Development of An Education Tool for Computer System

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Abstract

An education tool has been developed to explain internal behavior and structure of computer graphically. It is written in Java Language and designed for students to understand how computer works in the classroom lecture of information science. This paper describes some characteristics of our education tool and improvement of its facilities, especially embedded mail handling module for information exchange between teacher and students.

1. Design Concept for our Education Tool

First of all, we describe design concepts of our visual simulator as education tool and almost these concepts have been realized in the previous version of our simulator as the existing facilities. Our design concepts are summarized as follows:
1) It is used as a practical education tool, which covers from information literacy to computer system. It can illustrate internal structure and behavior of Neumann-style computer together with projector in the classroom lecture[1].
2) It may provide stepwise and continuous execution modes of programs and realize an easily learning environment for assembly programming exercise. It is implemented in a single source code of Java language to support both of stand-alone application and Java applet.
3) It is easily maintained, modified and customized for multiple applications such as demonstration tool, communication one (in other words, collaboration tool) and so on. It is quickly distributed from web server into users who want to utilize through network connectivity.
4) It is equipped with a simple GUI for interactive manipulations which includes initialization, program loading, stepwise execution and continuous (namely automatic) one. It is independent from kinds of operating system and machine specification and available in multiple platform environments. It works on the major web browsers such as Microsoft IE and Netscape Composer/Navigator so that it does not need additional software.

The existing facilities of simulator are illustrated with its characteristics and practical example of use. With our visual simulator, it is demonstrated how computer works: namely, loading program into memory, fetching each instruction of program in the memory, decoding it into several fields such as operation code and address fields, executing accordingly to the result of decoding instructions which includes, for example, data fetching, arithmetic/logical operations, data storing, conditional/unconditional jumping, subroutine call/return and so on. Many of these concepts are not only original ideas for our simulator, because they are efficient ideas for designing education tools and effective methods for utilizing tools in the practical situation. It is our original approach to develop a visual simulator(called “VisuSim”) with Java for understanding internal behavior and structure of computer and it is also designed to work as both stand-alone and Java applet in order to use from classroom lecture to after school and/or at home[2].

2. Some Improvements for our Education Tool

From a brief evaluation of VisuSim for a few previous years, it has been decided to improve VisuSim and enhance the following two facilities that can provide help message and its proper communication method through mail sending and receiving. This section explains details of the latest enhanced facilities such as online help/guideline and embedded mail handler. Both of online help message and guideline display are essential to students who manipulate Vis-
uSim after school or at home. The former is helpful to give students some kinds of concrete advices how to describe assembly programs by means of showing instruction set table and some sample program codes, and the later is useful to indicate how to operate VisuSim with mouse-cursor-position sensitive guideline message display. Online help message window can be invoked by pushing “HELP” bottom, used as an information board and utilized by students who learn from information literacy to assembly programming with VisuSim. By addition of online help and guideline message facilities into VisuSim, its users may obtain more information about operation of VisuSim than the previous version. Its online help mechanism is implemented to make VisuSim read a specific file and display its contents on the newly created window. In the same manner, teacher can rewrite such a specific file, customize the help message of VisuSim for each student, and select suitable files of sample codes according to student’s understanding level.

The mail handling facility embedded in VisuSim has been realized with pure Java code and consists of two major parts below: namely, SMTP-based mail sender module and POP3-based mail receiver one.

1) Characteristics of SMTP-based mail sender: This mail sender is different from other general-purpose mailers’ sending modules at the following two points. At first, when students who use VisuSim meet some problems and consult such a situation to teacher or friends, they can transfer the current data of all the registers and memory into mail to be sent simply. Data in the content received mail can be analyzed in order to investigate whether student understands or not by teacher who received such a mail. This is a major reason to develop a special-purpose embedded mailer for VisuSim. Secondly, user may specify the e-mail address as not only domain-name oriented notation such as “imai@eng.kagawa-u.ac.jp” but also IP address specific notation such as “imai@#192.168.1.1”. Almost temporary (informal) mail server for users of VisuSim should not always be entered on the official DNS and therefore such a mail server must be only specified with IP address.

2) Characteristics of POP3-based mail receiver: As the same functions of SMTP-based mail sender, this mail receiver has the following two characteristics different from others; namely easy restoring data of all the registers/memory in VisuSim from content of the received mail and IP address direct specification of mail server. On the other hand, it has some weaknesses to handle several kinds of mail message. For example, it cannot process mail with attached files. Although it reads out the specified mail from server, it shall not delete that mail from server. So another mailer will be able to process non-deleted mails with attached files. The mail facility of VisuSim may be useful not only for consulting communication between students and teacher but also for online submission of students’ reports to teacher. The mail sender and receiver of VisuSim can handle message in Japanese as well as English.

Figure 1 shows a sample scheme of information exchange between users of VisuSim by means of its mail sending and receiving facility. With such embedded mail handler of VisuSim, students who need some kind of advise can send help mail to others and obtain suitable advises from teacher and/or other students who has understood more than them.

Figure 1. Scheme of Information Exchange through Mail Communication by VisuSim

3. Concluding Remarks

We can conclude our study as follows:
1) With use of our visual simulator, graphical demonstration can be available in classroom lecture on computer system and information literacy, so that it is efficient for even beginners of computer to understand the internal structure and behavior of computer more precisely.
2) Online help and guideline message get useful to users, and embedded mail handling facility can be provided for communication between its users. These facilities will let students manipulate our simulator not only in the classroom lecture but also after school and/or at home.

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References