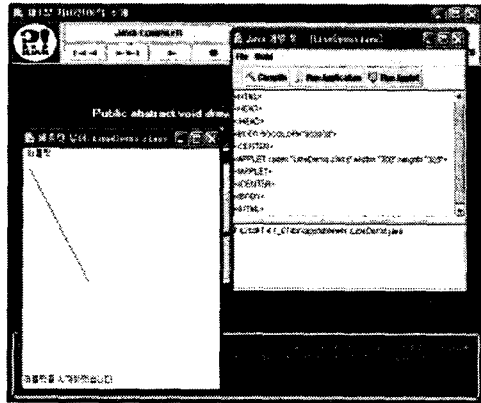


Fig. 11(d) Execution

Instructors usually exploit quizzes to examine to determine how much and how well their students are learning. In the JWP program, quiz is presented abruptly to the students during concept learning processes to make students concentrate on the subject and get more achievement. Figure 12 shows a quiz presented abruptly. A wrong answer causes proper explanation to be called as shown in Figure 13.

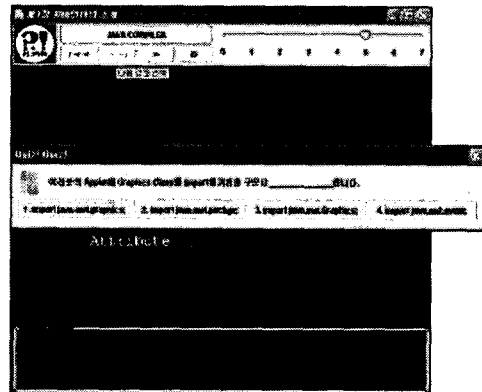


Fig. 12 Quiz presented abruptly



Fig. 13 Explanation for a wrong answer

At the end of each chapter during learning process, learners are to be given an intensive achievement test by using such quizzes as shown in Fig.14. According to the answer, proper explanation is provided to the learner to boost the effect of learning.

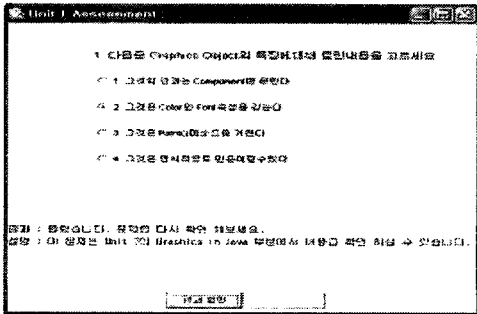


Fig. 14(a) In case of selecting a wrong answer

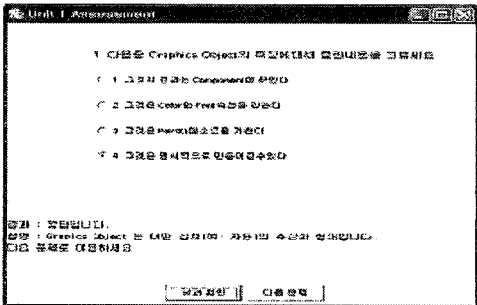


Fig. 14(b) In case of selecting a right answer

#### IV. CONCLUSIONS

An internet-based self-learning educational system with creative multimedia contents for Java language is implemented as Java application program free from security problems by the Java Web Start technologies that supports an integrated learning environment featuring as follows. First, the multimedia contents with the synchronized video and audio is provided to effectively convey the concept of Java programming to learners. Second, user-friendly compilation and execution environment is provided by including a Java compiler. Quizzes presented abruptly and achievement test at the end of each chapter are exploited to enhance learners' understanding.

The proposed system would contribute to saving time and labor of learners since the learning process is designed to enhance the multimedia capabilities on the basis of various educational technologies. The proposed system can be a useful model for implementing a self-learning system on the Web.

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