DESIGN AND IMPLEMENTATION OF TOURIST WEBGIS BASED ON J2EE

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Abstract WebGIS has been one of the most important aspects of GIS in the past ten years, and J2EE is a platform for distributed computing. In the paper, we have done some research on the tourist WebGIS, and in practice founded a system based on J2EE for Henan province in China. The Henan Tourist WebGIS includes two subsystems, Province Subsystem and City Subsystem. The main function of Province Subsystem is generally introducing the tourist sights and traffic information of how to get to these sights, and it’s another important function is analyzing of tourist information such as income, visitor number, peak time, carrying capacity and etc., which is for the tourist administrant department. The City Subsystem focuses on displaying the sights in the city and some other places for which tourists care much including restaurants, hotels, marketplaces and so on.

1. INTRODUCTION

Since its birth, GIS has walked away for about 40 years, and are applied in various domains including surveying and mapping, irrigation works, land administration, telecom and so on. In recent years, with the rapid development of Internet, WebGIS, which integrated GIS and Web techniques, has been one of the most important aspects of GIS. WebGIS is the extension of traditional GIS based on Internet, and it is a system that can implement storing, query, analysis and visualizing of spatial data on Internet. Through WebGIS, we can distribute spatial and other special information all over the world. In china, with the rapid development of social economy, people’s daily lives are getting more various and wonderful, and going out for a trip has been an essential part. By tourist WebGIS one at any website throughout the world can browser the tourist and relevant information we publish, and that will strengthen the impression of those sights and help to attract more visitors. The tourist WebGIS is not only useful for visitors, but also for the tourist administrant department to hand the general status of tourist resources and make decision. J2EE is a platform for distributed computing, it applies components to design, develop and assemble enterprise application, and it aims at implementing a transplantable, compatible, robust and secure system. In the paper, we have done some research on the tourist WebGIS, and in practice founded a system based on J2EE for Henan province, which is a province of all 34 provinces in China. The Henan Tourist WebGIS includes two subsystems, one is installed and maintained at Zhengzhou city, the capital of Henan province, which is called Province Subsystem, and the other is installed and maintained at other 5 cities of Henan province called City Subsystem. The main function of Province Subsystem is generally introducing the tourist sights and traffic information of how to get to these sights, and it’s another important function is analyzing of tourist information such as income, visitor number, peak time, carrying capacity and etc., which is for the tourist administrant department. The City Subsystem focuses on displaying the sights in the city and some other places for which tourists care much including restaurants, hotels, marketplaces and so on. The Henan Tourist WebGIS provides much convenience for those who want to have a trip.
2. J2EE

J2EE, Java 2 Platform Enterprise Edition, is a platform-independent, Java-centric environment from Sun for developing, building and deploying Web-based enterprise applications online. The J2EE platform is designed to support component-based distributed multitier applications and the custom enterprise applications can be designed, developed, deployed by J2EE components. The main technical aims of J2EE is to provide a highly portable, compatible and securable enterprise platform. J2EE includes mainly Java™, J2EE Components, web services and Server Communications etc.

2.1 Java™

J2EE platform based on Java™ defines the specification through Java API interfaces and any product that is compatible to the specification can realize these interfaces. In order to guarantee the compatibility, J2EE Platform Specification include a compatible test software: J2EE Compatibility Test Suite. Using it, any manufacture can test whether their J2EE platform accord with J2EE specification and realize J2EE compatibility.

2.2 J2EE Components

The J2EE platform simplifies enterprise applications by basing them on standardized, modular components, by providing a complete set of services to those components, and by handling many details of application behavior automatically, without complex programming. J2EE adds full support for java component types, including applets, Application client, enterprise java bean, XML technology and web components (Java Servlets API, JavaServer Pages). Java Virtual Machines (JVMs) run different kinds of components in different kinds of containers, and make appropriate services available as APIs that the components can call to interact with the container, the Java Runtime Environment (JRE), and other components of the application. These containers provide services such as life cycle management, security control, transaction management and thread management for those components. J2EE wraps all the enterprise components belonging to an application system to install any J2EE platform through approach to the design, development, assembly, and deployment of enterprise applications. With simplicity, portability, scalability, and legacy integration, the J2EE platform is the platform for enterprise solutions.

2.3 Web services

J2EE Specification provides four kinds of services. ①data access interface: JDBC is a service provider interface to attach a JDBC driver to the J2EE platform; ②Java transaction APIs (JTA): J2EE uses the JTA API to demarcate where the entire transaction, including both operations, begins, rolls back, and commits to ensure the characteristics of ACID of transaction in distributed environment; ③Java naming and directory interface (JNDI): JNDI provides applications with methods for performing standard directory operations. Using JNDI, a J2EE application can store and retrieve any type of named Java object; ④security service: J2EE applications can access various secure services through the security service interfaces. J2EE security services offer two models including identification authentication and resources authorization. The Java Authentication and Authorization Service (JAAS) provides a way for a J2EE application to authenticate and authorize a specific user or group of users to run it.
2.4 Communication
As a distributed environment specification, J2EE uses some widely used communication protocols such as Internet protocols (TCP/IP, HTTP 1.0, SSL 3.0), RMI (Remote Method Invocation) and CORBA protocols (Java IDL, IIOP) etc. Any application that is compatible with J2EE platform must obey these protocols.

J2EE platform architecture shows as fig1.

Fig1. J2EE platform archetecture[3]

3. SYSTEM DESIGN

3.1 model design
According to the structure of J2EE, we use four-layer model to found the Tourist WebGIS, which are data layer, application layer, net layer and representation layer. Every layer is composed of various function components. The data layer includes databases and spatial data engine, its main function is to store and supply spatial and other data that system need. The application layer comprises of GIS server and many analysis modules, which are used to implement data operation, information querying and spatial analysis. The net layer means internet server that accomplishes the intercommunion between the client and server, including data packaging and transferring. The representation layer is the tool that shows the results of users’ querying and analyzing on the client side.

In the model, the data layer is as a data server which is used to store, access and manage all the spatial and non-spatial data. The requests from client users are inputed through the GUI of representation layer, transformed and transferred by the tools of representation layer, and are changed to the request form to data layer by the application layer. After we get the result form data server, the result is transferred orderly through application layer, net layer, and at last is displayed on the representation layer.

3.2 function design
Different from other special topic GIS, the Tourist WebGIS mainly serves administrant departments and visitors. For these people, what they care for is mostly focusing on six aspects, including restaurant, hotel, traffic, sight, special local products and entertainments. So Tourist WebGIS should supply these information in detail. And at the same time, for the users are public people who has no knowledge of professional GIS, we should develop the system interface as
simple and flexible as we can.

For the Henan Tourist WebGIS is composed of two subsystem, Province System and City System, and the two systems are connected by hyperlinks, there are different functions. The Province System emphasizes particularly on introducing the tourist sights and traffic information of how to get to these sights as a whole, and the City System cares more for the factors in cities.

The functions that Province System and City System both should implement are divided into five kinds and listed bellow.

1) basic operations of GIS, including map scanning tools such as zoom out, zoom in, move map, and spatial measuring tools as distance, area.

2) display controlling tool, which is used to control a map layer whether is visible or not.

3) navigation window.

4) traffic querying, in Province System it supply train and highway query between cities, and in City System the tool includes the shortest route analysis and bus-change analysis.

5) sight information querying and city features querying such as restaurant, hotel, shop and so on. This tool should both supply exact and fuzzy querying.

In order to introduce the tourist resources wholly and meet the demand of administrant department, the Province System also has typical cruise and decision-aided tools. For the Henan province has a very long history, and is the source of Chinese culture, in the system we design many typical cruises to chose by various tourists. By decision-aided tools, the manager can analyze tourist information such as income, visitor number, peak time, carrying capacity and etc, and then decide the tourist developing strategy.

4. IMPLEMENTATION OF TOURIST WEBGIS

Based on J2EE, we implemented the Henan Tourist WebGIS system. The system is composed of client, server and database. In the server side, we installed Microsoft Windows2000 Server, jakarta tomcat3.2.1, Apache Web Server1.3.12 and Jserv1.1.1 as running environment. And in the client side, one need not install any extension software. Only if he has a standard internet browser with Java Virtual Machine such as Internet Explorer and Netscape Navigator, he can scan the website and get his interested information normally.

The running interfaces of Henan Tourist WebGIS system are shown below.
Fig. 2 Province subsystem of Henan Tourist WebGIS

Fig. 3 Zhengzhou City subsystem of Henan Tourist WebGIS
5. CONCLUSION

Tourist WebGIS is very useful for those who want to go out for a trip. In the paper we design and implement the Henan Tourist WebGIS to distribute relevant information. The system has single operations and rich functions, can not only provide convenience for visitors, but also can serve the administrant department.

References


Biography

Wang Ji-zhou received the B.E. degree in land administration in 1998 from Wuhan University of Surveying and Mapping, Wuhan, China, and the M.S. degree in cartography and geographic information engineering in 2001 from Wuhan University, Wuhan, China. He received the Ph.D. degree in 2003 from Chinese Academy of Surveying and Mapping, Beijing, China. His main research interests include Internet GIS, Mobile GIS, and 3D GIS.