Research of the Display of Historical Relics Migrations Based on a G/S Model

Fang Miao
Chengdu University of Technology, China. *mf@cdut.edu.cn*

Deng-Xiang Xu
Chengdu University of Technology, China. *seagull1020@sina.com*

Lu Lin
Chengdu University of Technology, China. *linlu@cdut.edu.cn*

Abstract:
This article puts forward a new type of spatial information network service module (G/S module). During the process of digitalization of historical relics we studied and proposed an approach and realization thought making use of a G/S module and the architecture of IOT to realize a historical relic migration presentation system. Lastly, we present an example and validate the feasibility of the approach.

Key Words: *G/S Module, IOT, Databases*

Introduction

Historical relics are the heritage left behind by human social activities and have certain historic, artistic and scientific values. How to exploit and protect historical relics is a concern of all people in the world. To analyse the current status of the management of historical relics current museum management systems merely use text files to record the status of the migration historical relics, thus it cannot present migration directions and safety status directly, instantly and timely. Moreover, the spatial representation of historical relics requires access to large amounts of spatial information in the network. However, current spatial information network service modules have bottlenecks in visualization, storage, computation and network bandwidth. Under the traditional spatial information network service module, systems based on the C/S module lack distribution and compatibility and usually have high development costs. Systems based on the B/S module usually suffer low responding speed and hardly create personalized functionalities. This article adopted a new spatial information network service module (G/S module, GeoBrowser/distributed spatial data server cluster module) that implements the characteristics, architecture and functionalities of historical relics, as well as combines it with the technologies of the Internet of Things (IOT) to construct a historical relics migration presentation system. The article therefore provides a new approach for the spatial realization of historical relics migration.

G/S Mode and Fundamental Theory of IOT

During the process of migration, data about locations and status are multi-sourced and isomerous, therefore there must be a data organization and description standard for the process of data exchange. The G/S module, GeoBrowser/distributed spatial data server cluster (spatial data cloud) module, is an Internet-based spatial information service module, and

uses the standard hyper geographical mark-up Language (HGML) to store, organize, exchange, schedule and display massive data of various types and formats distributed in the network. It uses a client side polymerization service based on "request-polymerize-serve" to accomplish data and functionality polymerization and finally to provide all spatial information services. HGML is the mark-up language of spatial information, the core of the G/S module, and it is able to organize, manage and display spatial information. It is also the unified data exchange format. In the process of migration, the intelligent recognition and management of historical relics are realized through IOT. In a narrow sense, IOT denotes networks that connect objects to other objects, through which to realize object locating, tracking, monitoring and management; in a broad sense, IOT is the combination of information space and object space, digitizing and networking everything (Liu et al. 2010). IOT is capable of realizing an efficient information exchange approach between objects, between objects and people, people and the environment, as well as incorporating all kinds of information technologies into society through a new service module. During the process of migration data about location and status collected by various devices are being exchanged in the network with service platform. Network service modules based on current spatial information service module have bottlenecks in visualization, storage management, computation and network bandwidth. G has powerful computation and graphic processing capabilities, it is able to download spatial data once and use it many times, thus reducing the computation load of servers and data traffic in the network. S is a distributed server cluster, and has the functionalities of data slicing, redundant storage, concurrent processing, multi-point download and load balancing. S can therefore eliminate network-accessing bottlenecks and can improve the ability to offer services (Kong and Wang 2009; Li at al. 2010).

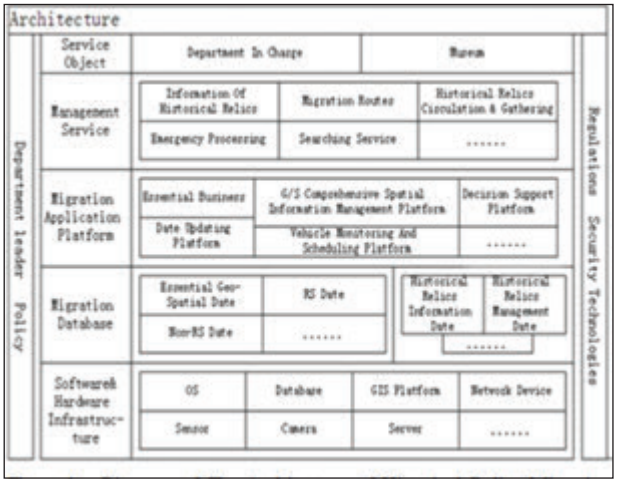

Figure 1. Diagram of the architecture of historical relics migration presentation system.

Historical Relics Migration Presentation System

The spatial representation of historical relics migration refers to historical relics information display, migration routes, emergency processing, etc. The historical relics migration presentation system is based on a digital earth platform and makes use of GPS, remote sensing, network technologies, 3D virtual reality technologies and IOT technologies. This system conforms with the digitization requirements (made by the department of historical relics management) for migration routes, locations of historical relics, and realizes the efficient organization, scheduling, integration, publication and presentation of migration-related information in 3D virtual environment.

The architecture of the historical migration presentation system

The historical migration presentation system makes use of all kinds of data provided by spatial information and IOT technologies as the essential data of the system. Commonly, historical migration presentation systems include: software and hardware infrastructure,

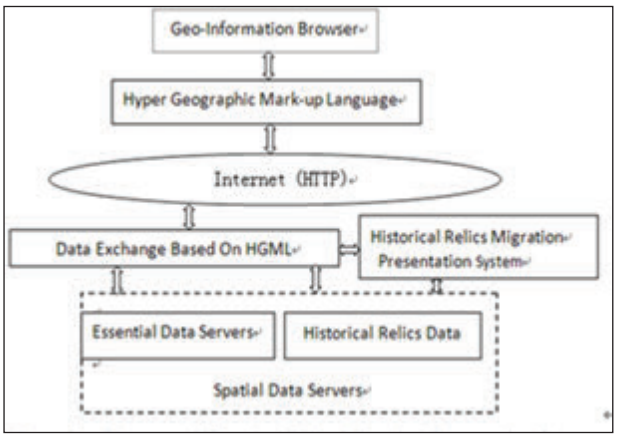

Figure 2. Diagram of the historical relics migration presentation system based on a G/S module.

a migration database, a migration application platform, management services and service objects. The architecture of the historical migration presentation system is displayed in figure 1 (Guo et al. 2009; Miao et al. 2007; Shen et al. 2009).

Historical relics migration presentation system based on a G/S module

The historical relics migration presentation system based on a G/S module is constructed with respect to the architecture of the G/S module. This system is Internet-oriented and uses HGML as the standard for data representation, exchange, organization and management. Through constructing the essential data for a historical relics migration representation and historical relics data server cluster the system supports various types of data. It takes full advantage of the computation capabilities of the client side to construct a historical migration presentation browser based on Geo-Browser.

As figure 2 illustrates, the essential spatial information server cluster uses remote sensing, non-remote sensing and essential geo-data as support. It sends data to the Internet and provides essential information services through data exchange based on HGML. The historical relics migration presentation system immediately provides all kinds of spatial data, attribute data and time data that are related to representation of historical relics migration and it sends data to the Internet through data exchange based on HGML. The historical relics migration presentation browser might be a desktop computer, laptop or mobile terminal that supports GPS that usually have Geo-Browser supporting HGML installed (Guo and Miao 2009).

Demonstration of the Historical Relics Migration Presentation System Based on G/S module

The historical relics migration presentation system is designed according to the architecture of a G/S module. The system uses Geo-Browser as the service to browse information and for the collection, processing, storage and presentation of all kinds of data, on a distributed server cluster and local servers. Since HGML is completely compatible with KML and GML this article adopts KML as the data exchange standard.

Supporting technologies

According to the characteristics of a G/S module, the creation historical relics migration presentation system mainly used the following technologies: GNSS, GIS, RS, network, 3D visualization, IOT and location-related real-time video collection and display technologies.

Comprehensive historical relics migration presentation and management system

Comprehensive historical relics migration presentation and management system is an application, service and decision support system that consists of spatial data collection, storage, transmission, conversion, processing, analysis, searching and representation. The vector map

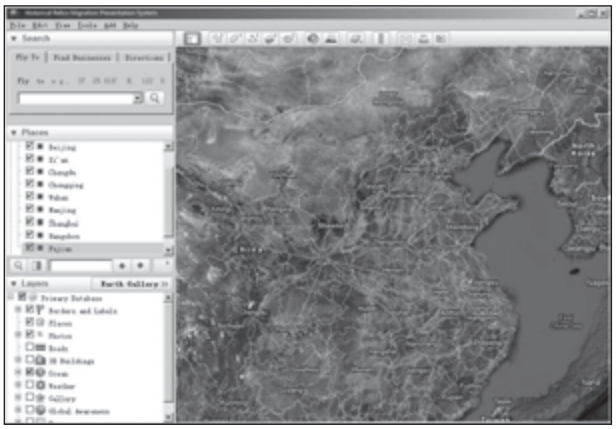

Figure 3. Large-scale map of the migration routes of terracotta warriors.

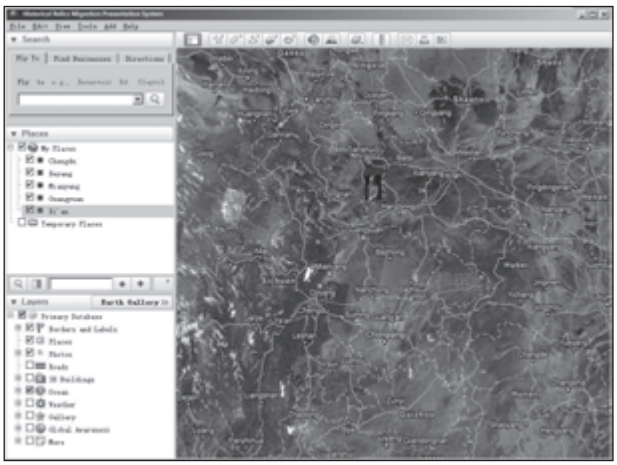

Figure 4. Detailed map of the migration routes of terracotta warriors (taken from Xi'an to Chengdu as an example).

of migration routes this article used is converted into a KML file by dedicated software (such as ArcGIS), and then imported into Geo-Browser. The migration routes of "the eighth wonder of the world", Emperor Qin's Terracotta Warriors, is added to the map through the routes-adding function of the Geo-Browser. The secondary development of Geo-Browser takes advantage of Google Earth's COMAPI and an HGML file to display the migration routes of Emperor Qin's Terracotta Warriors, as shown in figure 3.

Through analysing the migration routes of Emperor Qin's Terracotta Warriors we learn that there are 3 migration routes: northeastwards, southeastwards and southwestwards.

Historical relics managers can exploit the market value of Terracotta Warriors through migration routes. The southeastwards route in particular has more exhibitions. One reason for this is the standard of living and the other concerns degree; thus historical relics managers can exploit the southeast market in advance. The presentation details of Emperor Qin's Terracotta Warriors are displayed in figure 4. Under the support of a G/S module, incorporating IOT makes the process of historical relics migration able to intelligently recognize, locate, track, monitor and manage; if there are emergency events during the migration process, the system will take corresponding decision support actions. It Analyses event information and uses spatial locating and video surveillance technologies to deal with current events. At the same time it coordinates all departments' resources to make a resolution.

Conclusions

This article connected the spatial display of historical relics with a G/S module and IOT and constructed a historical relics migration representation system based on a G/S module. It therefore provided departments of historical relics management with a more efficient 3D migration representation. Meanwhile, monitoring the status of historical relics in real time is a significant development direction of digitalized representation of historical relics. The historical relics migration presentation system not only makes use of existing network platforms but it can also be expanded and improved. While enriching the information of historical relics, the methods of presenting migration are also enhanced. However, the digitization of historical relics migration in many regions is still at a developing stage. We need to put more effort in establishing a public-oriented, fully functional system that has an efficient commercial operation mode (Shen 2009).

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