THE KEY TECHNOLOGIES TO IMPLEMENT GEOGRAPHICAL MARKER ON 3D GEOGLOBE PLATFORM

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1. INTRODUCTION

Recent years, 3D virtual reality platforms become more and more popular. Besides rendering raster data and vector data, people need a platform that can mark their or others' interests. In this article, we have done some researches on how to manage and display geographic markers in a 3D virtual reality platform. Our markers can describe a facility or a place with words, hyper links, photos and videos.

2. TECHNICAL ENVIROMENT

Our experimental platform is a 3D virtual reality platform developed by our lab, and we named it GeoGlobe. This platform is a Google Earth-like 3D virtual earth which can render raster and vector data. We used and developed the platform, so that it can support geographic markers' render.

3. THE KEY TECHNOLOGIES TO IMPLEMENT GEOGRAPHIC LABELING ON 3D GEOGLOBE PLATFORM

3.1. Classification and description of geographic marker

In the platform GeoGlobe, we separate the geographic markers in two kinds, local custom marker and network share marker. When the GeoGlobe software starts, we can see network share markers first. The network share markers are stored in the server, and can be downloaded and watched for every user. That means, for two different users, if their view angle and altitude are the same, they will see same markers at their screen. For network share markers, at first there will be none of them at the client, as they are added by the users. Users can build their own local custom markers for their interested places, homes, favorite restaurants and so on. The local custom markers are only stored at the client, only the user who added them can see them. But they can upload the local custom marker to the server. One thing you should remember is that all the markers are described by a XML with the same format, no matter what kind they are.

In this research, we use a KML-like XML file to describe the geographic markers. There are two kinds of XML. The first one is a XML for a single marker, and this kind of XML can only describe one marker, while the other is a XML for multiple markers, and this kind of XML can describe lots of markers within a single file. The

multiple one is usually used in describing a group of markers for a tile or a search result or a semantic search result. For a single marker XML file, according to the users' setting, the structure of a XML file can be different, but the main structure is similar. A XML must have 'Name', 'PlaceMark' and 'Style' node , and these nodes are used for storing a marker's name, attributes and display styles. The node 'PlaceMark' has multiple sub nodes such as 'latitude', 'longitude', 'altitude', 'tilt', 'range', 'heading' and so on. With these parameters, a marker can be displayed in a fixed camera angle and elevation, so we call it 3D geography marker. The node 'Style' also has multiple sub nodes such as 'IconColor', 'IconScale', 'FontColor', 'FontSize', 'LineWidth' and so on. A XML can also have multiple 'Style' nodes for different icon condition such as selected and unselected. For a multiple markers XML file, all the parameters and setting are the same, but it treats a single marker as a node of the XML, so it can describe multiple markers within a single file. Figure 1 is a structure table of a single marker XML..

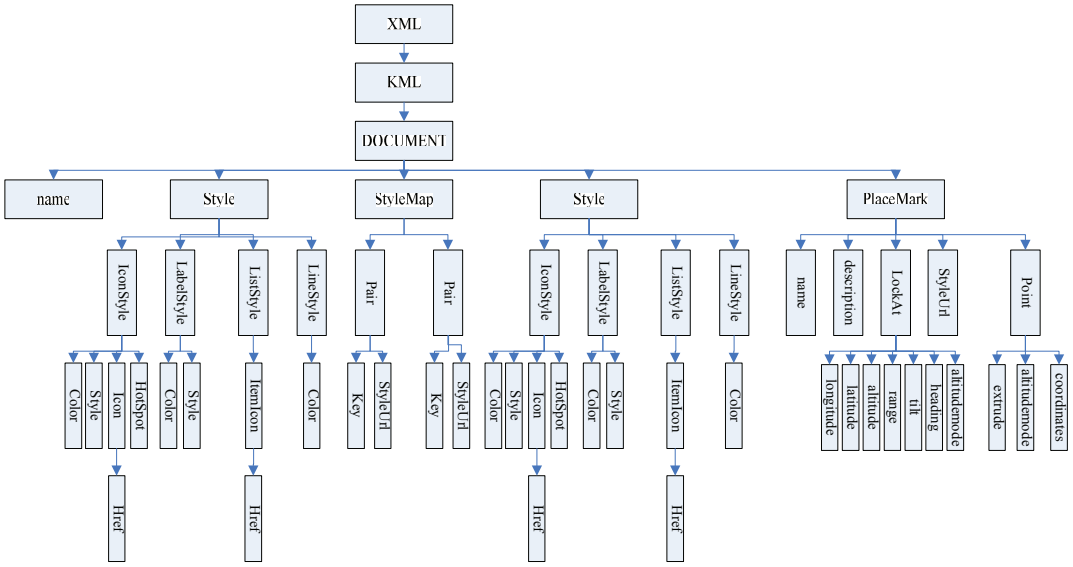

Figure 1: a structure table of a single marker XML

3.2 The management and render of local custom markers

As local custom markers are stored locally in the client side, and they don't interact with the server directly, most importantly, the number of local custom marker is relatively small; we just use a single module to manage them. That means while handling the local custom markers, we do not use the blocked strategy. Similarly, since the client does not separate the local custom markers by their altitude while handling them, we do not use layered strategy neither. While rendering the local custom markers, each marker is a structure object which is stored in a vector container so that the client can add and reduce the number of markers flexibly. In order to make the add marker and delete marker operation easier, at the client, we supply a friendly UI, so that users can set the attribute of a marker in detail or delete it. Meanwhile we also supply an upload function, so that users can upload their interested markers. We collect the uploaded markers at the server side, and audit it manually. If a marker has

passed the audit, it can be added to the network share markers, so that other users all over the world can explore it.

3.3 The pyramid-like layered structure to manage network share markers

Since there are mass of markers and their information are on the server, and we handle the network share marker with different strategies separated by the markers altitude (different altitude range displays different markers), we can not download all the markers to the client at one time and render them. So we use blocked and layered strategy to handle them. Recently our layered strategy is like this. We layered from 50000 meters height to the ground. If the height range is from 25000 meters to 50000 meters, we call it layer number 8, and the height range is from 15000 meters to 25000 meters, we call it layer number 9, just like this. So, if the height is from 0 to 80, we call it layer number 17. And here is our blocked strategy. We separate the whole ground at layer number 8 to 200 sub blocks (20 multiplied by 10), and from layer number 9, next layer will separate previous layer's each block to a averaged 4 sub blocks (2 multiplied by 2). In this way, we separate the blocks layer by layer till layer number 17, and this is just like a pyramid structure. Different from the raster data's pyramid structure, we do not use a recursive search and index method; we prefer to let the client to determine the layer number by the current frustum's altitude. Similarly, the client can also determine which blocks of the layer will be seen by the current frustum's longitude and latitude. In this way, we can determine which blocks' content will be downloaded, and this will make the downloading content much smaller at one time, so that users will have a better experience. The settings of the layered and blocked strategy will be saved in XML format, and it will be downloaded from the server when the client started. After downloading the setting XML, the client will analysis it and apply the settings. According to the number and rate of the users' requests, Sever Administrators can adjust the strategy by changing some parameters of the XML to make the strategy most fitful.

3.4 Store and download strategy of network share markers

Since there are massive markers and there contents to store, server uses Oracle database to store data. XML is stored in BLOB, other then BLOB, there is a 32byte Unique Key which generated by block's layer, column and row number.

The server and client can communicate with each other through Http Get request. The request sent from client includes the information of layer, column and row number. The server will calculate the key automatically and match the key in the data table. If the data matched, server will respond a XML file which includes all markers' information in the matched block. The client will analysis the XML and render makers. The server can find the XML by only one match, so that the time consuming is low.

When handling network share markers, download queue and cache functions can be used to improve the performance. Download queue is used to solve the problem that multiple requests at the same time. The download queue is not fixed at all time, when the camera moves, those in-queue but out-frustum requests will be

removed from the queue immediately, so that the tiles in frustum can be downloaded faster. The other function is cache. After using the client, there will be XMLs downloaded to the local HDD. If the user explores the same place, client will compare the timestamp of the local XML and the server's, if the timestamp is the same, this block's request will not be added to the download queue.

3.5 Applications and results

We also have some application on this solution. We have developed a city facility semantic search system by Oracle Semantic Technology. But Oracle can not give us a result display solution. So we use our markers platform to render the result. Figure2 shows a hotel semantic match result. We use our semantic match system to find hotels near Wuhan university, actually 3 results matched. In the picture, you will find GeoGlobe works fine.

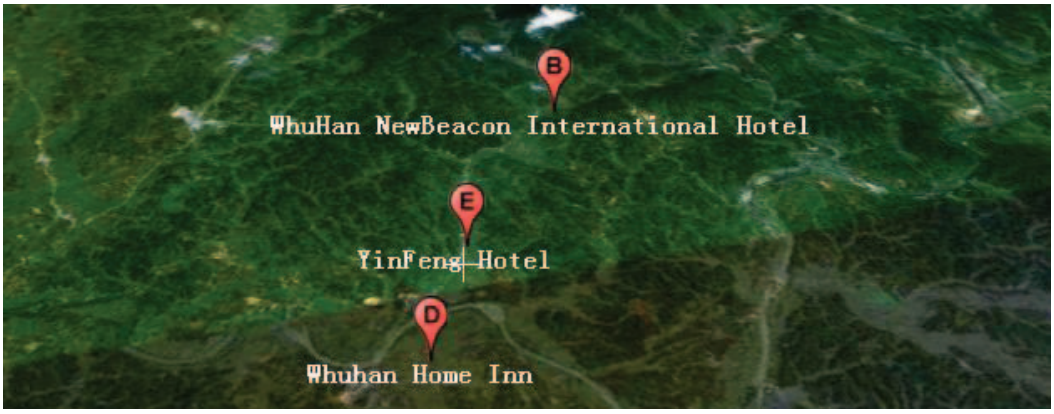

Figure2: A hotel semantic match result showed in GeoGlobe

4. CONCLUSIONS

After our research, we found that use our technology; we can gave our platform GeoGlobe a good geographic marker function. We can display the markers with layered and blocked strategy. We can not only show the markers, we can also have the markers' descriptions or related photos or even related videos displayed. It makes our platform very useful. Besides, with our platform an technology, we show the detail information and search result on buildings, facilities, restaurants, hotels and so on. Other than showing them, we also have a navigation system. If we continue developing the system, it will be used in wider areas.

11. REFERENCES

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