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TRAINING PROGRAM BASED ON DIGIEAL CONTENTS FOR PROTECTING CULTURAL ASSETS FROM FIRE

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Abstract

This study will build a prompt response system based on accurate information about the internal structure of cultural heritages, including the roof structure, to improve the ability to contain and respond to the fire of wooden structure for safe preservation of cultural heritages with historical and academic values that are very vulnerable to fire, and develop a training simulation program based on virtual reality by applying the concept of Edutainment for systemized and interesting training of trainees with a response manual.

keywords : cultural heritage, fire safety, simulator

1. Introduction

As most of the major cultural heritages of Korea are wooden structures, it is actually impossible to contain fire after about 20 minutes, but there are currently no standardized fire safety technologies(Geumjeong Fire Station 2008; Jongno Fire Station 2008-1; Jongno Fire Station 2008-2). For these reasons, it is necessary to develop a fire response game software for each type of cultural heritage for the firefighters to acquire accurate knowledge of the internal structure of cultural heritages, including the roof structure, for prompt response systems, develop a response manual for the burning process based on the accurate understanding of internal structure of cultural heritages for systemized training, and improve the execution.

2. Development Measures

As shown in Fig. 1 below, the software consists of a DB of internal/external members and structures of wooden cultural heritages for safe preservation of cultural heritages with historical and academic values, a cultural heritage characteristic recognition program to learn the structure of cultural heritages and the accurate process of assembly/disassembly, a simulation module of burning process to build a simulation of cultural heritage burning mechanism, including the occurrence of fire, the process of

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spreading, and the time to the peak of fire, and a fire control game simulation model that allows systemized training of fire containment and response procedure considering the characteristics of cultural heritages.

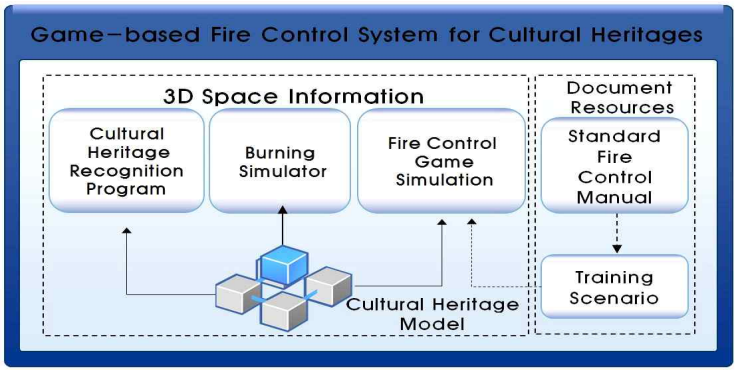

Fig. 1. Software Configuration

2.1 DB of Cultural Heritage Models

The system configures a DB using numerical data and actual drawings to provide accurate information about the structure of cultural heritages. Numerical data and actual drawings were used to build the DB of actual models of architectural materials, including the stylobate, foundation stones, stairs, columns, window frames, beams, walls, Jusimpo, Eaves, angle rafters, Jeoksim, plaster compacting, and roofing.

To maximize reality, it applies real-life mapping instead of mapping of virtual architectural finishes to configure a DB of texture using the related photographic and image resources to provide realistic finishes and architectural assembly information for the virtual simulation.

2.2 Development of Burning Simulator

The scenario of fire of cultural heritages uses the FDS and Smokeview based on the computerized program of fire and Pyrosim, which is a commercial program, to gather the data of burning process and configure them into a 3D animation of how the fire spreads and burns. For a realistic depiction of fire of cultural heritages, this study applied FDS (Fire Dynamic Simulator) which is a program developed to clarify the burning process based on the computational fire dynamics. This program was developed by the U.S. NIST (National Institute of Standards and Technology) based on Field-Model to simulate and analyze the impact of fire on a space. FDS is based on Navier-Stokes Equations and able to use a visualization program called SmokeView to qualitatively analyze the computational results of FDS on the fluctuation of smoke and temperature. It also uses the ASCII file for a quantitative evaluation of each position. The calculation structure of this program calculates the physical quantity (temperature, smoke concentration, carbon monoxide, carbon dioxide, heat discharge, etc) through the process in Fig. 2.

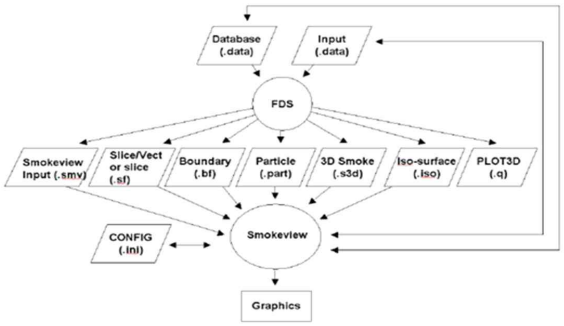

Fig. 2. Calculation Structure of FDS

3. Conclusion

This study discusses the development of a program that trains and nurtures the ability to responds to fire promptly and properly in the early stage for the protection of cultural heritages from fire. The program suggested by this study largely consists of four modules: first, it is a DB of 3D model for 3D visualization of target cultural heritage in real-time. Second, it is a cultural heritage characteristic recognition program for the fire responders to recognize the characteristics of cultural heritages. Third, it is a simulation program to identify the characteristics of fire of cultural heritages for a proper response scenario. Finally, it is a training game program that uses the outcomes of the three other modules to nurture the ability to respond to various fire scenarios.

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