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Location Based Application for Mobile Devices

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Abstract: *The wireless internet and mobile computing these are the two rapidly developed technologies with more and more mobile based services go through the personal and business and personal life. LBS (Location Based Service) are one of the significant services which required to use in mobile devices. The use of PDAs, wireless internet, 3G, 4G and Internet-based GIS telecommunications, the supporting mobile GIS technologies are rapidly gaining the effectiveness and popularity. So employing GIS data on mobile devices has received a generous boost, due to the increasing power of PDAs and cellular phones and the growing availability. The technological potential of Mobile Spatial Interaction (MSI), Mobile Human-Computer Interaction requires a comprehension of visualization possibilities for spatially referenced content and application programs make devices to able to move themselves between different hosts on the network.*

Keywords: Mobile Spatial Interaction (MSI); GIS; Intelligent Transport System (ITS); Geographic Data Access Middleware (GDAM)

I. INTRODUCTION

The development of mobile applications, follow the media paradigm of anytime, anywhere and provide transparent access to services through different portable devices. Mobile applications have the ability to adapt themselves to the user's viewpoint. With the rapid development of spatial technology and wireless network, the requirement of information services by user at anytime anywhere is more and more critical. LBS, that could supply geospatial information services for anybody at anytime anywhere is becoming practicable. The LBS geospatial database is characterized by multi levels of detail and multi scales data, during the traveling across different regions, people try to search for the information about the region that is like the GPS.

Application user with the function of navigating with different details of level from overview screen to detailed views, as well as with the best route calculation and views function, it is compulsory to store and manage those representations of the same geographical feature. LBS, linked to Geographical Information Systems (GIS). These are motivated by the wide availability of GPS positioning and supply facilities such as local maps and directions and spatial queries. A location-aware system has two primary components a location-determination system and a computational model of the space.

The locations provided by the former applications have very limited use without the perspective provided by the latter. A system that automatically illuminates a user's path based on their location data should not require the user or their digital agent to provide regular inputs to the system beyond reporting position if necessary.

To generate the requested location events efficiently, a spatial indexer is used. It's a process that monitors for spatial interactions and generates the events. The efficiency of a spatial indexer is important within an inside environment. The basic concept, a virtual zone might be attached to computer terminals. When a user interacts with a client (by entering it), this is a signal which implies physical proximity to the terminal.

Web sites allow the user to interact with a map, and providing functionality to zoom and pan on the client side, to click an object to request further detailed information, or to form a query with spatial conditions. SDBMS uses server to manage spatial data objects where static maps at one or more scales are used, map can be generated on demand by using the data retrieved from SDBMS and the spatial objects are individually stored and the geometries of that objects are represented as a sequence of points to generate map in picture format. One way to describe the law is that the rendered image on display should maintain a ratio of the number of pixels for objects over the number of pixels for the background; therefore, information is not too crowded visually. Information density dependent on query result and also on the resolution of the target display and the possible combinations of spatial and non-spatial query conditions and target display sizes can be prohibitively large for any approach based on pre-materialization.

II. ARCHITECTURE OF SPATIAL DATABASE

Generalization of spatial data is a non-trivial task. It is a step beyond object selection, which can be readily processed by a DBMS. It involves object simplification and several other operations such as tokenization and amalgamation. These operations may lead to an alternation of object geometry, dimensionality, and sometimes even existence.

Mobile applications provide various type of information concerned with user's position through cable and wireless transmission. 4S technology integrates 4 kinds of systems that process spatial information: GIS (Geographic Information System), GNSS (Global Navigation Satellite System), ITS (Intelligent Transport System), and SIIS (Spatial Imagery Information System).

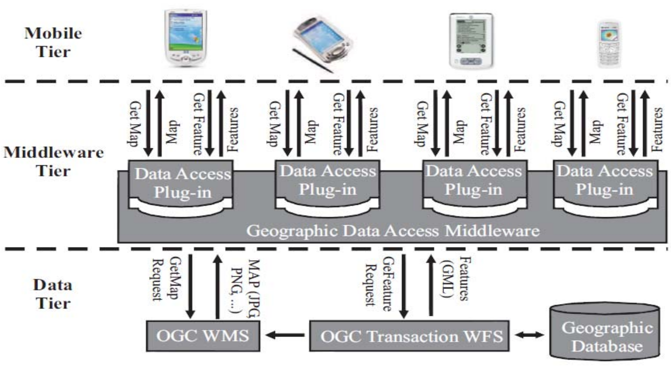

Figure 1: Architecture of Spatial Database on Mobile Device

Data Tier: The function of this tier is to provided well-known OGC WMS (Open Geospatial Consortium Web Map Service) and WFS (Web Feature Service) interfaces. These services can be accessed through the HTTP protocol, either by a GET or by a POST request. The interfaces indicate operations for retrieving service metadata and for retrieving a map (in a raster image format) or a collection of features (in GML).

Middleware Tier: The functionality of the extensible Geographic Data Access Middleware (GDAM) enables mobile devices with limited capabilities to invoke the operations of well-known OGC web services and assists them in processing the results. This tier supports two tasks: First, downloading maps and features from the WMS and the WFS services, and second, updating the geographic database through the Transaction operation of the OGC WFS-T according to the changes reported by the client PDA GIS application.

Mobile Tier: The GIS software installed in the mobile devices supports the interpretation and edition of the existing geo-data and the insertion of the new one.

III. SPATIAL DATA FOR MOBILE DEVICES

Research for mobile computing ranges from hardware and communication networks to software and data management aspects such as new interface metaphors, data models for mobile applications, continuous queries, adaptive applications, information exchange between disparate applications. A number of research project have begin exploring the potential of LBS and most of the research projects uses maps to communicate geographic information on mobile devices. However, largely the used maps are in raster format which is generally scanned paper maps, which were designed for the different medium.

Research on employing geographic data on mobile devices has received a substantial boost, due to the growing availability and increasing power of PDAs and cellular phones. There is marginal research on map design and visualization on small display devices and there is need of further research seeing all the limitations and possibilities of map design for the mobile devices.

LBS indexing have received much attention in the space of GIS. Researchers have developed a B-trees, Rtrees, Quad-trees, D-trees.

A. Architecture:

If we know accurate location through device such as GPS, very wide improvement is expected in human life, as an invention of watch for accurate time makes wide advances in many parts of human life. Spatial applications can process vector map such as building boundary, raster map such as satellite image, road information using ITS, location information obtained from GPS. Spatial data for mobile environment constructed from existent spatial data original sources are managed by server for distribution and used by application system.

B. Quad-tree Spatial Monitoring:

The SPIRIT middleware used a dedicated software process to monitor based on a pure Quad-tree dissection of space. The basic principle of using a Quad-tree persists today. When using a Quad-tree for spatial indexing, each zone is represented as a filled two dimensional simple polygon. Every node in a Quad-tree is associated with a square area, and the area associates with the root node. Each node is either a leaf node or has four children, each corresponding to a quarter of their parent node's area. The root node is recursively split until nodes are found that are either fully contained by the shape.

The advantages of using a Quad-tree are that the process is conceptually straight forward also the tree structure is appropriate for spatial searching. The disadvantage is the ease with which the tree can become un-balanced or skewed.

C. R-tree Spatial Indexing:

An R-tree is a height-balanced tree where node is a rectangular area which completely contains the nodes below it and rectangles may overlap. Their use in spatial indexing amounts to indexing the bounding boxes of each polygon and referencing the original shape from the associated node.

R-tree operates only on rectangular regions. A spatial indexer, the R-tree is used to identify candidate pairs of zones with overlapping bounding boxes. R-trees are fast and efficient for general spatial searching, but overhead of checking polygonal boundaries can be high.

D. Dynamically Updating the Spatial Model:

To overcome the gap between abstract spatial model and real-life location systems a distributed Java application World Modeling Service (WMS) is introduced. To support a new location system one must write a small adaptor module which converts the native notions of space and location onto the entities supported by the WMS are the Spirit Adaptor and an Aglet Adaptor.

The Spirit developed originally at AT&T Laboratories Cambridge. Its function is to take a stream of raw location events received from a network of sensors and combine these with a spatial database to produce. The Aglet adaptor allows us to track the locations of Mobile Agents as they migrate from host to host. Combined with the Spirit adaptor, this allows us to simultaneously monitor the positions of all people, computers and applications in our environment.

E. Multi-Scale Modeling For Mobile Application:

Mobile GIS has become the perfect platform for the development of comprehensive LBS, and LBS can be seen as the logical evolution of geographic applications in the context of mobility.

The traditional GIS has the nature such as the various source of data, platforms and mess data, which cannot match the nature of the wireless environment in mobile location services system, which has a feasible networks connection narrow bandwidth and the limitation of the computer resource. With the developing need of multi-scale spatial data organization and management in mobile location service system, and in order to ease the mobile user to use the spatial

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information as same as the traditional user do, it is necessary to build a special model for mobile applications.

The Principle of Multi-Scale Modeling Compared with other geospatial database, LBS is characterized by multi-scale levels of detail and scales data it is necessary to store and manage those different representations of the same geographical feature. Similar to single-scale model, multi-scale model consist of three level model, conceptual, logical, and physical model. During multi-scale modeling, the multi-scale characteristics should be extracted at conceptual model stage. The entities, relations, attributes in the model could be extended to present multiple geometries, multiple attribute values, as well as scale and semantic relations among the entities at different scales. Hierarchical Abstract Mechanism of Road Feature for the sake of different details at different scale, a larger scale to a smaller scale, the change will arise that several features are aggregated into a single feature, which shows n:1 part-whole relation.

Relation among Multi-Scale Model Elements i.e. Level, Class, Type, Feature and Representation. Level is defined as a set consisted of many feature or feature class. Class is defined as a set consisted of those features having the same property (or attribute). Feature is defined as a digital representation in computer environment for the geographical entities of real world. Representation is defined as an instance of feature at corresponding abstract scale. Type is defined as a geometrical characteristic presented by a Representation.

IV. CONCLUSION

The strong current trend of enhancing mobile devices with advanced navigation sensor technology like built-in GPS receivers, digital compasses and acceleration sensors will open the path towards highly intuitive interaction between the user and her physical surrounding. Therefore, we have argued for a joint approach integrating MSI and visualization, whose potential has been demonstrated with three consecutive application oriented projects exploring different ways of representing the user environment on the mobile device in order to allow for efficient and intuitive modes of user order to allow for efficient and intuitive modes of user interaction.

Whereas these case studies have shown that visualization is clearly one of the central issues in this context, our current MSI research activities go far beyond and additionally strive for integrating also audio and gesture based approaches as further important features and options for a natural mode of user interaction. For example, within our focus on device-awareness, we are looking into possibilities of controlling orientation by tilt-sensors only, thus alleviating the requirement of having a compass embedded in a certain device. With the widespread use of PDAs the technology supporting mobile GIS is rapidly gaining popularity and effectiveness. From the view of mobile location service, this research focuses on the multi-scale modeling, representation, and adaptive visualization for spatial data. The next generation of internet is mobile environment. Mobile applications of 4S technology for integrated spatial data such as GIS, ITS and SIIS, classified available approaches to building mobile applications and implemented the data construction system, the mobile event application.

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