Design of User Interface for Query and Visualization about Moving Objects in Mobile Device

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ABSTRACT

As diverse researches are working about location acquisition, storing method, data modeling and query processing of moving objects, the moving object database systems, which can gain, store and manage location information and query processing, are turning up. As the mobile device is moving but have constraints, the convenience user interface for spatio-temporal query and viewing query result needs.

In this paper, we designed user Interface for spatio-temporal query related moving objects, viewing query result, tracing current and past location of those and monitoring. And we designed system for implementation of these interfaces.

Keywords : Interface, moving objects ,mobile

1. INTRODUCTION

As recently the use of wireless device is increasing and the acquisition technology of location information of objects is developing, the diverse application services are being demanded and developed. So for the sake of satisfying applications' demands, the system, stores and manages the continuous changing location information and processes diverse user queries, needs. It is difficult that the legacy database system stores and manages the continuous changing location information and processes diverse user queries. The research of spatio-temporal database systems that targets moving objects is under

way and system such as LBS platform is appears on business.

Therefore, it is possible that searching, analyzing and monitoring location of moving objects by utilizing moving object database system which gain, store and manage spatio-temporal information and process user queries.

But for the sake of transmitting user's requests, the user presents a request with spatio-temporal query language. But spatio-temporal query language provided by database system is complicated and inconvenient. It is difficult for user to request through mobile device in the open. Also, we need viewing interface of query result in order for user to knowing by intuition.

So in this paper, we deal user interface for querying and viewing result in mobile device, which has an advantage of moving and on the contrary has several constraints such as small size display. And we design a architecture of system for implementation..

The paper is constructed as follows. In section 2 related work is briefly reviewed. Section 3 describes the moving objects database system. Section 4 describes the design of system architecture. Section 5 is describes how to interface for querying and viewing result of query in mobile device. Section 6 offers conclusions.

2. Related work

Moving objects change position or extent continuously[1]. And it can be represented the temporal development of spatial entities such moving point or moving region[2]. Moving point may change their location or position over time such as cars, ships, planes and animals. Moving region may change their location as well as their shape (grow or shrink) such as forest shrinking, storms trajectory and cancer growing.

In order for DBMS to storing and managing moving object that change position or location continuously, discrete model that fixes representation and is generally far more complex is used. The CHOROCHRONOS projects propose slices for the sake of representing attribute information and definition of spatio-temporal operators is based on it.

The spatio-tempoal query language (STQL) [3] is classified spatio-temporal data definition language and spatio-temporal manipulation language. The spatio-temporal data definition lagunage have spatio-temporal table create statement, index and view definition statement and spatio-temporal update statement. These statements have components such as general attribute, temporal attribute and spatial attribute. And the research of implementation of spatio-temporal query processing has worked for the sake of processing spatio-temporal STQL effectively[4].

3. Moving Objects Database System.

In this paper, we target the moving objects database system that store moving points only and their current location as well as past location. For storing trajectory of object over time, we must gain location information of objects continuously. But we can merely gain their location discretely such as every second and every minute in spite of using advanced wireless network

technology and Global Positioning System (GPS). So location information of moving objects is stored with fixed time interval discretely.

Moreover we assume that moving object database system provide interface which accepts spatio-temoral query language for searching moving objects and return query processing results. Many a related research is working.

4. Design System Architecture

Figure 1 is the system architecture for accessing the moving objects database system.

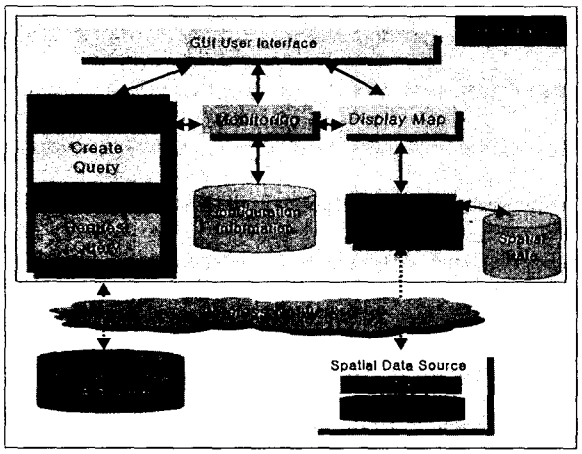

Figure 1 System Architecture

The GUI User Interface in Figure 1 is interface for accepting user's request. This interface will be explained in next section.

The ST(Spatio-Temporal) Query component in Figure 1 is composed of two components. One is the Create Query component. The other is the Request Query component. The function of the former is to translate user request accepted from GUI User Interface into spatio-temporal query language. The function of the latter is ti send query language created in Creating Query component to moving object database system and accepting query results.

The Monitoring component in Figure 1 stores configuration information accepted from user. It obtains current location information of moving objects from the ST Query component and sends query result to the Map Display component. The Monitoring component repeats these works every configured time in order to monitoring location of moving objects.

It is essential to view location information of moving objects over map in order for user to knowing by intuition. This system has two plans how to get spatial data so as to displaying map. One is to transfer from GIS Server when new viewing area didn't store in device memory. Another is to loading from device's memory directly. For this way, in advance, a user has to loading spatial data by means of synchronizing PC. Recently mobile device' memory size is increasing. So it is efficient for user to synchronize PC for loading spatial data which user need previously. This way decreases data communication over wireless network and increase performance. The Display Map component displays query results over map. Query results are trajectory or location of moving objects. The Request Map component gets spatial data from spatial data source by way of OGC data provider. The OGC data provider provides common interface. So the Request Map component can obtain spatial data by common interface from diverse GIS servers.

5. Design of User Interface

The main window to interact user is Figure 2. The part A in Figure 2 is main menu. The part B in Figure 2 displays result of user request over the map.

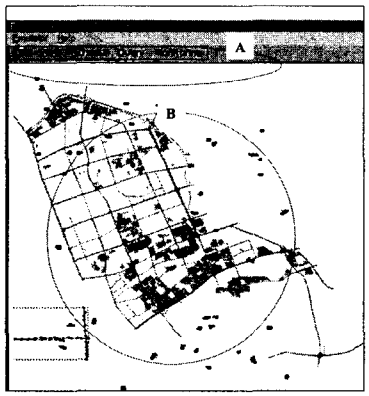

Figure 2 User Interface of Main Window

The map and trajectory of moving object in Figure 2 is sample data for testing. And figures in this paper dump from Pocket PC emulator.

We will look at the important main menu.

View Menu

We compose view menu of several submenus such as Table, QueryString, Panning, ZoomIn, ZoomOut.

The Table sub menu shows a table filled with query result as Figure 3.

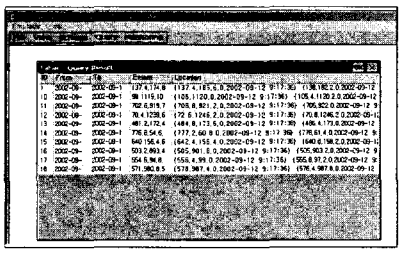

Figure 3 Query result window : Table

The QueryString sub menu merely displays text box filled with query string sent to the moving objects database system.

The purpose of Panning ZoomIn, ZoomOut sub menu is to view map.

Schema Menu

A user need the schema information so as to requesting query. We compose sub menus of interface for obtaining schema information of moving object database system. The schema interface bases on Meta information of GIS data source provided by the Open GIS Consortium. DBSCHEMA_OGIS_FEATURE_EXTENT is added. This interface providers whole time interval and MBR(minimum Boundary Rectangle) of moving objects stored a table.

Query Menu

This menu composes of interfaces for accepting user request. The query menu was composed depending on analyzing pattern of user query.

We survey type of query to analyze pattern [5].

First, if moving object is man :

"Movement of criminal", "location of guard",

"list of customers visited during a week"

Second, if moving object is animal,

"Determine trajectories of birds, whales,...."

"Where are the whales now"

"Which distance do they traverse?"

Third. If moving object is Cars

"Taxis : Which one is closest to a passenger request position"

"Truck : Which routes are used regularly"

Fourth, If moving object is ships.

"Are any ships heading towards shallow areas?"

"Find strange movements of ships"

Examples showed above does not all possible query type but those are requested frequently or generally. So when we analyze, pattern of request query classify below.

The first type is to search location of moving object at any time. The second type is to search trajectory of moving object. These two types are frequent query. Additional types are to search moving object contained particular area and to find closest object from any location.

According to analyzing patter of query, The Query menu has several sub menus such as "Search Location", "Search Trajectory", "Region Query", "Find Closest Object", "User Define Query".

Figure 4 shows the Search Location interface. A purpose of this interface is to accept request for searching location of moving objects at any time. It is composed of selecting moving objects that user want to see and selecting time. Depending on time, User can show objects' location information of past, present or future time over map. If moving object database system provides location prediction operation, it is possible to obtain objects' location of future.

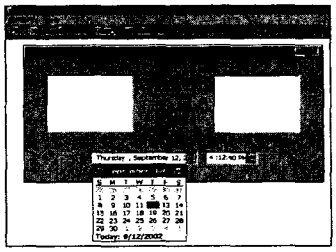

Figure 4 user interface of search location

Figure 5 shows Search Trajectory interface. A purpose of this interface is to accept request for searching trajectories of moving objects. It is compose of selections of objects and time interval.

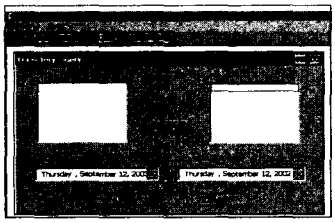

Figure 5 user interface of search trajectory

Figure 6 shows Region Query interface. A purpose of this interface is to accept request for finding objects contained area. It is compose of inputting interface of area and selecting time interval. As a matter of convenience, default area is set current viewing map area and moreover, there are extent of map and current viewing map area.

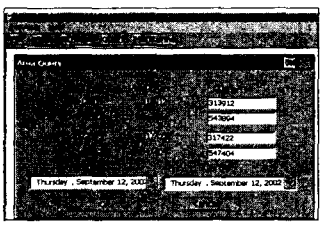

Figure 6 user interface of region query

A purpose of the Find Closest interface is to find closest object from a spot. If a mobile device has GPS, it

can find closest object from itself.

• **Monitoring Menu**

We can monitor moving objects because moving object database system is obtaining continuously location of moving objects.

The Monitoring menu is composed of submenus such as "Set Environment", "Start" and "Stop".

The Set Environment sub menu accepts configuration information from user. Figure 7 shows this interface. It has selecting objects and selecting update interval.

The Start menu starts monitoring and displays current location of object over map. The Stop menu stops monitoring.

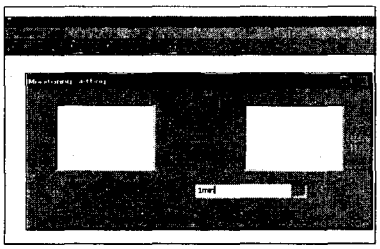

Figure 7 user interface of Set Environment

6. Conclusion

We design interface that a man, who uses the mobile device such as web pad, can readily access moving objects database system that can gain, store and manage location information and process user queries. A user can monitor moving objects and query spatio-temporal query by way of graphic user interface.

We need to implement this interface and additionally to analyze and apply query result.

Our project, which is to research and implement the moving objects database system, is on going.

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