Application of GIS in electronic commerce

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***Abstract*—In recent years, GIS(Geographic Information System) develops rapidly, and it is applied in various industries. But the application of GIS in electronic commerce is far behind its application in other areas. Using the programmable interfaces provided by Google Maps, we created an online shopping system which has the map functions to probe the application of GIS in electronic commerce. The system adopts the B / S three-tier architecture model and uses the Google Maps API to embed the Google Maps into the system website. It uses Oracle database to save the system data, and the spatial data is used the data of Google maps. The data of the system Oracle database and the spatial data of Google maps are connected through the latitude and longitude. These can improve the system's extensibility greatly and reduce the developing difficulty and cost remarkably.**

Keywords-electronic commerce; GIS; Google Maps; Google Maps API

I. INTRODUCTION

With the development of the Internet and electronic commerce, the online shops are attracting more and more consumers because of their advantages in price, time, geography and other areas. They are competing fiercely with the physical shops in some areas [1][2]. However, the online shops have the shortcoming of low recognition of consumers, and the phenomenon of that consumers are not trusting the online shopping is universal [3][4]. Therefore, the combination of the online shops and the physical ones will be an inevitable trend of the future development of electronic commerce. They can make use of the advantages of the other and develop together.

As an important tool and technology of obtaining, collating, analyzing and managing the geospatial data, GIS develops rapidly in recent years, and it is applied in various industries [5]. Google Maps is a web mapping service application and technology provided by Google. It has the characters of easily operated, pre-generated, analysis capabilities and so on. Google launched a public API in order to let the people, who have interests in Google Maps, voluntarily develop Google Maps' services, meanwhile Google might also carry on the management of these services through the API. The Google Maps API lets you embed the Google Maps into your own web pages, and it provides a number of utilities for manipulating maps and adding content to the map through a variety of services, allowing you to create robust maps applications on your website [6].

In this paper, we intended to apply the GIS into the electronic commerce. Taking experimental into account, we used the Google Maps API to embed the Google Maps into an online shopping system website and implemented the function of marking and displaying shops on the map. This can reduce the developing difficulty and cost remarkably. The system adopts the B / S three-tier architecture model, uses Oracle as the system database and uses the spatial data of Google maps to provide the spatial data.

II. SYSTEM DESIGN

The system architecture is as Figure 1. The system uses the B / S three-tier architecture. Each layer is independent, and the changes of any layer will not affect the functions of others. So the scalability and extensibility of the system are greatly improved [7][8].

- The presentation layer (the Web browser) is located in the client, and it is responsible for interacting with users. The Web browser sends the service request to the Web application server and displays the accepted result on it.
- The intermediate layer (the Web application server) is a logical bridge between the customer service and the data Service, and it is responsible for receiving the request from the browser and sending it to the data layer. The Web application server sends the request information to the database server aftert changing it into the form that the database can accept (such as SQL). Then it sends the returned data of the database server after logic processing and changing into the form of HTML and various of scripts back to the client. On the other hand, it calls the spatial data of the Google Maps server through the Google Maps API and sends it back to the client.
- The data layer (including the Oracle database server and the Google Maps server) is located in the lowest layer, and it is responsible for managing the data. It accepts the request of operating the database server and the call for the Google Maps server, realizing functions

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such as the database query, modify, updating and map service, and then it submits the results of data to the Web application server.

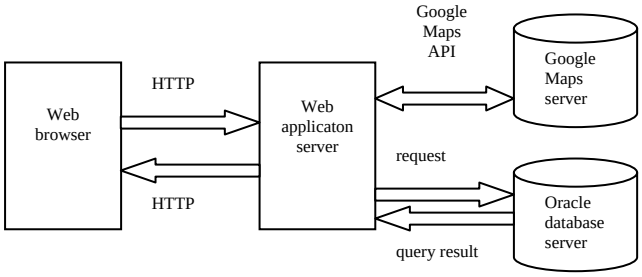

Figure 1. The system architecture

The client interacts with the application server mainly through HTTP, and the visits between the application server and the database server may use the database access interfaces such as JDBC [9]. For the spatial data, it is used the spatial data of Google Maps. The requests of the spatial data such as map displaying, map zooming, map panning and map types switching are all operated through the Google Maps API. The database server connects with the Google Maps server through the latitude and longitude.

III. SYSTEM DETAILED DESIGN AND IMPLEMENTATION

A. System function

The system is mainly divided into two functional modules: the front shopping subsystem module and the back management subsystem module, and each subsystem is made up of some smaller modules. The system function module structure is as Figure 2.

1) Front shopping subsystem module

a) User register module: Fill in the user's information. There are two kinds of users: the ordinary user and the shopowner. The ordinary user can browse and purchase goods through our online shopping system. The shopowner can register his shop and mark the position of his shop on the map, and then he can add and manage the goods of his shop.

b) User login module: Check the user's name and password with the information registered. Only the logined users can do trading through our online shopping system.

c) Map functions module: Realize the functions of map browsing, marking the position of shops on the map and displaying the shops marked.

d) Goods display module: Display Goods. Users can browse and search goods by category.

e) Shopping cart module: Save the goods that the users like for temporary. Users can do the add and delete operations.

f) Order module: After choosing the goods, users can choose the payment method and contact information by filling the order.

2) Back management subsystem module

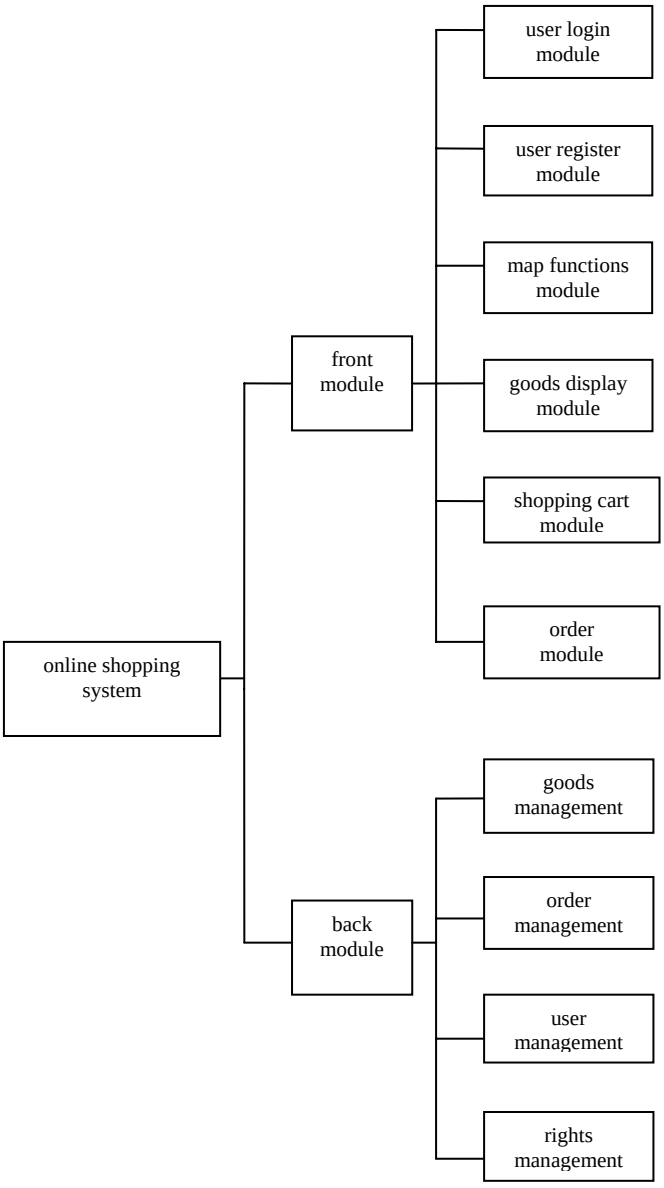

Figure 2. The system function module structure

a) Goods management module: View the goods information and set the display levels.

b) Order management module: Process the user orders.

c) User management module: Manage the information of the users.

d) Rights management module: Set the administrators' management rights.

B. Database design

The system uses Oracle as the system database to save the data of our system and uses the spatial data of Google maps to provide the spatial data, and they are connected through the latitude and longitude. When marking the shop on the map, we can get the latitude and longitude of the shop with the use of the Google Maps API and save the latitude and longitude information and other information of the shop into our Oracle

system database. When inquiring, we can display the information and position of the shop on the map through the latitude and longitude with the use of Google Maps API. Part of the Oracle database design is as TABLE1.

C. The implementation of the map functions module

Compared with the general online shopping system, this system has the map functions module. The online shops and the physical ones are connected together in the form of geographic information through the map. The functions of this module mainly include:

- Functions such as map viewing, map panning, map scaling, map types switching and the overview map.
- Marking the shop's position on the map and filling its information in the information window, as shown in Figure 3.
- Displaying the positions and information of the shops marked, as shown in Figure 4.

Map functions are mainly implemented by using the JavaScript calling the Google Maps API, parts of the implementation codes are as follows [6][10].

TABLE I. THE STRUCTURE OF THE ORACLE TABLE

id	number	id
username	varchar2(100)	name of the user
shopname	varchar2(100)	name of the shop
shoppic	varchar2(100)	picture of the shop
lat	number	latitude
lng	number	longitude
note	varchar2(100)	description of the shop

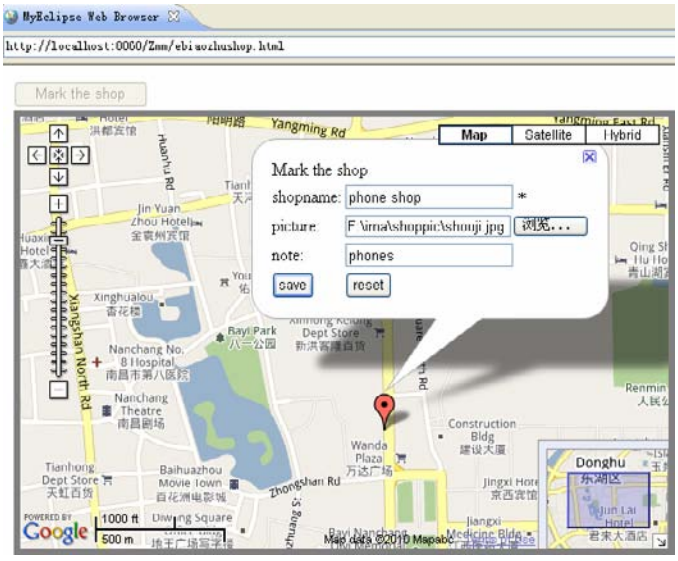

Figure 3. Mark the shop's position and fill its information

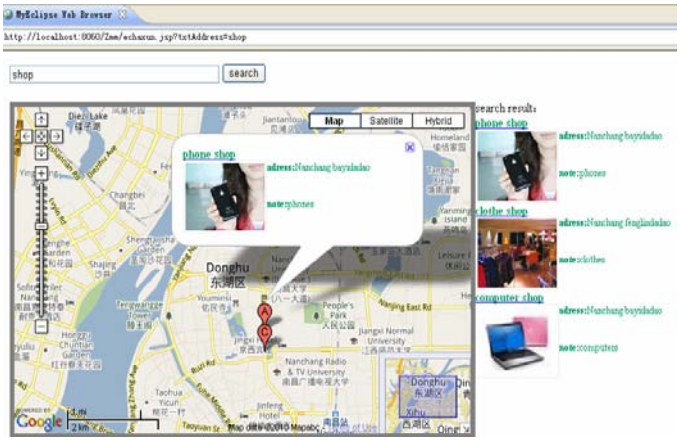

Figure 4. Show the positions and information of shops

```
// Create a div element "map_canvas" to hold the Map
<div id="map_canvas" style="width: 600px; height: 400px"></div>
// Loading the Google Maps API
<script src="http://maps.google.com?file=api&amp;v=2.x&amp;key=ABQIAAAAzr2EBOXUKnm_jVnk0OJI7xSosDVG8KKPE1-m51RBrvYughuyMxQ-i1QfUnH94QxWIa6N4U6MouMmBA&hl=en" type="text/javascript"></script>
// create a "map" object
Var map = new GMap2(document.getElementById("map_canvas"));
// center the map on a given geographic point and set the UI
//to a default configuration
var center = new GLatLng(28.6833, 115.8928);
map.setCenter(center,12);
//add the GLargeMapControl()
map. addControl(new GLargeMapControl());
//add a control for selecting and switching between supported map types via buttons.
map.addControl (new GMapTypeControl ());
//add a control that displays the map scale
map.addControl(new GScaleControl());
//create an overview the map in the bottom right corner and
//set its size
var Overmap = new GOverviewMapControl(new GSize(120,100));
map.addControl(Overmap);
//the createMarker function
function createMarker(icon, point, html, index) {
var letter = String.fromCharCode("A".charCodeAt(0) + index);
```

```
//define the image of the marker
icon.image = "http://ditu.google.com/mapfiles/marker" + letter + ".png";
var marker = new GMarker(point, icon);
// event Listener
GEvent.addListener(marker, "click", function() {
//open the information window
  marker.openInfoWindowHtml(html);
  });
markers.push(marker);
map.addOverlay(marker);
 }
```

IV. CONCLUSION

In this paper, we introduced the design of an online shopping system as an example of the application of GIS in electronic commerce. The system adopts the B / S three-tier architecture and uses the Google maps API to embed the Google Maps into the system website, which improve the system's extensibility greatly and reduce the developing difficulty and cost remarkably. By combining the online shops with the physical ones in the form of geographic information, it can enhance users' trust in online shopping and promote the development of electronic commerce.

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