Chapter 3.31
CAL Student Coaching Environment and Virtual Reality in Mechanical Engineering

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ABSTRACT

This work presents an extension of our study on multimedia patterns of interactions and development of computer aided-learning (CAL) engineering tools. We used four approaches in implementing the CAL tools for user visualization that is, that is, 2-D, 3-D, coach environment and desktop virtual reality. The designed CAL tools have been enhanced to enable the integration and investigation of visualization in various engineering problems for undergraduates with particular weak learners. Each problem was designed using different authoring tool. More significantly, we have enhanced some of the CAL tools to the degree where the user can interact and be coached independently. This dramatically increases the quality of the tools i.e. patterns of interactions, 2-D and 3-D views of synthetic models. In general the result shows that the CAL tools could alleviate the user interacting and instill a sense of learning and the user understand the engineering problem better.

INTRODUCTION

Multimedia has been applied successfully in diverse areas of medicine, manufacturing, scientific engineering visualization and education (Manjit Sidhu, Selvanathan, Diljit, & Ramesh, 2002; Mcateer, Neil, Barr, Brown, Drapper, &

Henderson, 1996; Sheingold & Hadley, 1990). However today, both multimedia and desktop virtual reality CAL tools are becoming one of the most used technologies in delivering high quality teaching aids and allows virtual perception in general. Thus, the world of virtual perception has now extended into the area of engineering.

Before conducting a complicated experiment, a learner can now rehearse on a virtual engineering problem, that is, by using a computer simulation. By wearing a special pair of glasses, which produce the impression of a three-dimensional object, they are able to manipulate the objects parts as they would in a real situation.

Modern and powerful computers are capable of astonishing things, however they are still a long way from reaching their peak of performance. Engineers and technicians increasingly can enter into and interact with, an artificial, virtual reality environment that is more and more like the real world. Furthermore the computer can provide sensory impulses for our eyes and ears, creating a near perfect spatial object. As such, in the context of engineering users of CAL tools can interact, manipulate, and visualize the objects better.

The major aim of this study is to identify engineering problems that are difficult to visualize and understand among undergraduates with particular weak learners. The weak learners are students who take a longer time to complete the mechanical engineering course. The advanced students normally takes approximately four years to complete the undergraduate degree course, however the weak learners may take up to five years to complete. As such, the weak students need an alternative means of learning to improve their knowledge in the subject matter. Other aims of the study includes, to design and develop interactive multimedia and desktop virtual reality (DVR) CAL tools with appropriate patterns of interactions by providing interactive user interfaces for exploring, visualizing and problem solving. The study also identifies the ways that multimedia and DVR support the approach at both theoretical and undergraduate practical level in engineering. The application area in this research is engineering mechanics and dynamics because this area contains a wealth of interesting and difficult to understand problems among weak learners at University Tenaga Nasional (UNITEN).

COMPUTERS AND PERCEPTION

Today, with the aid of virtual reality environments, a rich variety of applications and new three dimensional and imaging technologies ranging from automotive, engineering, and aerospace design to weather simulation, climate modeling, and medical applications, with many different research and engineering objectives, and user types are being carried out. Visualization can be useful and important in many ways. For example, an architect can walk in a house that has not been built, a doctor can travel through the respiratory system looking for malignant tumors, a chemist can create new compounds at a three dimensional drawing board and the builder of a new power station can put his designs on different foundations in order to test them for safety.

For many years now, automobile companies have developed their new model, using computer simulations; even high-speed crash tests are carried out with advanced computers. After the virtual crash, design engineers can inspect the vehicle from all sides and look into the mangled interior. Thus the use of computer simulation considerably reduces the number of prototype cars, which must be built before a vehicle is ready for production. Consequently, multimedia and desktop virtual reality CAL tools are increasingly being employed in industry and education.

VISUALIZATION

As an important component of the CAL engineering tools, the use of visualization for engineering