A Rocket Launcher Virtual Training System Design

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Abstract. The overall design scheme of a rocket launcher is proposed in this paper. Modeling and rendering, model transformation and scene synthesis in scene generation has been studied. And the interactive training processisdeveloped. Moreover, the key technology of system design is illustrated.

Introduction

After years of development, virtual training has been successfully applied in the aviation and aerospace equipment [1], tanks and missiles [2][3], military vehicle [5] and other equipments. It has been proved that virtual training has the advantages of low investment, prove its high yield, good effect. In the research of virtual maintenance of large equipment, some work has already been done. Li et al [5] studies system design, system structure, composition and realization method of virtual maintenance. Dynamic link library has been used to constructe a complicated equipment maintenance training simulation system [6]. Distributed network virtual repair system are established by using VRML language, so the distributed users can share the maintenance activity under the network environment [7].

With respect to the characteristics of a certain type of rocket launcher training, this paper establishes a virtual training system development platform, which can be used for operation training and repair training. In the framework of the platform presented in this paper, Solidworks is utilized for modeling and 3ds Max is used for renderingto achieve realistic results. Finally, Virtools is utilized for interaction design.

Overall design

Based on modeling, rendering, animation and so on, the rocket launcher virtual training system constructs the rocket model and virtual environment, simulatesthe operation process of arocket launcher, to achieve the teaching and training of the rocket launcher with little resource consumption and short development cycle.

The mechanical parts are modeled in Solidworks and rendered in 3ds Max to achieve the sense of reality, and then they are plugged into Virtools for interaction design.

A.Virtual environment modeling

SolidWorks, a 3D mechanical software developed by the French Dassault company, is utilized forrocketparts modeling.

B. Interaction mode

A desktop virtual reality system is adopted.Keyboard and mouse are utilized as interface device. The behavior executed by mouse and keyboard are defined by Virtools BB script, i.e., operation training and maintenance training.

C.Disassembly process planning

Disassembly process modeling is a problem need to be solved in virtual training, and the disassembly method is the key point. Petri network planning method is used to model the disassembly process of the rocket launcher system as a guide virtual training system development.

D.Virtual training

SolidWorks is utilized as the modeling method, 3ds Max is adopted as the intermediate platform, and Virtools BB script language is used to develop virtual training system.

Scene generation based on Virtools

A. modeling and rendering

3D model is the basis of the rocket launcher virtual training system. Therefore, model will directly affect the operation effect and the fidelity of the virtual environment.Sincethe rendering materials cannot be shown in Virtools, 3ds max is utilized for rendering model to achieve the true sense. Because most parts are made of metal materials, the sense of reality and gloss material is very important. At the same time, in order to achieve the best display effect in Virtools, 3ds max mapping function is applied.

B.Model output

Virtools comes with output plug for Maya,3ds MAX, Light Wave and XSI. Therefore, 3ds Max is utilized as an intermediary to connect SolidWorks and Virtools. MAXScript is used to import STL entity components in batch.

C.Scene generation

Through the 3ds Max Exporter exe plugin, the 3ds Max rocket file can be exported into NMO format. The elements whichcan be derived from 3ds Max are: (1) the rocket digital model; (2) the model material and color; (3) the modeling set light, including Free Spot, Target Spot, Oni, Target Direct, Free Direct and other standard lamp types; (4) any camera created in 3ds Max.

Interactive design

The simulation of rocket launcher virtual operation, and the display of structure parts, demand a two-way communication betweenthe system and the participant.

When the operator clicks parts in the model, and then click the option box, the selected components will make the appropriate action, such as flicker, moving, rotating, which can make the whole picture more dynamic. The interaction task and scene control should be accomplished by using 3D pick up of the mouse in Virtools.

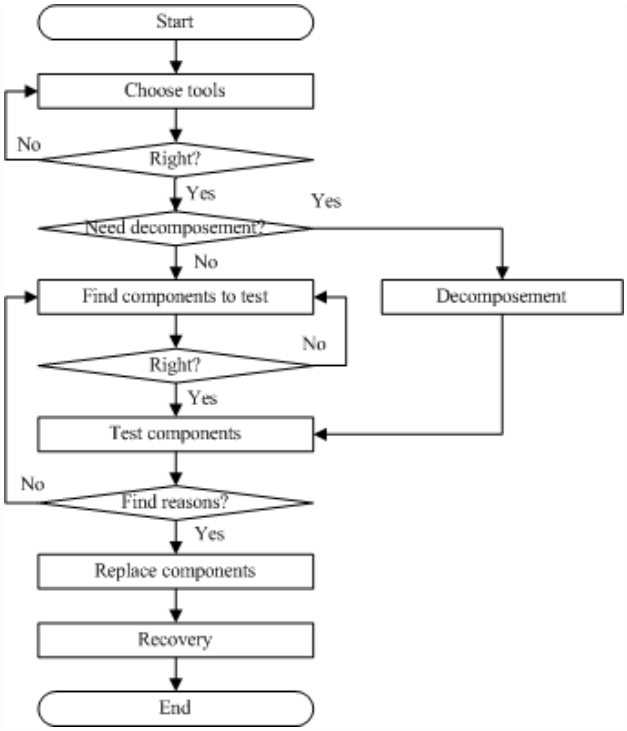

Fig.1. Maintenance flow chat

Key technology

A.Same object cannot be chose twice

"Set Cell"can choose a unit in the array according to the column and row indices. By using two "Set Cell" to replace the "Object Set" (see Figure 2),objects after the implementation are assigned with a "security", i.e.,they cannot be selected again.

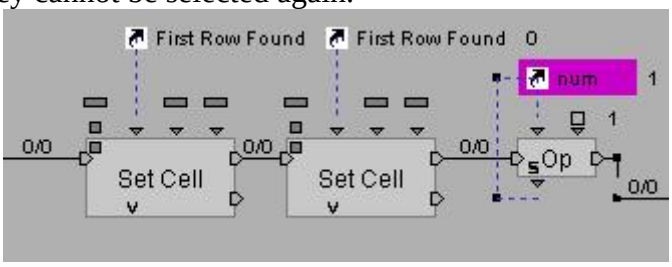

Fig.2.Replace Object Set

B.Tools and components cannot be hidden

Tools and spare parts are all set to hide at initialization. They are shown when needed and hidden after using. Since some tools and spare parts is composed of various components, abusing the "Hide" module may leads to bug. Therefore, the "Group Iterator" module is used to package all models which need to be hidden, as shown in Figure 3.

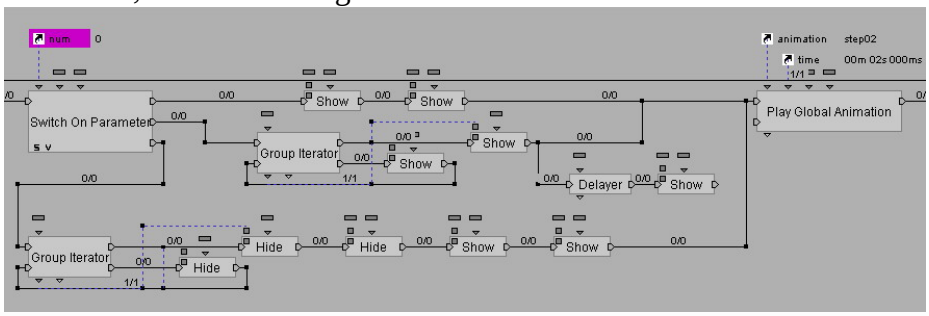

Fig.3. Hidden realization

C.Warnings aboutRealtime Updating

It is found out that the lack of information interaction results in that script failed with synchronous operation. Therefore, the information interaction between the operator script and the warning script is added. As shown in Figures4 and 5, a "Send Message" is addedto the operation script anda "Wait Message"is added to the warning script.

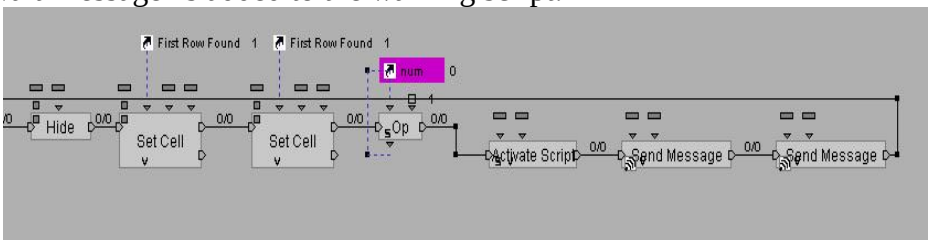

Fig.4. Modified operation script

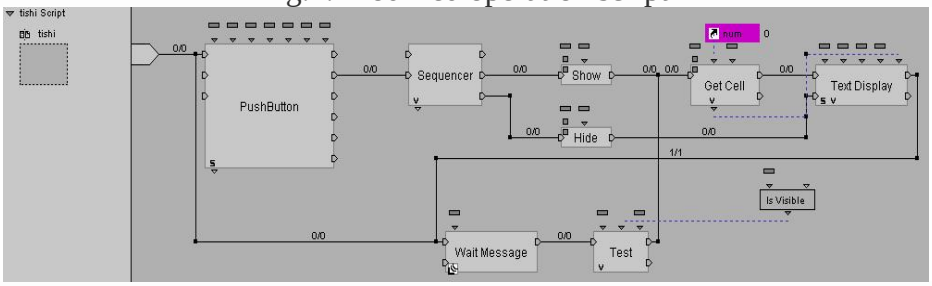

Fig.5. Modified warning script

Conclusion

A rocket launcher virtual training system is developed. The modeling of rocket launcher parts, the rendering of material models, the model transformation among various software, and the scene synthesis method are studied. Three key technologies, i.e., same object cannot be chose twice, tools and components cannot be hidden, warnings about realtime updating, have been solved or existing solutions. The Virtual training system can sustain the teaching and training mission, and enhance the equipment maintenance ability of the weapon system.

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