MULTILAYER SOLUTION USING MULTIMAP FOR DEVELOPE A MOBILE APPLICATION

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Abstract: For developing mobile application virtual globes software products offer several features and capacities. The paper presents the system objective, function, component modules and key techniques in the procedure of system development. The system, based on the spatial information and attribute information of vehicle and road, was developed and applied in MCLocator. The system, based on platform independent solution and virtual globe software integrate sensors' information of vehicle parameters and geo position dates obtained from MultiMap, based on the GIS's strongpoint on spatial analyzing and use of location and communication equipment based on GPS and GPRS.

1 INTRODUCTION

Virtual hyperglobes and earth browsers are scale-bound structured models of planets from virtual space. In Buttler opinion the ease of use of virtual globes and their capacity to display spatial information offers a strong potential to communicate spatial data and it is believed that virtual globes could lead to a democratisation of GIS technology (Butler 2006). Virtual globes incorporate features and functionality that provide significant advantage over traditional spatial data mapping interfaces. These advantages can be bound in three major features: the earth imagery displayed on a globe structure is free of distortion; data displayed in virtual globes can be viewed at any scale and from any angle, a large degree of interactivity, allowing the user to move to different locations and visualize different type of spatial data (Riedl 2007).

Geospatial software and applications are based on several concepts as: coordinate systems, map projection, data types and geodatabases. *Coordinate systems* are a fixed reference framework superimposed onto the surface of an area to designate the position of a point within it. Common coordinate systems are *geographic* (three-dimensional), in which locations are measured in degrees of latitude and longitude, and planar (or Cartesian), in which the earth's surface is projected onto a two-dimensional plane and locations are measured in meters or feet. For representing and access data we need *projections* - a method of representing the earth's three-dimensional surface as a flat two-dimensional surface. There are many different map projections, all of them can distort shape, area, distance or direction (ESRI, 2003).

Data management uses different data types: *tabular databases,* join with vector file by common attribute, mapped as points using coordinate points such as latitude and longitude gathered from a GPS Geocode for associate address field with street file, *vector* (points, lines, polygons), *raster* - a model as a surface that is divided into a regular grid of cells, *images* (aerial photographs), *grids* (derived data representing continuous values such as an elevation surface or categories such as vegetation types).

Our paper offers a solution for development mobile applications, focused on multilayer approach and using digital globe technologies features and facilities. After an introduction in virtual hyper globes and geographic information system (GIS)

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tools, we focused on mobile application prototype (MA) in collaborative environment. In section 2 we present system objective and functionalities, then functional design of system modules in section 3, and in section 4 multilayer conceptual architecture, based on MultiMap solution.

2 SYSTEM OBJECTIVE AND FUNCTIONALITIES

MC Locator is a monitoring and management application of the auto fleet activities through the use of location and communication equipment based on GPS and GPRS with the following features: on-line position locating, speed and movement direction of vehicles, checking of vehicles route, automatic generation of individual journey forms and detailed roadmap reports, monitoring the fuel level in the tank and/or the fuel consumption, monitoring other parameters of the vehicle (open/closed doors, refrigeration room temperature, etc.), switching on/off certain parameters.

The system builds up on two hierarchies of a macro network and a micro network. The macro network is the road network of our country and the micro network is the monitoring network of individual landslide. The system database contains all information of roadmaps and vehicles movement and parameters of the vehicle being collected through road information and vehicle monitoring. By integrated some mathematical optimization models and spatial analyzing capacity of GIS, system will provide the information of dangerous road events, monitoring and changing the vehicle route based on degree alarm rank, according to field monitoring data.

The administration module of system offers all features to import, modify, edit, store and export all kinds of data or information about vehicles route, movement direction of vehicles, road landslides. Correspondingly, the system will automatically renew the database and the messages via GPS or GPRS in time.

The field monitoring data of road and vehicles, collected by GPS and GPRS, should be processed and compute in a series of sheets, charts, reports and figures by the related modules of the system. For each sampled locations and vehicle, the following information was recorded:

- the coordinates of each sample point;
- the vehicle parameters present at the moment in this point;
- a detailed description of the road;
- traffic incidents or vehicle events.

The use of virtual globe technology allowed the synthesis of these GIS data, descriptive text and images within a spatially dynamic and interactive interface.

3 FUNCTIONAL DESIGN OF SYSTEM MODULES

Our prototype offers an application integral for flagship in-vehicle navigation solution, using GPS and GPRS devices and geocoding and reverse coding features of MultiMap. We decomposed system in three module: Data Import/Export Module, Management and Monitoring Module, and Database Module, linked with a strong Middleware Application Module for information import/ export and inquire (Figure 1).

Data import/export module has divided in two parts: Vehicle Map Layer, which contains tools for real time and static time monitoring information and vehicle parameters information and General information, based on three components: vehicle geoposition, traffic information and traffic events, last two component offer parameters only by request (Wang at all, 2008).

Vehicle Functionality Module are the role of monitoring the fuel level in the tank and / or the fuel consumption, monitoring other parameters of the vehicle (open / closed doors, refrigeration room temperature, etc.), switching on/off certain parameters.

In special cases (bottleneck road, accidents, and vehicle defection) this module can initiate a request for Route Optimization Module in order to change the road or to manage the inconvenience of incidents (according with transport agreement with customer).

Database module is formed by Multimap database and a mobile application database, which are linked together grace to a strong middleware mobile application, which manage relationship between Data Import/Export Module, Management and Monitoring Module, and Database Module. Middleware conception will be detailed discussed in next section.

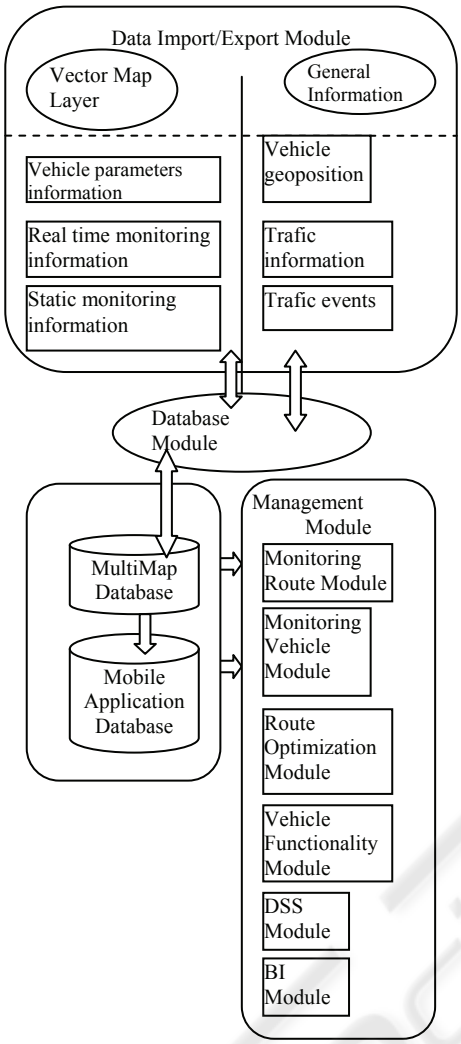

Figure 1: Functionality module and system structure.

Based on Aurambout criteria and particular features for each software product we select Microsoft MultiMap as GIS software for develop a mobile application with web-based location management system, especially for a street and location data, geocoding, and routing with the existing functionality (Aurambout, 2007).

With web map components, MC Locator can incorporate map visualization, proximity analysis, location-directed search, and real-time web services into the same infrastructure, and with no greater complexity than what is required for other visualization and analytic tools. Another factor influencing the cost and effort of implementing location-aware business intelligence applications is the expense associated with managing the data itself.

Software architecture includes components, connectors and configuration, linked together in a decomposed system, focused on well decomposed set of components with clear responsibilities. Major interest was middleware part, as an adapted solution of collaborative environment, offered by Caramba solution (Dudstar, 2004).

4 MULTILAYER CONCEPTUAL ARCHITECTURE

We used GIS paradigms and exchange data with XML features from MultiMap, and implemented XML Reverse Geocoding service offered by UK MultiMap GIS solution for solving the objective of MC Locator, a monitoring and management application of the auto fleet activities through the use of location and communication equipment based on GPS and GPRS.

Middleware solution was divided in three layers: object access layer and adapters, mobile application space as a middleware core, and persistence layer using meta model framework for manipulation and description of content. These layers offers flexibility, concurrent remote access at persistence resources, enable customization and extensions, embedded new technology and mobile devices.

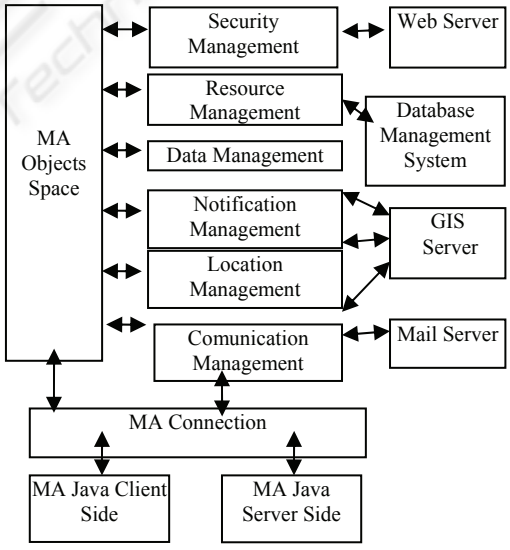

Figure 2: Mobile application Middleware.

Object access layer and adapter serves as an access solution at objects and services, depending on client request and observed parameters. By separation between presentation, logical and data stored this layer provide facilities for object observe and notification services and all the customized services are implemented based on object observers

and changing positions, given by GIS server and this objects and methods' implementation.

Mobile application space provides a shared object space, requires a relevant context of information, performes activities and sub-activities related with business process and normal and special events appeared. It composed by an object metamodel, and object manipulation, which interact with object mapping and object transformation.

This layer is composed by protocols and standards: HTTP and XML, package and Java Enterprise features: Java Remote Method Invocation with specific methods implementations, servers and beans for persistence objects and them instances, mobile application objects for auto, positions, maps, and MultiMap Object (Figure 2).

5 CONCLUSIONS

We focused on digital globes features as a potential for the communication in collaborative companies, especially for monitoring and management application of the auto fleet activities through the use of location and communication equipment based on GPS and GPRS. For our prototype we have choosen MultiMap UK Microsoft as a virtual GIS software.

The application design is object-oriented based on built specific classes grouped in packages, according with conceptual multilayer model. The request launched to MultiMap offers facilities to obtain the details of the position from our country and abroad, makes possible decision to change route and monitoring vehicle parameters based on Java RMI extended methods and several particular interfaces.

Relational database of MCLocator can be access in several modules, and gives facilities to significant reduces of the amount of data in management model run.

Furthermore with multiple possibilities for query results and complex questions, we can use them in monitoring and optimization routes, monitoring auto fleet and individual vehicle, determine optimal charge and road in transport services companies.

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