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Design of Simulation Training System for Fire Safety Inspection Based on Computer Simulation Technology

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Abstract

The purpose of this study was to design a simulation training system for fire safety inspection based on three key technologies which involved three-dimensional geographic information system technology, three-dimensional modeling technology and visualization of human-computer interaction technology. First, basic development ideas and guiding principles of the simulation training system were drawn from the analysis on current situations and actual demands of fire safety inspection practice training at present; Accordingly, the basic framework with three platform was designed, including back-stage administrator control platform, teachers' guidance platform and student training platform in front stage; as well as it was put forward to establish three-dimensional model not only consist of basic scene models and detail scene model base to diversify specific training scenes. Finally, functions of the system was divided into four modules from double angles of teaching staff and trainees respectively, including auxiliary self-learning, human-computer interaction, arrangements for training task, training effect feedback and evaluation. Fire safety inspection three-dimensional simulation training system could be applied to colleges or universities for fire profession teaching, fire brigades and fire safety key units to cultivate fire safety inspectors, and realize " practice training everywhere as well as teach, practice, test, assessment with seamless docking ".

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Keywords: computer simulation, fire safety inspection, three-dimensional model, simulation training

1. Introduction

It is necessary for public fire safety police officers and fire safety manager in enterprise to grasp fire safety inspection skill. At present, after fire safety on-site inspection, the practice on illegal investigation and fire hazards rectification have achieved simulation exercises through fire supervision and inspection module of fire supervision and management business information platform or the household registration management system and intelligent fire terminal in enterprises. However, practical training of fire safety inspection is also mainly used in two ways: First, to construct inspection scenes with plane picture and video display of real building and situation; Second, to carry out practical training with realistic sites and buildings. The former training methods could not bring strong sense feeling for trainees, and it is difficult to grasp whole of inspection situation, as well as pictures and video are often only for fire hazards so that the content of training subjects and effect was limited. The latter method could make trainees enter actual fire safety inspection environment for training, but frequent training needs could not be meet because real scene were limited, and it is difficult to ensure quality and quantity of training [1-3].

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Three-dimensional simulation training system based on computer simulation technology could provide a training platform with real information, real-time dynamic for trainees to practice command, practice procedures, practice skills and practice tactics. Three-dimensional simulation training system has become prevalent practice way because of unique realistic, efficient and economical and so on. Consequently, it is necessary to develop a set of both economic and efficient simulation training system with realistic fire safety inspection environment, diversity inspection scenes, powerful training platform to achieve practical training of fire security check with actualization, all-weather and economic.

2. Key technologies

Developing three-dimensional simulation training system of fire inspection mainly involve three-dimensional geographic information system (3DGIS) technology, interactive interface technology and three-dimensional modeling and other mature technology of computer simulation and software engineering.

2.1 3DGIS Technology

Virtual reality technology and geographic information technology are integrated into 3DGIS technology which dispense with data preprocessing, can quickly integrate different, distributed real-time transmission of source data to quickly build real-time three-dimensional interactive environment, and achieve three-dimensional scenes with real-time reflection, dynamic shadows and high-quality, realistic real-time rendering, so that all virtual activities are in a real space-time background [4]. 3DGIS technology is applied development simulation training system with the following advantages [5]:

- Complexity of point, line, surface draw by 3DGIS is higher;
- Intuition and visualization are better;
- Compatibility of three-dimensional space management and spatial analysis are stronger.

2.2 3D modeling technology

Three-dimensional modeling technology is used to achieve real world reproduction in the three-dimensional space through building 3D model to simulate things shape, color, material, light and shadow, movement and other properties. The core of 3D modeling technology is to construct its three-dimensional geometric model according to the three-dimensional spatial information of the research object, and use the relevant modeling software or programming language to generate the graphical display of the model, and then carry on various operation and processing [6-7]. Three-dimensional modeling techniques are applied to the simulation training system with the following advantages:

- Trainees feel more intense visual stimulation, more comprehensive visual perception;
- Any angle view, perspective and axis side, can generate and keep correct projection relationships between the view by object's three-dimensional data;
- Data structure of model is relatively simple to save computer hardware resources.

2.3 Visualization of human-computer interaction technology

Human-computer interaction technology, including machines provide a lot of information and prompt, etc. by output or display equipment, and people input information, answer questions and give instructions to machines by input device. [8] In the process of human-computer interaction will produce large amounts of data, data volume and type are far beyond abilities of analysis and understand to human brain, in that way, visualization technology will convert mass data into graphics to visualize data characteristics, relevance and significance, so that users can understand data friendly and improve efficiency of human-computer interaction. [9-10].

3. Research ideas and guiding principles

3.1 Research ideas

Fire safety inspection simulation training system will build a distributed interactive simulation training environment based on computer local area network. The research ideas as following: The real fire inspection site environment is simulated restoration by 3DGIS technology, and by drawing basis model to change partially or fill main scene to achieve a variety of fire inspection scene as close as the reality. To design fire inspection items and make safety inspection instrument model, so that Individual trainees and role assignments can select inspection subjects and tool to carry out training by