Research on the Application of Education Information Service Platform Based on WebGIS

ZHENG Yue-feng College of Adult Education Zhejiang University of Technology Hangzhou,Zhejiang P.R.China

MA Wei-feng School of Information and Electronic Engineering Zhejiang University of Science and Technology Hangzhou,Zhejiang China

> MAO Ke-ji College of Information Engineering Zhejiang University of Technology Hangzhou,Zhejiang China

Abstract: - Along with the development of education, it becomes more and more important to issue and gain the education information day by day. According to the education information's characteristic, we can change the single attribute query type to a better one which can satisfies the requirement of education information service through the Web Geographic Information System(WebGIS). This paper proposes a new design for education information service platform based on WebGIS, and analyses the key technologies including MapXtreme's basic work principle, the architecture and so on. At the same time, the paper introduces the function of service platform, data structure and the implementation method of MapXtreme in detail by ASP.

Key-Words: - Education information service platform, WebGIS, MapXtreme

1 Introduction

By the fast developing of the society, government has been paying much more attention to the education, which makes its position upwardly. Numerous of schools and universities being built, and the importance of education has been already accepted by people, meanwhile, the requirement of improve their quality is becoming much more insistent, at home or board. Recently, the way of college students obtaining information and knowledge is not only by the traditional means of reading newspaper, listening to the broadcast or watching TV, but also surfing Internet. University students could acquire the latest and abundant information of politics, economy and culture anywhere of the world from Internet. Consequently, the university information-based construction should be intensify in earnest.

The construction and application of campus' information network is an important component of education information-based. Being grounded on campus, it lays out the education informatization in more practical and specific level. Which's kernel is to organize and develop campus digitalization, and to create high-level and all-direction digital environment, then construct the modern education pattern, exploit new educational information resource and optimize the degree of higher education. So far, the campus network has already achieved the target of 1000M backbone and 100M access. It could supply high quality basic network service for teachers and students, some application and information service system have been operating stably.

Education information service platform based on WebGIS combines the university electronic map information and its introduction together. It brings

much more convenience to help the user to get the position of the university from the electronic map, meanwhile to accept some relative information on the service platform. Users can get the information what they concern very easy with such electronic map. Comparing with paper map and compact disk map, electronic network map has the characteristic of infinity information and could liberally add searching items. For freeing of restraints of the scale and pattern, it could intelligently show the message which the user cares about much more visualized. On the other hand, appointed men take charge of collectting various information, so the electronic network map could be updated immediately. For example, the new building, the contemplation school district, the much more shorter way by taking a just finishing path and so on, could been laid out on the electronic map and bring great help and convince to students. At the same time, the philosophy of this platform's development and application can give brand new inspiration to other vocations and extend the application of GIS and its value added to us. Meanwhile it can also enhance the developing speed of society.

With the development of Internet, the geographical information system WebGIS has been highly developed, and becomes an important research direction of the GIS development. According to various demands, WebGIS provides corresponding geographical space data and graphical information through Internet.

At present, there are many educational enterprises. In order to publicize these educational enterprises as well as convenient the people who using this services to across-the-board understand each educational enterprise in detail, this paper proposed a educational information services platform based on WebGIS. The position and correlative information of Hangzhou's educational enterprises is displayed through the electronic map which includes text, picture, voice, multimedia system and so on.

2 Key Technology

2.1 WebGIS

With the constant developing of Internet technology and people's demand to the geographical information system (GIS), releasing and publishing the space data on Web, offering the function of the data browse, inquiry and analyze to users, have already become the necessary trend of the GIS development. Then, the geographical information system on the basis of Internet technology --WebGIS arises at the historic moment.

WebGIS is the result that GIS developed on Internet technology. through WWW, GIS function is expanded, which really becomes a tool that used by most of the people. From any node of WWW, Internet users can browse the space data, make thematic picture, carry on various space searches and analisis in WebGIS website, that makes GIS enter into the huge numbers of families. WebGIS has the following characteristics:

Customer/Server globalized apply: at any WWW node in global range, Internet users can get various of GIS service that WebGIS server offered, even upgrade the GIS data in the global range.

A real popular GIS: with the high speed development of the Internet, Web service is now entering the huge numbers of families, thus WebGIS can offer much more chance for people to use GIS. WebGIS can use the general browser to browse, inquire, extra plug-in, ActiveX and Java are usually all free, which lighten the terminal user the burden of economy and technology, expand the potential user range of GIS to a great extent. At past, because the technological difficulties and high costs, GIS becomes the professional tool that a few experts have, it is very hard to popularize.

Good expansibility: WebGIS can be integrated with other information service in Web very easily and seamless. It can set up flexible and changeable GIS applications.

Cross-platform characteristic: before WebGIS, though some manufacturers have offered corresponding GIS software for different operating systems: (such as Windows, UNIX, Macintosh) separately, but none of GIS software really have a characteristic of cross- platform. But WebGIS based on Java can write once, run anywhere, play the role of crossing- platform thoroughly.

Nowadays, there are many support software platforms of WebGIS such as the ARCIMS of ESRI Company, the MapXtreme of MapInfo Company, the SuperMapIS of SuperMap Company, the Geobeans of Beijing NCG and so on. These platforms offer a map engine in service end and a set of standard correspondence interface which allow the different application and different language to realize the GIS. These interfaces can be packaged by service and script languages (such as GCI,ASP,etc) and programming language(such as java,etc), which can easily embed the function module into the map engine. While in the client portion, Web browser communicate with the service end through HTML, embedded Activex plug-in , Java Applet, etc. This model can effectively support the application and second programming of GIS in the environment of network. Mapinfo Company's product MapXtreme has become a representative program platform of WebGIS system recently. It is widely applied in some area such as environmental protection, public information inquiry, traffic control, city management, etc.

2.2 Architecture of Mapxtreme Map Service

MapXtreme is a map application server based on Internet and must be installed in the server portion. In the client portion, we can use HTTP protocol to get strong map server including map showing, map navigator, map scaling, map object finding, map edit, drawing special map, buffer analyse and so on through Web browser.

MapXtreme application server is composed by a map engine and a MapxCourier component. Map engine has contained three components including Mapx, Mapxserver and Mapxbroker. Each component has their specific object, attribute and realization function method. The architecture is in Fig. 1.

MapX is the core component of MapXtreme server. It is a GIS map component based on OCX which provided by MapInfo company. It is the genuine provider of GIS function. At the same time, it offers many map data accessing mechanism, such as file mode, ODBC, DAO, and so on.

MapXServer is the encapsulate component of MapX. Each MapXServer instance runs in a special processing space. Each MapX instance runs in a safe thread. Application program can get object of MapX through initial MapXServer.



Fig. 1 MapXtreme server architecture

MapXCourier object is not just a part of map engine and acts as messenger role between the application procedure and the map engine. MapXCourier can enable the application program to visit MapX object through the MapXServer instance. So MapXcourier is always used to visit the MapXServer instance, and the MapX instance is gotten through the MapXServer instance.

MapXBroker is not necessary. However, when you open the MapXBroker, it will generate a sharepool which special in managing MapXServer instances. This function can extend the capacity of server.

2.3 The System Architecture Based on MapXtreme

The system architecture of network geographic information system based on MapXtreme can be divided into three levels generally, namely presentation layer, application layer and data presentation level. Its work process is following. Firstly, client sends service request to GIS through HTTP protocol. Secondly, after receiving this request, the Web server will run relevant application program and send GIS service request to the MapXtreme map server.Thirdly, map server processes these request and returns the result to the client portion.



Fig.2 System architecture based on MapXtreme

In Fig.2, there are three different solutions, namely thin client, middling client and fat client.

In the model of thin client, the GIS function is realized in the MapXtreme map server portion. Client portion only shows the map result in JPEG and GIF format by using HTML hypertext format. This development way is simple and can realize complex GIS analysis function. But because each operation is required to communicate with the server, the burden of server is high.

In the middling client model, major part GIS function is realized in MapXtreme map server portion. Client portion embeds a small Java Applet program which realizes a small part of GIS function. In the fat client model, a front MapJ client software, that taking on the majority of GIS function, is realized and can directly browse vector data. So the burden in the MapXtreme map server is reduced greatly. However, it is not easy to realize the complex GIS analysis function for high cost and complicated development way.

2.4 WebGIS Data Management

webGIS data can be divided onto Space Data and Property Data, which combined closely to form the description of the ground objects. The operation to one data will inevitably influence another related data. Therefore, how to store and manage those two kinds of data is the basic problem of webGI, as well as the most fundamental and basic technology. Two strategies can be adopted to manage GIS data in the MaPXtreme System: File Strategy and Space Database Strategy.

(1) File Strategy

In the Geographic Information Systems, "LAYER" is a concept to distinguish space information to store different features. The space objects on the same layer have the same property information, that is a particular feature or information is stored in a particular layer and has a related data. The File Strategy is that every type of map data is stored in a TAB file and the property data of the related map objects is managed by the common relation data base management system. The two are linked by a certain issue and several TAB files are linked to indicate the comprehensive map information. This strategy is the main data management of WebGIS till now. MaPXtreme System uses GeosetManager to manage those TAB files. GeosetManager is able to pack several TAB files into a GsT file which contains the related map information. Set the Gst file into the map feature of MaPXBroker, clients are able to read the related map data by MaPXBroker and free to scale, roam or visit the related information on the map. Also, it is possible to produce a certain subject map to analyze the geography.

(2) Space Data Strategy

The GIS Space Database uses space database to realize the integration management of the space data and property data, which can take advantage of the present large scale business database. It is easier to realize the distributed structure, multi-oriented database connection, multi-clients, etc.. Therefore, space database is a researching focus in the field of GIS.

2.5 Extending Issue

Before the construction of the GIS application, extending the website should be considered first. To Mapxtreme System, the map engine will created a MaPXserver object example every time when the clients have a conversation and remains active until the end of the conversation. Every MaPXserver will fully occupy the individual space(CPU or EMS). If there are hundreds of even thousands of clients visit, the server will face a severe test.; on the other hand, it is an inefficient way to keep an active MaPXserver for every client. How to solve the problem will directly affect weather our developing system is practical or not.

(1)Horizontal Extension

Horizontal Extension refers a distributed setting way-to add the number of the server to distribute the task. Each server needs to install Mapxtreme. This is suitable for large pageviews but expensive.

(2)Vertical Extension

Vertical Extension is realized by optimizing the Web server through MapXBroke of the MapXtreme system. MapXBroke is run as a system service. When it is started, a MaPXServer sharing pool(called as pre-initiation issue) will be created. When an application of Mapxtreme needs to execute a requirement related to map operation, it would apply for an object example from MapXsServer. When the moving webpage with a map is created, the examples of MapXServer will set free the sharing pool so as to be convenient for other clients to apply for it. This sharing issue makes it possible to support a lot of clients' requirements within limited sources. Another advantage of this issue is that when an application applies for a MapXServer object, this object is in the sharing pool and running, so it is faster than applying for another MapXServer object.

In the practice, horizontal extension and vertical extension can be combined according to various situations.



Fig.3 System function design

3 System Design

MapXtreme provides two kinds of WebGIS solutions. One is based on java and the other is based on Windows platform. This system uses Windows2000 platform and constructs with thin client model based on MapXtreme. This system also uses ASP technology to realize certain application and Web expressions.

The main research contents of this article:

(1) Integrating an abundant of spatial information and attribute information based on establishing a GIS model of Colleges in Hangzhou and making use of managing the spatial data of GIS.

(2) Demonstrating the text, graph, form, image, sound, cartoon and video of college information to the customers reply on the electronic map and collecting data.

(3)Realizing customers' bidirectional query and browse between attributes and map making use of spatial query, statistics and analysis of GIS, and provide analysis tools for statistics data and most short circuit path choice etc.

3.1 Main Innovation Point

(1)Applied advantage

We can get requisite spatial data , graph and image by Internet from GIS, and also we can process and analysis something about spatial information, the information of electronic map can be updated anything, as the development of the world go forward ,the efficiency enhanced continuously, this kind online electronics map service has pressing demand and vast applied foreground.

(2)Technique characteristics

The customers can find the proper colleges easily and conveniently from the map making use of GIS, ASP and database technology, which combine the electronic map and universities' information.

The key technology of this project is GIS, and realize customers' bidirectional query and browse between attributes and map making use of spatial query, statistics and analysis of GIS, and provide analysis tools for statistics data and most short circuit path choice etc.

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3.2 System Function Design

This service platform for the realization of the main functions of the different users are divided into two major parts: the background and customer management systems. Management systems against the background of the main administrator, to achieve the maintenance and management platform. Customer education, including information systems, institutions of higher learning, electronic map system and the exchange of inquiries and so on it (such as Fig.3).



Fig.4 Data Organization

The main function as follows:

(1)We can do some operations such as enlarging, reducing, navigating, computing the distance of line, and recovering entire view, etc, on the windows of Hangzhou education teaching unit distributing map. Its advantage is that users can understand intuitively the geographical environment information of each unit;

(2)You can click on a certain educational teaching unit, which relative information you can search and browse. These information shows in the form of text, picture, table, sound, painting, video and many other media;

(3)School position searching, locating and showing relative information in the provided map;

(4)Geography analysis function, which can give out the most short-path and best route available between one school and another school according to current user's position, is provided.



Fig.5 Database Design

3.3 Organization and Construction of Data

Data is the key part of the system. In the geographic information system, data is divided in two parts, one is special data, and the other is attribute data. In this system, data saves in the form of mixing the file and SQL Server2000 database, data organizational structure is shown in Fig.4, and database design is shown in Fig.5

Special data is an electronic map about Education Teaching Unit, which organized in the form of MapInfo formate. This electronic map divides into 8 chart levels: Hangzhou administration district chart level, Hangzhou river system chart level, Hangzhou path chart level, Hangzhou main unit chart level, Hangzhou main market chart level, Hangzhou main public utility chart level, Hangzhou main station chart level and Hangzhou education distribution map level, etc. System data organizational structure is shown in Fig.6.

Attribute data is the information of educational teaching units, which organized with text, picture, audio, video and many other multimedia ways. It also includes unit survey, unit geographical position, recruitment of student situation, unit environment and so on.



Fig. 6 System data organizational structure

4 System Implement

System is realized by using ASP and Vbscript program language. The running result of system is shown in Fig. 7.

In the process of developing system, MapXtreme provided six storehouse files which are saved under the LIB folder by ASP document form. These files include MiMapEngine.asp, MiUtilities.asp, Miconst.asp, MiMapMaker.asp, MiErrorSystem.asp and MiDebug. Asp, which MapX control function. provided realized correlative storehouse function and constant value. transferred by the developer to complete the GIS function.

4.1 DataBase Connection

Database connection code is shown in Fig.8.

4.2 DataBase Connection

There is a Global.asa file in the MapXtreme ASP application. This file defined two events, one is user start-working time, and another is finish-working time. Therefore, the function code of obtaining and releasing the map data can be realized in these two events. (Fig. 9).



Fig. 7 The running result of system



Fig. 8 Database Connection code

4.3 The Basic Operation of Map

There are many operations such as enlarging map, reducing map, navigating map and getting the relevant information of map through clicking on it. The realization of this operation's key code as follows: (Fig. 10).

Sub Session_OnStart

// *the event of starting to work. gains Hangzhou

University's map data.

bResult= InitMapEngine(OBTAIN_FROM_BROKER, GetServerGroupName())

//create a object of MapX

Session(cMapImageHeight)=350 Session(cMapImageWidth)=350

//set photo's wide

strFile=CreateUniqueExportFileName()
//create a file with exclusive name

strExportFile= CreateAbsoluteFileName(strFile)

//create strFile file's absolute route

bResult=ExportMapToFile("gif",str

ExportFile)

//output this file strMapVirtual= CreateRelativeFileName(strFile)

//create network virtual route

bResult= UnInitMapEngine(RETURN_TO_BROKER) //release MapX resource

End Sub

Sub Session_OnEnd

//* the event of finish work, released all resources which connected with server.

Dim strSessionFiles

Dim objCourier

If Len(Session(cFileNamePrefix)) > 0 Then

strSessionFiles= Session(cAbsMapPath)& Session(cFileNamePrefix) & cWildcard

Set objCourier Server.CreateObject(cMapXCourier)

objCourier.DeleteFiles(strSessionFiles)

Set objCourier = Nothing

End If

End Sub

Fig. 9 Initialization code

Session(cMapXObject).SetMapCenter cMapX, cMapY

//SetMapCenter function realize map navigating function

Session(cMapXObject).ZoomMap dZoomValue

// ZoomMap function realize enlarging and reducing function

Set Features = Layer.SearchAtPoint(objPoint) //getting the click-on object

Set objDS = Session(cMapXObject).DataSets(Layer.name)

//getting the data set of the layer where the object located

For each f in Features

//passing through object

For Each fld in objDS.fields //passing through any attribute field of a certain object

strHtml= strHtml+"
"+ fld.name+":"+
objDS.value(f, fld)

Next

Next

Fig. 10 map operations

4.4 System File

System file is shown in Fig.11. <!--#INCLUDE FILE=".\hzuniv\lib\miConst.asp"--> <SCRIPT LANGUAGE="VBScript" RUNAT="Server"> Sub Session_OnStart Dim strDirname Session. Timeout = 1Session(cMapImageHeight) = 358Session(cMapImageWidth) = 493Session(cExportFormat) = miFormatGIF Session(cExportFileExt) = "GIF" strDirname = "/mapimage" Session(cAbsMapPath) = Server.MapPath(strDirname) & "\" Session(cRelMapPath) = "http://" & Request.ServerVariables("SERVER NAME")&" :"&Request.ServerVariables("SERVER_PORT") & strDirname & "/"Session(cImageFile) = "" 'we will generate this file name later on. Session(cFileNamePrefix) = "" Session(cFirstAccess) = True

=

Session(cMapPath) = "" Set Session(cMapXObject) = Nothing Set Session(cMapXCourierObject) = Nothing If InStr(1, Request.ServerVariables(cHttpUserAgent), cMozilla, vbTextCompare) <> 0 And _ InStr(1. Request.ServerVariables(cHttpUserAgent), UCase(cMSIE), vbBinaryCompare) = 0 Then Session(cClientBrowser) = cNetscape Else Session(cClientBrowser) = cIE End If End Sub Sub Session OnEnd Dim strSessionFiles Dim objCourier If Len(Session(cFileNamePrefix)) > 0Then strSessionFiles = Session(cAbsMapPath) & Session(cFileNamePrefix) & cWildcard Set objCourier = Server.CreateObject(cMapXCourier) objCourier.DeleteFiles(strSessionFiles) Set objCourier = Nothing End If End Sub

</SCRIPT>



5 Conclusion

WebGIS technology developing fast and gives a new way and method for the space information's issue analyse and management. It becomes an important GIS research direction recently. MapXtreme map server provided by the MapInfo Company offers a nice solution to the WebGIS application for its easy development and strong function. This paper provided an educational information service platform based on WebGIS. It provided an educational information searching service through utilizing the GIS's special information expression ability and multimedia technology. Compared with traditional gateway website, it has many advantages such as exhibition intuitive, convenience, big information amount, and powerful function and so on. At the same time, collecting perfect the relative information about university, elementary and middle schools is the further work.

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