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Analyzing the Navigation Behavior and Generating the Operational Profile-based Test Technique in the VR Tourism Systems using Formal Verification and Modeling Tools

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Abstract: This paper describes a behavior based model that provides deep experience about the transitions of navigation through the events or activities illustrated through the example of the VR Tourism Systems is proposed. This research aims to identify the most common and initial behavior of traveler and complex operational properties in the processes of navigation to design and develop the better and real system under real operation condition. By using a Perti Net design tool Hierarchical Petri Net Simulator (HiPS), we realize to model and analyze navigation behavior and also generate Operational Profile-based Test in order to improve the reliability of the VR application system.

Keywords: VR Tourism System, navigation, HiPS, Operational Profile-based Test, Petri Nets.

1. Introduction

Nowadays, the development of the Virtual Reality (VR) [1] systems are emerging rapidly and becoming the next generation technology. Despite the challenges such as unarranged plan and various complex operational properties, the development of these systems are growing fast. Here, "Exploration Behavior" in VR Tourism System means the random event participation and place visit of tourist during travel. Virtual Reality (VR) application are being developed and used in a wide range of application domain. These systems provide new insight into many difficult problems and offer advanced interaction techniques that may not be available. We also target to formalize the Operational Profile based behavior of the tourist such as taking a picture, watching a view and emotional or mental expression. For the Modeling, Analyzing and Testing the Operational Properties, we uses HiPS [3], developed and released by Wasaki Lab., Shinshu University as a Petri Nets design tool. Petri Nets [2] are a graphical and mathematical modeling tool. They are a promising tool for describing and studying information processing systems that are characterized as being concurrent,asynchronous, distributed, parallel, nondeterministic, and/or stochastic.

2. Motivation

During the development of VR system the complex process and final debug will be cost a lot. The use of operational profile based ability will help to design nontrivial technical systems which is more efficient and less risky. For this we are classifying the operational and functional profile of the whole system related to the users, VR devices and system. Here in Figure 1 we can see the classification. The usage of HiPS will help us to design non-trivial technical system which is more efficient and less risky. This motivates to implement the HiPS that can simulate and measures the potential performance of operational profile of VR system under real operating condition and user can watch and manipulate the simulated environment in the same way we act in the real world, without any need to learn how the complicated user interface works. In addition, during the development of VR system with the effective performance and interaction, simulation of critical system like medical hearth surgery, flight training, atom bomb or nuclear plants are the great challenges for the software engineers. Today improving the reliability of concurrent

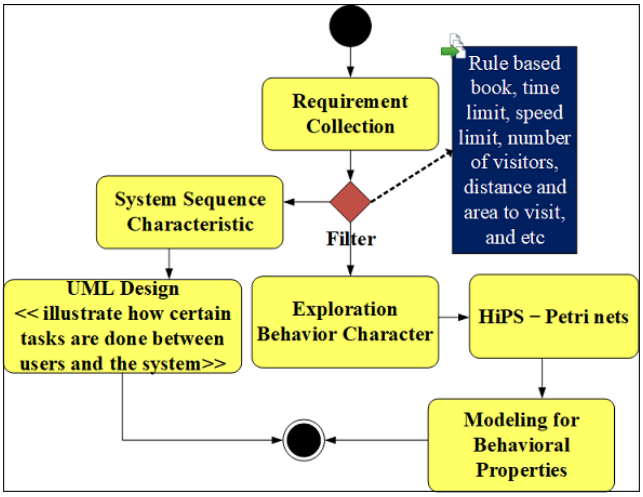

Fig. 1 State Diagram:Modeling and Verification Methodology

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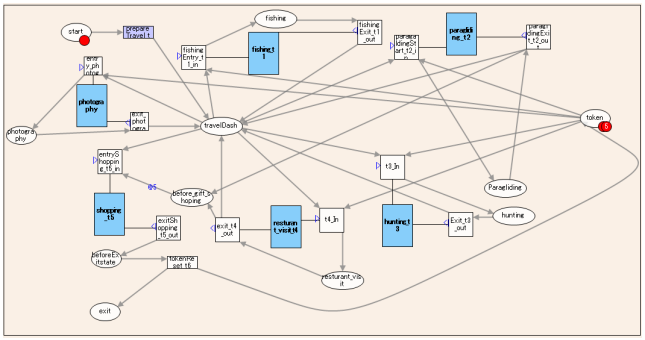

Fig. 2 VR Application modeling using HiPS Tool

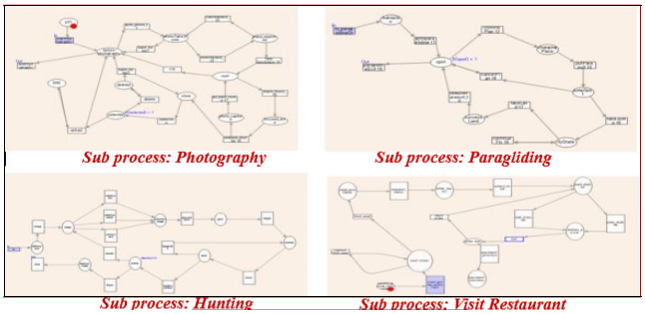

Fig. 3 Module Based Modeling: Subprocesses categorizationl

software to prevent users from being damaged by the occurrence of the faults is one of the serious issue [4]. In this research work, we focus in modeling the exploring behavior to:

(1) Generate the extended coverability tree for testing Liveness, Persistence, Synchronic distance and Fairness properties to accurately maintain transition information [2], and

(2) Design the non-trivial technical systems to measure the potential performance of real system under real operation conditions which is more efficient and less risky.

3. Methodology

System developments are very complex and the development of a complete and consistent model of the system is almost impossible and never cost effective [5]. In software engineering, engineers rarely invent new modeling languages to address such complexity during the construction of application. In the use of UML [6], Use Cases and Sequence diagrams can be used in the early analysis phase to discuss early requirements that supports the modeling of behaviors during the complete design of the system and deployment of the digram that can model the design and implementation details. The dynamic properties depend on the initial marking and are in fact analyzed by generating the set of reachable state spaces [3]. In this research work, we use HiPS tool to model the exploring behavior of the system that has been designed to be develop. Though HiPS cannot satisfy all needs of VR Application modeling but present features that can be appealing in many context within the application development process. The ability of easily modeling concurrency and synchronization aspects, the intuitive graphics notation, the formal semantics that supporting tools make HiPS modeling tool. Here we can determine the following behavior from the different perspective of modeling.

(1) Determine the set of transitions, where each transition has event, precondition, post condition and guard, and

(2) Calculate the expected time spent and total time in the transient tangible marking.

4. A Case Study

Here we are able to trace all the possible transition from the events and subsets of activity process simulated by HiPS tool. This method implicates on the number of resources that has been used during the resources utilization in system like memory, process, devices for travel, activities and threads that run simultaneously. In the Figure 2, it shows the modeling of VR system associated with events or activities and linked by the transition which is ready for the simulation of random visit possible events during travel by the tourist. Due to the large system it is quite complex for modeling the all the profile and behavior of the whole system and for the better solution we have implement the divide and conquer technique to make the better modeling. We can see in Figure 3 the implementation of module based modeling of the system.The sub process like Photography,Paragliding, Hunting, Visit Restaurant has been investigated for determining whether the event access pattern among the set of events or exploring subsets during travel that help for the best trip planner.

5. Conclusion and Future Work

This original proposal is based on the Exploration Behavior and Operational and Sequential profile. It's implementation is under the test and analysis for modeling the VR Application System. During the implementation of the Extended Coverbility Tree (ECG) [7], reports the behavioral analysis related to the resources utilization and suggest for the refine modeling to guarantee no overflows in the buffers or resources utilization. In the future, we will improve the model to the Stochastic Color Petri Net to simulate and measure the potential performance of real system under real operation condition. The analysis and results of modeling will help to improve quality of VR system.

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