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Estimation of e-Education system using Virtual Exploratory Learning

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Abstract

Recently studies using the e-Education system are expected very much, but most of them would be based on the WEB style contents, which includes texts, figures, photographs and actual videos. Although it is thought that actual videos are very effective, production cost of it may be too large to produce interactive teaching materials. Meanwhile, Studies using 3D-CG animation have been reported to be fine. To solve this problem, e-Education system named Cyber Assistant Professor 2 (CAP2) has been developed in my laboratory. It is based on the human shaped software robots implemented by 3D-CG animation and voice synthesis technology, which act as Virtual Teachers or Virtual Students. Further, the hypertext language named Cyber Person Scenario Language 3 (CPSL3) has also developed to reduce a production cost of teaching materials. Furthermore, Virtual Exploratory Learning (VEL) has developed to assist students in Virtual Science Experiment.

1. Introduction

On teaching the theory, principle or mechanism of science to junior high school students, the most effective teaching material may be an actual video. However, actually it is difficult to take pictures of invisible science phenomena. Moreover the production cost of the actual video may be too large depending on the subject and it is difficult to produce interactive educational contents. In Japan, one of the most representative science educational materials would be "Science Network" produced by Japan Science and Technology Agency. Science Network has a lot of actual video libraries. These actual videos are very effective to teach principles of science. But most of them are not interactive teaching materials. The drawback of it is that it's very difficult to

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edit or extend teaching materials by teachers on the spot of syllabus planning because it takes a huge cost to produce actual videos. On the other hand, the 3D computer graphics (3D-CG) animation using a virtual actor's speaking would be very effective as an educational medium[1,2]. But it usually takes long time to produce 3D-CG animations. The most popular method to produce 3D-CG animations is to use some 3D-CG animation tools and non-linear video editing system. But it takes huge time to render 3D-CG animation frames and to integrate the animation, sound, music, and speaking. And it can't construct an interactive system. Another way to make it is to use the programming language and some libraries (E.g., OpenGL). But its production cost also may be too much for educational contents. From this point of view, the SDK (System Design Kit) libraries for human shaped 3D-CG models were reported. "Jack"[3] was developed by Pennsylvania University, which was a LISP language SDK for military application. Alice[4] is a 3D graphics programming environment developed by Carnegie Mellon University. MPML[5] is a hypertext for the Web presenter developed by Tokyo University. TVML[6] is a script language that creates a real time CG animation of the news show automatically. However, as we have reported[14,16] these systems are not suitable for developments of teaching materials. To reduce the cost of producing 3D-CG educational contents and improve the capability of the educational system, we have developed **e-Education** system named **Cyber Assistant Professor 2** (**CAP2**) and the exclusive scenario language named **Cyber** Person **Scenario Language 3**(**CPSL3**) to write a scenario of 3D-CG animation. And we have developed the new function named **Virtual Exploratory Learning** (**VEL**) service in **CAP2** system. This paper describes the summary of **CAP2 and CPSL3,** and then describes the detail of **VEL** service.

2. Cyber Assistant Professor 2 and Cyber Person Scenario Language 3(CPSL3)

We have developed e-Educational system named **Cyber Assistant Professor 2** (**CAP2**)[7-19]. It includes **Virtual Actor**(s), **3D-CG Stage** and many kinds of **Stage Parts** (3D-CG shaped models, photograph panels or text panels). Fig. 1 shows the window of **CAP2 browser**. Virtual Actor is a software robot of human shaped based on **3D-CG** technology and **TTS** (Text To Speech synthesis). Virtual Actor speaks English or Japanese by TTS with facial expressions and body actions. To reduce the production cost of CAP2 animation, we have developed the exclusive script language named **Cyber Person Scenario Language 3** (**CPSL3**)[14,16]. To describe a 3D-CG interactive animation scenario easily, we designed the <TAG> based script

Fig. 1 Cyber Assistant Professor 2.

language similar to HTML for the Web page. The way to make a scenario is just to put an appropriate text string between a pair of <TAG> markers (Named Body Text). Some <TAG> marker includes the Option Switches to specify the system mode or set the State Variables. CPSL3 coding can be edited by using the text editor or the word processor. Fig. 2 shows the example of CPSL3 coding.
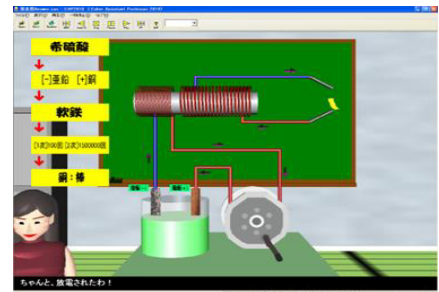
CPSL3 has more than 40 tags. Table 1 shows the main tag commands of CPSL3. CAP2 browser converts CPSL3 scenario file to the real-time interactive 3D-CG animation. **Target Link** function enables the interactive animation, which loads the specified scenario file by Student's operation. <REQUEST> tag command can set a **CASE** number in any **Stage Parts**, which works as a scenario link information (named **Answer Target**). <ANSWER>tag commands define the entry points of **CASE** number. If student clicks the **Answer Target** by mouse, the animation scenario will change to the specified scenario file. Figure 3 shows the example of **Target Link** coding. The detail of CPSL3 can be referred in References[13-17].