WebVRGIS: A P2P Network Engine for VR Data and GIS Analysis

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Abstract. A Peer-to-peer(P2P) network engine for geographic VR data and GIS analysis on 3D Globe is proposed, which synthesizes several latest information technologies including web virtual reality(VR), 3D geographical information system(GIS), 3D visualization and P2P network. The engine is used to organize and present massive spatial data such as remote sensing data, meanwhile to share and online publish by P2P based on hash. The P2P network makes a mapping of the users in real geographic space and the user avatar in the virtual scene, as well as the nodes in the virtual network. It also supports the integrated VRGIS functions including 3D spatial analysis functions, 3D visualization for spatial process and serves as a web engine for 3D globe and digital city.

Keywords: P2P network, WebVR, VRGIS, Big data, 3D Globe.

1 Introduction

With the development of VR (Virtual Reality) technology and widely applications in various areas, the requirements to VR are also increasing rapidly. Users do not only need to obtain the landscape geospatial data dynamically but also need to perform some analyses, calculations, managements and transfers based on data. Virtual Reality Geographical Information System (VRGIS), a combination of geographic information system and virtual reality technology has become a hot topic. With the popularity of network, the VRGIS platform based on the network environment also becomes a trend. The application of VRML, X3D and other online VR technologies have achieved networking of VR systems, because of the mass data, the network bandwidth constraints of transmission, a large number of request and multi-user collaboration controls, the online virtual reality technology still face numerous challenges. To improve the accuracy of modeling, the city planning has an increasingly high demand for the realistic display of VR system, however this will inevitably lead to the growth of the volume of data transmission. Virtual scene from a single building to the city scale is also resulting in the increased amount of data. The increasing number of user increase the server load and in more severe cases the server has to deny the services. These challenges and problems directly lead the on-line VR
technology failure to provide high-quality service to public base on the current network frame. Currently, few companies are investing mass of money to set up a large amount of data server nodes in order to break through the bottleneck of the network transmission speed. Therefore it is necessary to seek new, more efficient and more economical mechanism to create a WebVRGIS system on Internet. Using advanced computer technology to construct digital city has attracted the attentions from many walks of life. By integrating the friendly interactive interface of Virtual Reality System and spatial analysis specialty of Geographical Information System, WebVRGIS is preferred in practical applications, especially by the geography and urban planning. Urban simulation is becoming widely noticed nowadays, and some simulation systems have been developed in this area; e.g., ArcView3D Analyst, Imagine Virtual GIS, GeoMedia, etc. The above mature platforms are limited to a single computer running, while the publish methods based on network environment are proposed. WebVRGIS engine supports steadily real time navigation in virtual scenes which are constructed with massive, multi-dimensional data from various sources. VR and GIS modules are integrated seamlessly. All kinds of requirements for large-scale landscape simulation and a data management can be satisfied. 3D urban landscape database with various data sources can be produced to implement spatial analysis and 3D visualization and published in the Internet environment.

2 Background

In the early 1990s, Koller and others had an integration research about VR and GIS, and put forward the concept of VRGIS [9]. VRGIS is based on VR technology as a front-end interaction with users and supports GIS spatial data storage, processing, query and analysis functions of the system from bottom. With the development of VR technology and computer hardware technology, massive data management and 3D visualization technologies have been greatly improved. In VR field, massive data management and accelerated rendering technology include the following areas of study such as architecture design based on out-of-core, accelerate the 3D rendering, network optimization. However, most of current commercial platforms lack a timely application of these research results, which makes the combination of VR and GIS not in place and reduces the speed of city digitization. WebVRGIS integrates various up-to-date VR technologies, which can solve the problems in 3D visualization of massive data, P2P based massive 3D data share, realize the seamless integration of VR and GIS and provide a strong support for the city digitization. The stand-alone environment VRGIS [7] was developed. Based on VRGIS platform, WebVRGIS updates the overall framework as well as part sorts of key technologies, in which can support data publish on the network, and to support the mass data transmission and large numbers of users online simultaneously based on P2P technology.