

SITE LOCATION AND INFORMATION RETRIEVAL FOR ANTI-TERRORIST MEDICAL RESCUE SYSTEM BASED ON GIS

Haibin Meng¹, Jinghui Yu² and Dongsheng Zhao³

¹ *Associated Research Fellow, Institute of Health Service and Medical Information,
Academy of Military Medical Sciences, Beijing, China, 100850*

² *Assistant Research Fellow, Institute of Health Service and Medical Information,
Academy of Military Medical Sciences, Beijing, China, 100850*

³ *Correspondence Author, Research Fellow, Institute of Health Service and Medical Information,
Academy of Military Medical Sciences, Beijing, China, 100850
Email: menghb@bmi.ac.cn, weijh@bmi.ac.cn, dszhao@bmi.ac.cn*

ABSTRACT :

Terrorism is the common challenge that the world faced. China also faces serious terrorist threaten of East Turkestan. Geographic Information System (GIS) has profound effect in anti-terrorist rescue actions. This paper focuses on the key requirements of quick retrieval and location: site obscure query/location, multi-layer spatial selection with the integration of MapXtreme® and SQL Server®. The key technology is to separate the geographic information and other information, which stores the GIS information into map layers and other detail information into database tables. The layer name and table name remain the same. Every object in a map layer matches a record in a table. The GIS objects only contain two fields as object name and ID while ID matches the same record in the database table. Thus we can determine a GIS object and a unique record that matches the GIS object by layer name and ID. Site obscure query operates the SQL Server® tables with SQL. A result set that contains multiple sites is got and a list is returned to the browser with a hyper-link to site location and detail information display page. Detail information is got and displayed on the web page through retrieving the SQL Server table with the query parameters as ID and Table Name. Site location is realized through the operation of MapXtreme® with the input parameter as ID and Layer Name. This paper also proposes an approach of multiple layer spatial selection. The algorithms are described in detail and an example is given to exemplify the algorithms.

KEYWORDS:

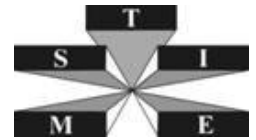
anti-terrorism, GIS, site location, multi-layer spatial selection

1. INTRODUCTION

Terrorism is the common challenge that the world faced today. China also faces serious terrorist threaten of East Turkestan, etc. The Chinese government has imposed the anti-terrorist preparation to cope with the potential terrorist attacks. Geographic Information System (GIS) has fundamental effect in anti-terrorist rescue actions. Because it displays information through map, it can give the decision-makers a direct overview of the situations. The first requirement of anti-terrorist rescue for GIS is rapid reaction. It needs the system to have the ability to locate the attacked region rapidly on the basis of obscure information and acquire the ambient situations such as other potential attacked sites, the location of rescue forces, etc. The query results should be precise and comprehensive. The response time should be as short as possible. These requirements should be considered when a rescue system based on GIS is designed. This paper implements the requirement of quick information retrieval using MapXtreme®, SQL Server® and Active Server Page(ASP®) language. The algorithm of site obscure query/location and multi-layer spatial selection are discussed in detail.

2. APPROACH

2.1. System Architecture



We implement the GIS based on MapXtreme®. The structured information of map sites is stored in SQL Server®. The properties of these two software platforms are shown in Table 2.1. MapXtreme® is a web-based GIS platform of Pitney Bowes© Corporation which supports multi-user operations in a network environment. It encapsulates MapX® objects as a pool to provide GIS functions and services in an object-oriented manner. SQL Server® is a large network-based relational database management system (DBMS) of Microsoft© Corporation. It has the features of high volume information storage ability, rapid query speed and multi-user operation ability. From Table 2.1, we can see the two platforms can be integrated seamlessly in a network-based multi-user environment on Browser/Server (B/S) architecture. It can make full use of the advantages of each other to meet the user's needs. The programming language is ASP. The system architecture is shown in Figure 1.

Table 2.1 The properties of MapXtreme® and SQL Server®

	MapXtreme®	SQL Server®
Basic Function	GIS	Database
Information Type	Map	Table
Operation Environment	Network	Network
System Architecture	B/S	B/S or C/S
Parallel Access	Support	Support
User Interface	Browser	Browser or Client
Query Type	Spatial/String Query	Structured Query Language(SQL)
Query Result	Selection Set	Record Set
Development Tools	ASP	ASP, Visual Basic ,Delphi, C# etc.

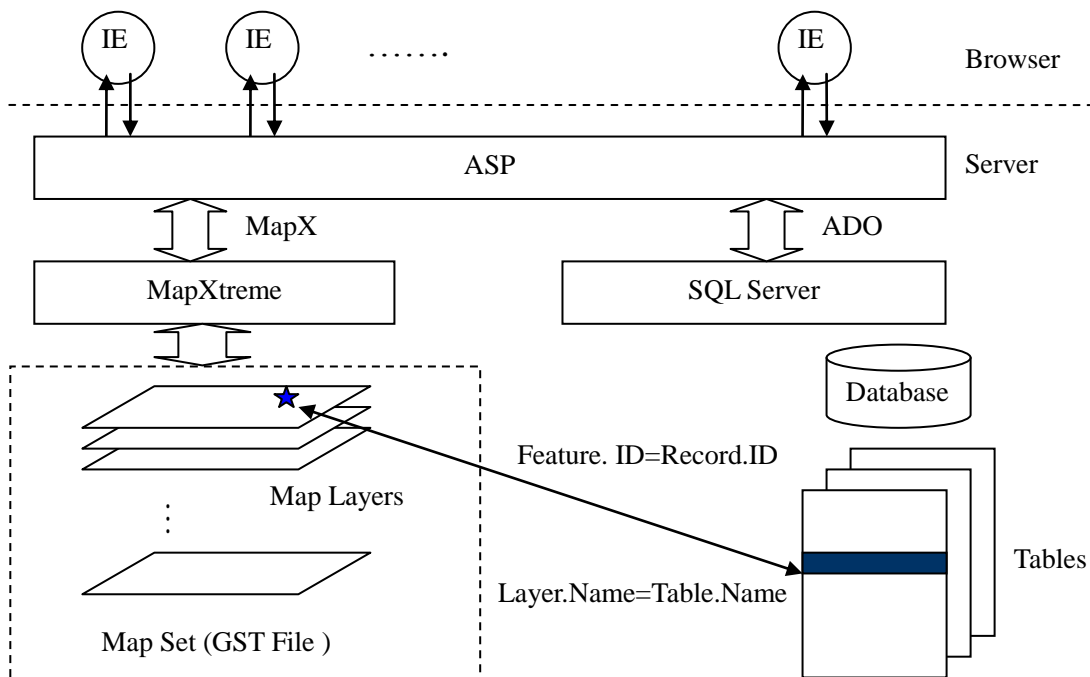
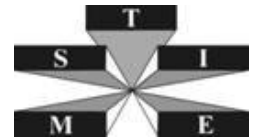


Figure 1 System Architecture



The information of system is stored in two parts: layers and tables. The layer name and table name are the same. Every object in a map layer (We call it a feature) matches a record in a table. The tables store the detailed information that describes the features. Each record in the table has a primary key called ID. The GIS objects only contain two fields as feature name and ID while ID matches the same record in the table. By the mechanism described above, we can determine a GIS object by layer name and ID. We can also determine a unique record that matches the GIS object.

2.2. Site Obscure Query and Location

Site obscure query and location can be divided into two procedures as site obscure query and site location. A result set that contains multiple sites can be got as the result of site obscure query. Therefore, a list is returned to the browser. Users can click the hyper-links to execute site location function.

2.2.1 Site obscure query

The object of site obscure query is the SQL Server® tables. We can query these tables by SQL. The programming language is ASP which runs in server side. The site obscure query algorithm is shown in Figure 2.

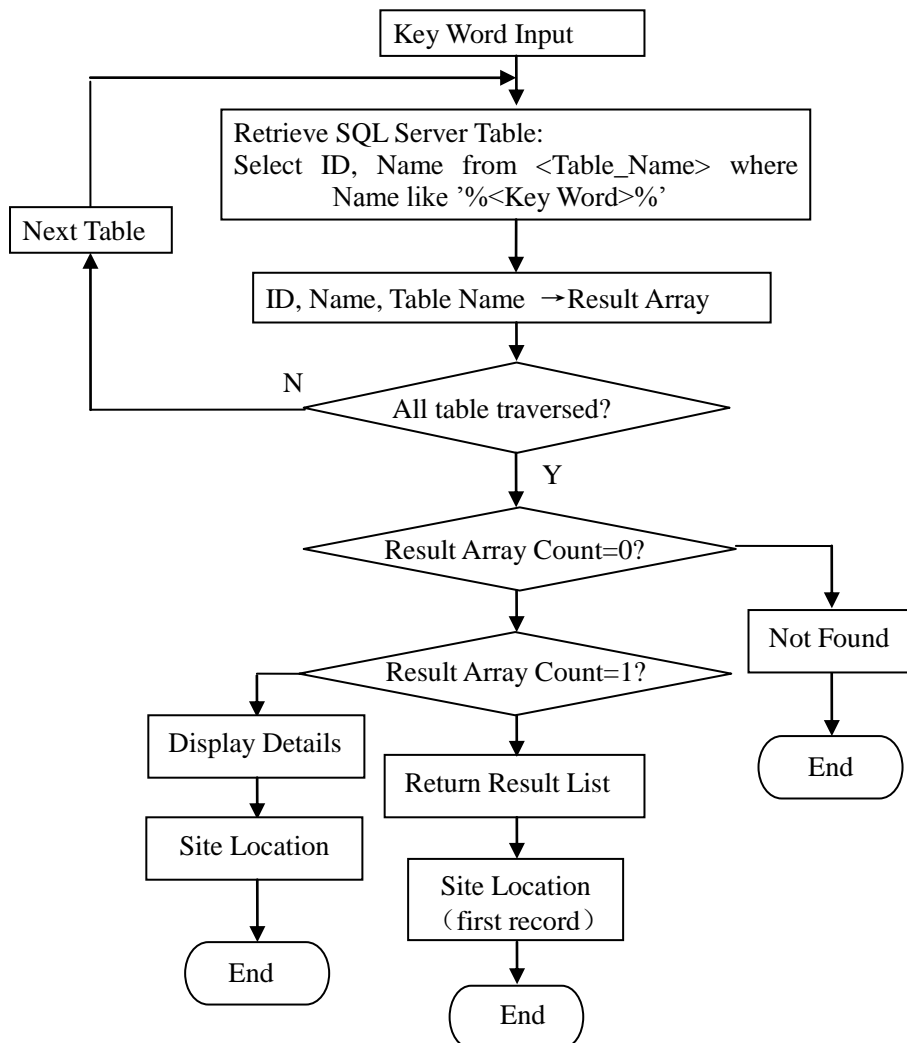
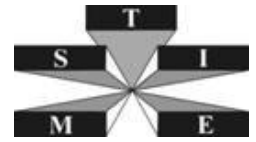


Figure 2 Algorithm of Site Obscure Query



Each line of the result page contains a hyper-link to site location and detail information display page. The HTML code is as follows:

`Haidian High School`, where tools is the MapXtreme® function number, layername is the name of map layer and fid is the ID of the map object. The user can call the detail information display and site location function by clicking the hyper-link above.

2.2.2 Detail information display and site location

Detail information is got and displayed on the web page through retrieving the designated SQL Server® table with the query parameters as ID and Table Name. Site location is implemented by MapXtreme® with the input parameters as ID and Layer Name. The algorithms are shown as Figure 3.

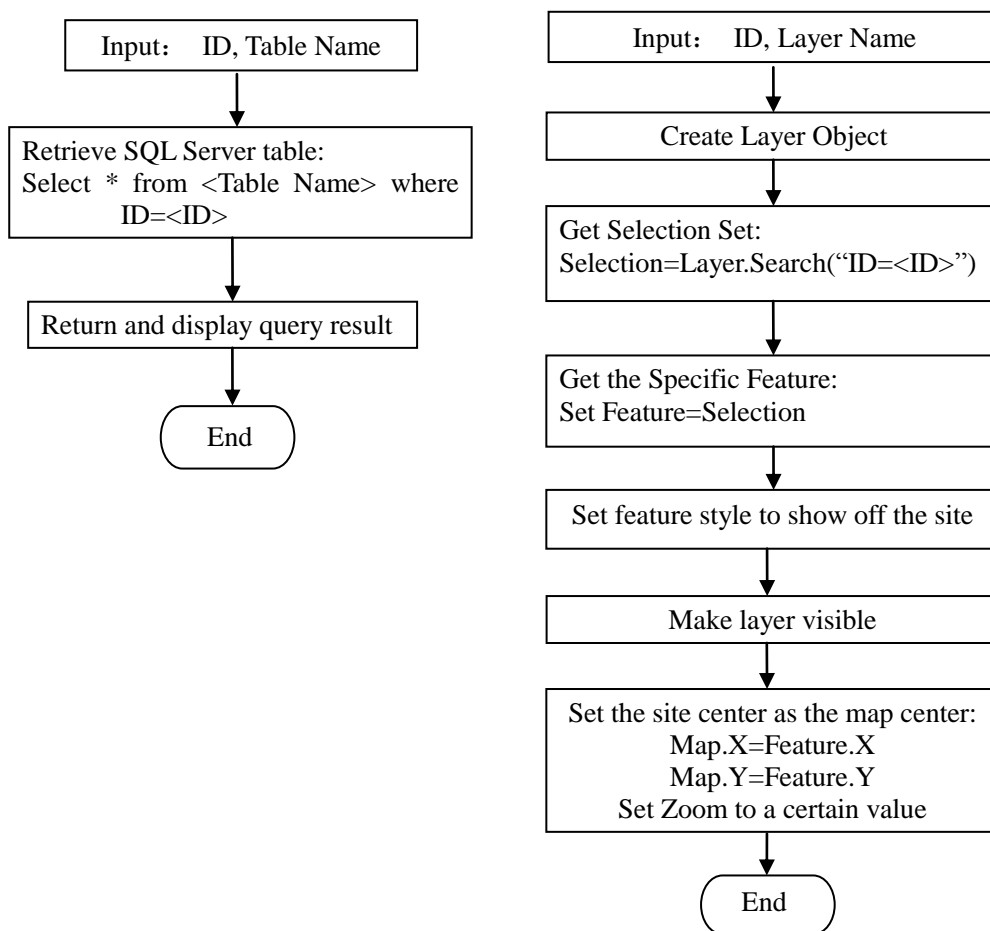
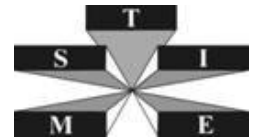


Figure 3 Detail Information Display and Site Location algorithm

2.2.3 Multi-layer spatial selection and retrieval

After determine the attacked site, we still need to know further information of the ambient situations, including other potential attacked sites, rescue forces, etc. These sites are stored in various map layers. Although MapXtreme® provides many spatial selection approaches, such as point selection, rectangle selection, radius selection and polygon selection. These approaches can only be used to a single layer. We propose an approach of multiple layer spatial selection, which is described in Figure 4. In Figure 4, we exert spatial selection operation on each layer and stored the result of selected map objects, which are called features, into a result array, including the ID, Name and Layer Name. In the end, we display the



content of result array through a web page. Meanwhile, we also redraw the selection region in a map window.

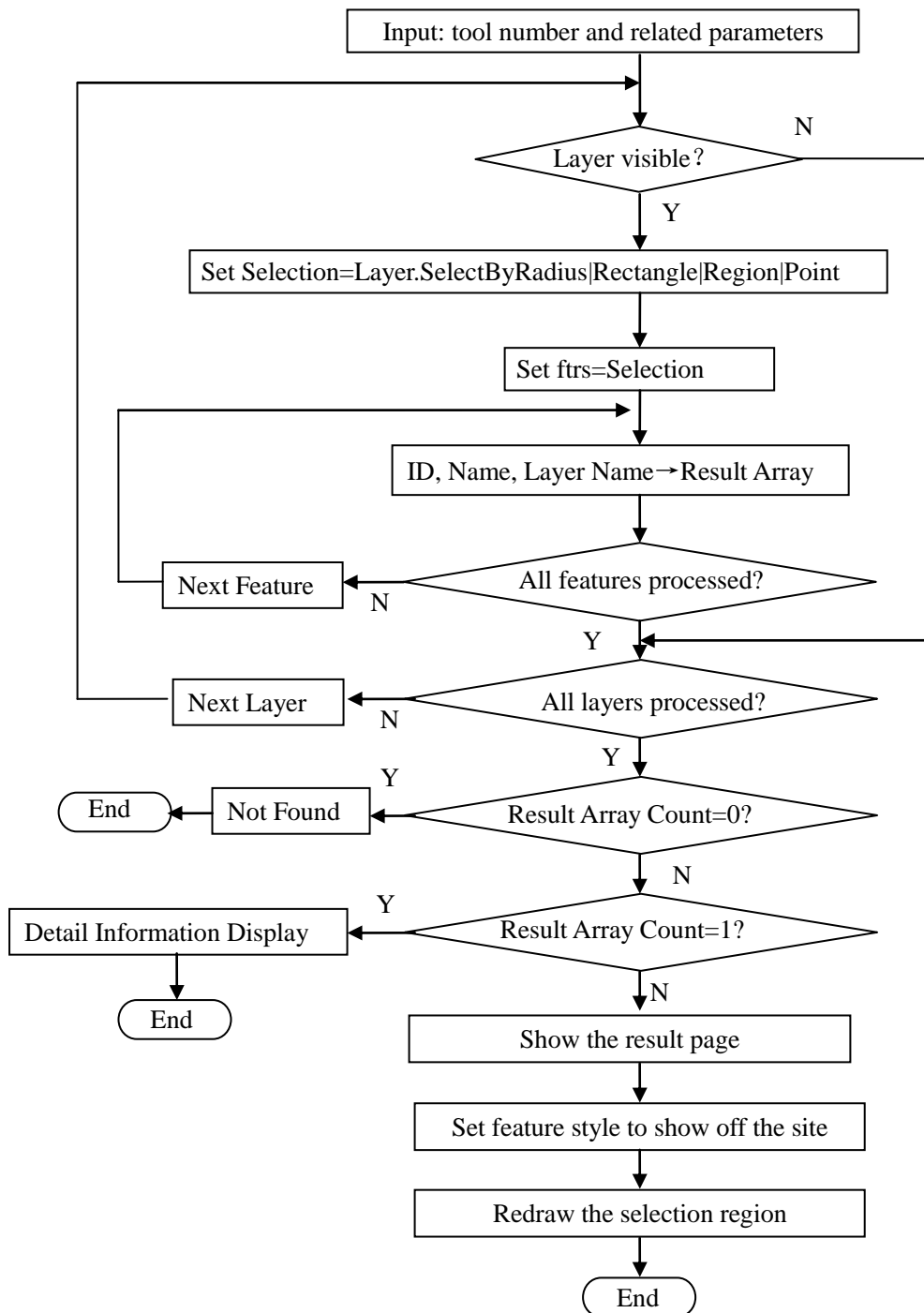


Figure 4 Multi-layer Spatial Selection Algorithm

3. RESULTS

Table 3.1 gives an example of the result of site obscure query. The key word for retrieval is “Haidian”. Noted that the result is got from various tables.



Table 3.1 An example of result array

ID	Feature Name	Table Name
1	Haidian Opera House	Cinema and Opera House
2	Haidian High School	School
3	Haidian Health Bureau	Government Department
4	Haidian Price Bureau	Government Department
5	Haidian Architecture Admission	Government Department
6	Haidian Fire Prevention and Control Bureau	Government Department
7	Haidian Changqing Hospital	Hospital
8	Haidian Balizhuang Hospital	Hospital
9	Haidian Hospital	Hospital
10	Beijing Haidian First-aid Station	First-Aid Center
11	Haidian Center of Disease Prevention and Control	Center of Disease Prevention and Control

The query result is shown in Figure 5. Noted that the map is properly zoomed and make the first site of the query result to the map center. The query result is displayed at the right part of the browser. After clicking the hyper-link of one site of the query result, the browser returns the detail information while putting the location of the site to the map center, as shown in Figure 6. Figure 7 shows the result of multi-layer radius selection. The spatial selection result belongs to various map layers which are categorized into 2 types as potential attacked sites(such as subway station, cinema, train station, stadium, etc.) and rescue forces(such as hospital, first-aid center, CDC, etc.).

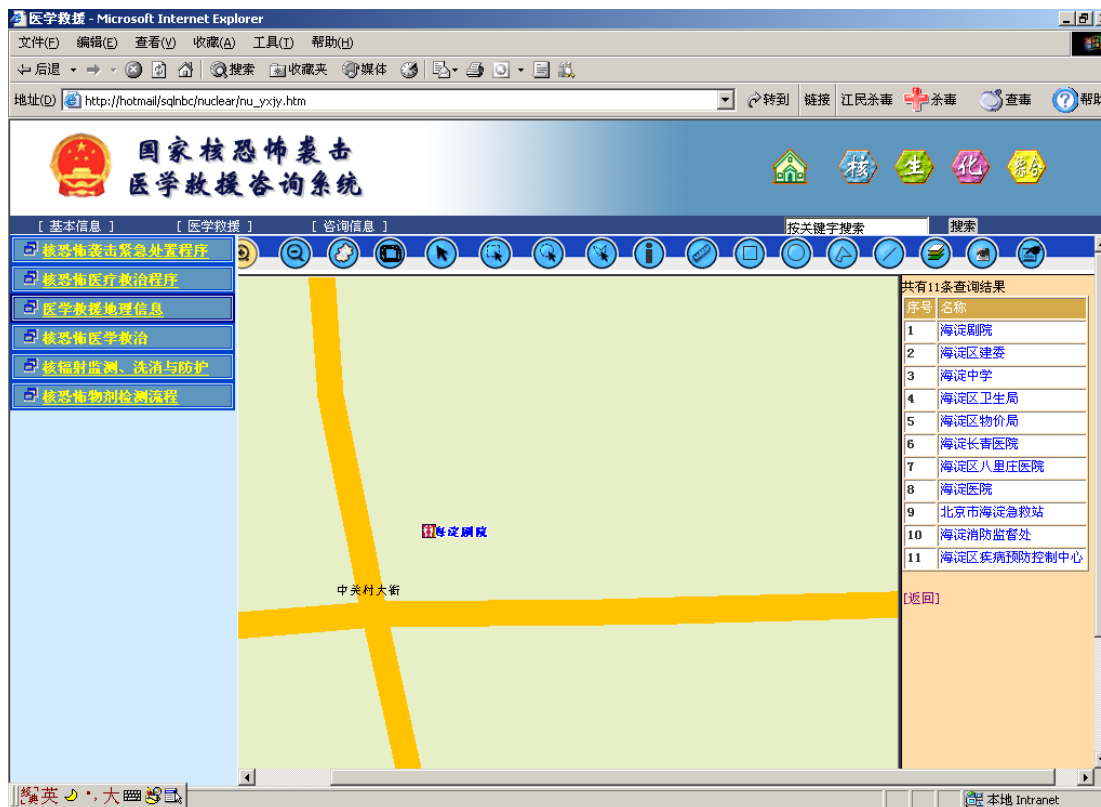


Figure 5 The Result of Site Obscure Query

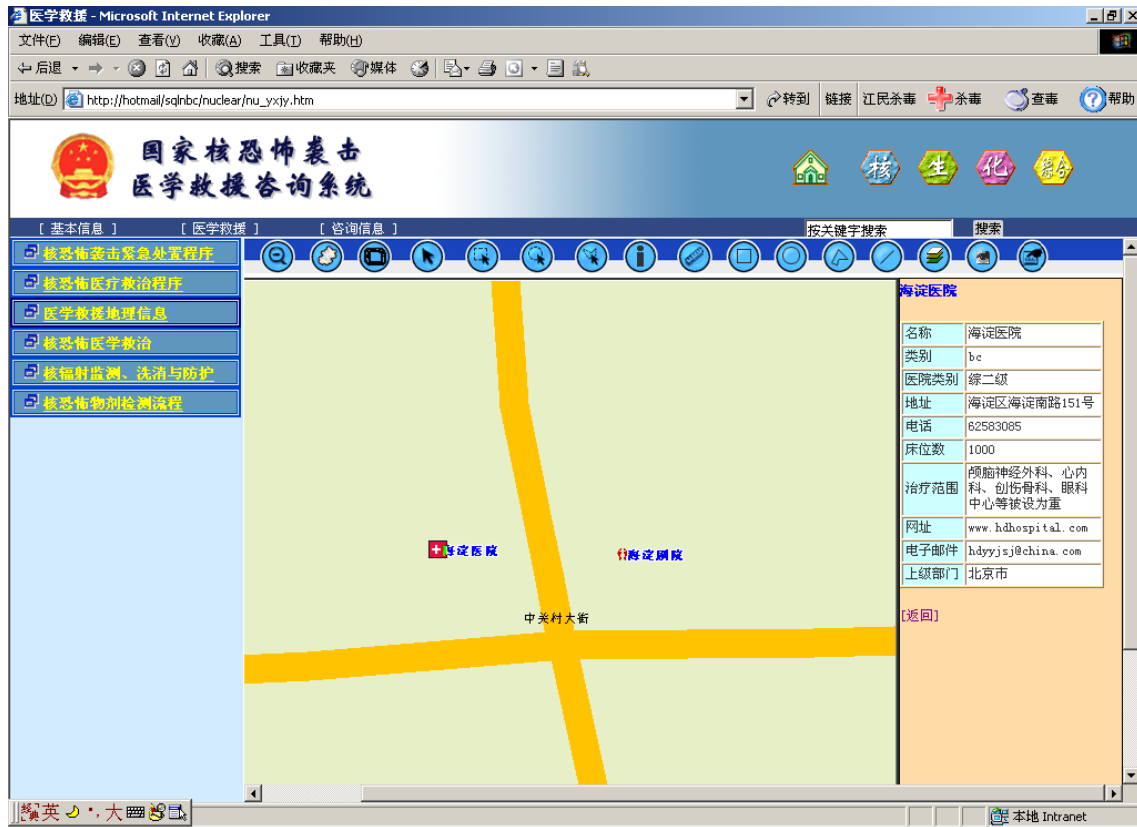
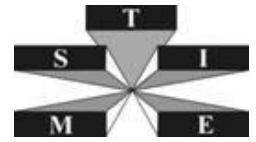


Figure 6 The Result of Detail Information Display and Site Location

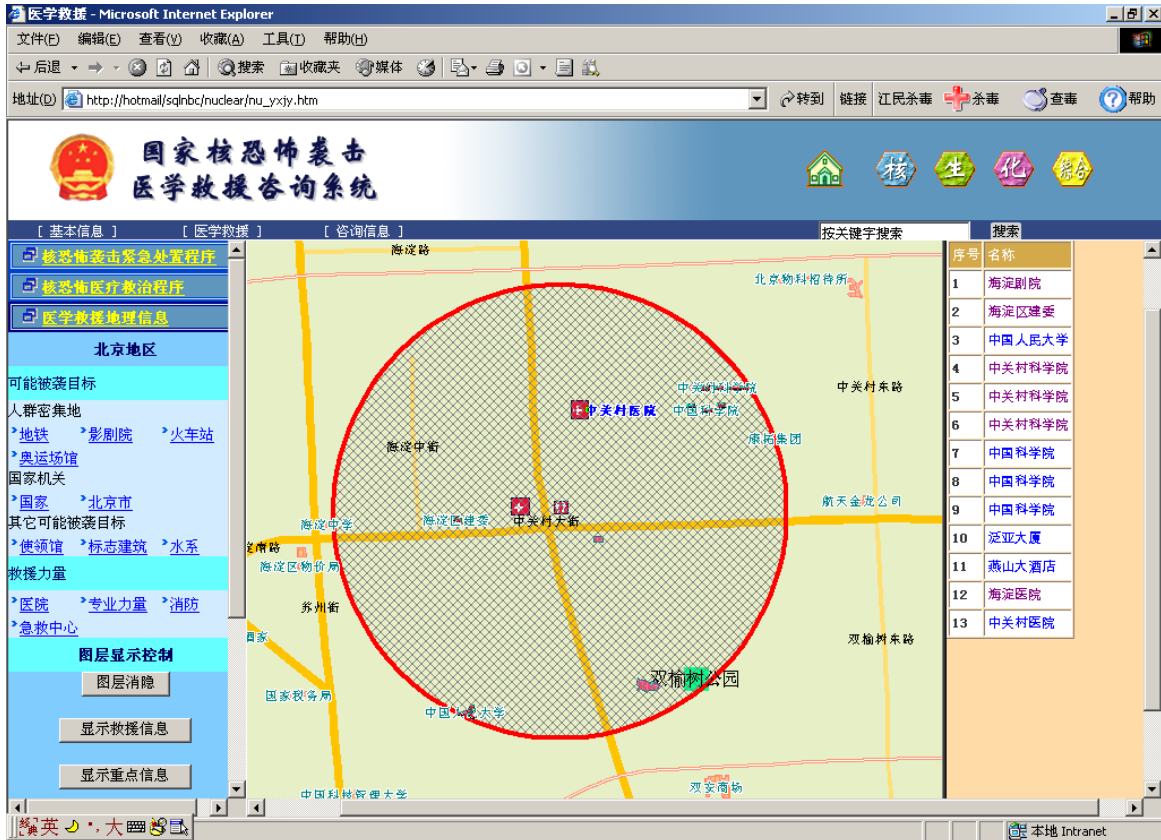
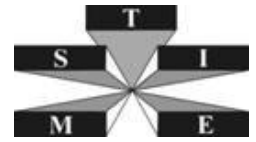


Figure 7 The Result of Multi-Layer Radius Selection



4. CONCLUSIONS

In this paper, we focus on the key requirements of anti-terrorism rescue GIS and implement the site obscure query/location, multi-layer spatial selection with the integration of MapXtreme® and SQL Server®. The key technology is to separate the geographic information and other detail information of sites. It can make full use of the respective advantages of GIS and DBMS and can be used in a multi-user, network-based environment. With this architecture, more complicated applications can be developed to meet the growing requirements of anti-terrorism.

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