THE SYSTEM FOR UPDATING PARTIAL MAP

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ABSTRACT ... Telematics is a leading IT service where wireless internet service represented by information and mobility is extended to the area of transportations to provide Telematics service. One of the killer-application about Telematics is navigation system. Recently, due to the mass storage conversion, the performance of the terminal and mobile communications technology development, navigation system is also changed.
It more and more develops into 3D in a pre-existence 2D map. In the future, it is expected to include the remote sensing map or video map. There is also the characteristic of all the information expressed in frequently a change partially happening. That is, POI(Point Of Interest) which is freshly registered or is deleted is many.
In a pre-existence, Map Contents Providers offer the new version map by off-line monthly or quarterly. And a user wastes time and is inconvenient because of updating the total map by the off-line. Thus, in this paper, in order to resolve this, we describe MAUS(Map Air Update Server) for updating only the partial map that was changed

KEY WORDS: Map, Update, Navigation

1. BACKGROUND

Telematics is the convergence technology that integrates vehicles with IT technology and it is one of the growth engines to lead Korea's economic growth. [1] For various Telematics services such as navigation, LBS and so forth, it is necessary to keep navigation map data in mobile devices. As the real world such as roads and buildings are changing every day, an important challenge is to keep navigation map data as up-to-date and accurate as possible in mobile devices. Updating geo-databases and sharing geographic information are indeed challenge for the GIS community, as Laurini. [2] Although navigation map data is typically updated by Map Contents Providers periodically, it is hard to provide accurate telematics services because of providing to users too late. So future telematics services will demand a much more up-to-date and dynamic navigation map data than what is presently available.

In this paper, we present the technology to update in real time up-to-date navigation map data in mobile devices via CDMA, WiBro and so on.

2. RELATED WORKS

In this chapter, we review ISO/TC211, ISO/TC204, TTA/PG310, ActMAP Project and G-BOOK mX.

2.1 Standard

2.1.1 ISO/TC211

ISO/TC 211 Geographic information/Geomatics is responsible for the ISO geographic information series of standards. This work aims to establish a structured set of standards for information concerning objects or phenomena that are directly or indirectly associated with a location relative to the Earth. These standards may specify, for geographic information, methods, tools and services for data management (including definition and description), acquiring, processing, analyzing, accessing, presenting and transferring such data in digital/electronic form between different users, systems and locations. The work shall link to appropriate standards for information technology and data where possible, and provide a framework for the development of sector- specific applications using geographic data."[2][isotc211, April 2007]

Many bodies are actively engaged in the work of ISO/TC 211. These include national standardization bodies, the OpenGIS Consortium (OGC), international professional bodies (such as FIG and ICA), UN agencies, and sectoral bodies (such as DGIWG and ICAO) [3]

2.1.2 ISO/TC204

ISO/TC 204, a technical committee for standardization for ITS within ISO, was set up in 1992 and went into operation the following year. In ISO, subcommittees (SC) are usually founded under technical committees (TC) and working groups (WG) under subcommittees.[4]

Regarding TC 204, working groups are directly under its jurisdiction. Among working groups, some have been suspended or integrated for the ten years since its inception, and now a total of 12 working groups are carrying out its activities. They deal with Standardization of information, communication and control systems in the field of urban and rural surface transportation, including intermodal and multimodal aspects thereof, traveller information, traffic management, public transport, commercial transport, emergency services and commercial services. Practically, in working group 3, they handle GDF, XGDF(eXtended Geographic Data File), PSF(Physical Storage Format) and Navigation API.

2.1.3 TTA/PG310

The scope of TTA's activities includes the fields of telecommunications, information technology. The purpose of TTA is to contribute to the advancement of technology and the promotion of information and

telecommunications services.[5] TTA/PG310 is responsible for standard on telematics. Recently following two interfaces were proposed.

There are MCP-MAUS Service Protocols for Map Air Update [TTAS.KO-06.0129] and MAUS-Terminal Service Protocols for Map Air Update [TTAS.KO-06.0130][6,7]. This standard defines the interaction protocol between MCP, MAUS and Terminal. The standard specifies are to facilitate a partial update for map information on telematics or LBS.

2.2 ERTICO ActMap Project

ERTICO is Europe's intelligent transportation system organization that funds research and defines ITS industry standards. ERTICO had executed ActMap Project.[8]

The ActMAP project focuses on online standardised updating mechanisms to deliver and integrate actualised map data into in-vehicle map database from map makers and location based content providers for Navigation and ADAS applications.

The aim of the ActMAP project is to investigate and develop mechanisms for online incremental updates of digital map databases into the vehicle. Up-to-date map components containing dynamic or static location-based content should be integrated and/or attached to the in-vehicle digital map.

2.3 The G-Book MX of Toyoda

Toyota has released a new G-BOOK mX telematics service at May of 2007. That has been of great help to drivers driving Toyota's vehicles. One of the features of the new G-BOOK mX is the Map-on-Demand. This essentially provides a navigation map to the driver with just a touch of a button. The navigation map covers expressways and toll roads and ordinary roads located near the location of the vehicle. [9] It is able to insert a map data but not to delete or change a map data.

Figure 1. The G-Book MX of Toyoda

3. ARCHITECHTURE

The architecture of Map Air Update System consists of MCP, MAUS and Terminal like following Figure 2.

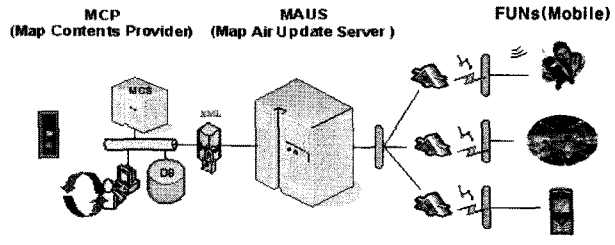

Figure 2. The architecture of Map Air Update System

3.1 Map Air Update Server

The roles MAUS are to parse interface, to check validation, to store difference map, to control version, to aggregation, to manage profile and to provide terminal with map changed,

3.2 Mobile Terminal (FUNs)

Mobile Terminal contains navigation application, updating module. It is request updating to MAUS and response xml with difference map from MAUS. And it applies mobile terminal.

3.3 Map Contents Provider

The main role of MCP is to extract difference map between old version map and new one. And it encodes xml document based on the interaction protocol between mcp and maus. Lastly, mcp send xml document to MAUS.

4. MAUS SERVER

The MAUS(Map Air Update Server) has following function.

4.1 Register Management

Update registering is to allow providing new map updates. If a MCP has new updates available, it delivers a notification to the MAUS system. The notification file is in XML format and includes information about the baseline map(s) and the corresponding partition(s), for which new updates are available. Figure 3 is a XML Schema.

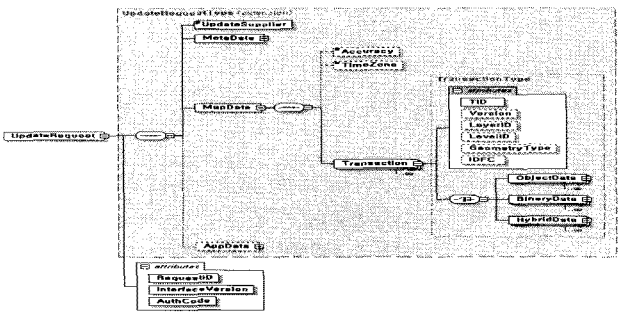

Figure 3. The XML Schema

4.2 Parsing & Store Management

Upon receiving the update notification, the MAUS system will parse the XML file to extract the information about the available updates and decide how to handle the notification. The MAUS system can either decide to download the update or to reject the download. Reasons for rejecting may be insufficient available storage space, irrelevant updates or updates already received. The information from the update notification file will help to do some basic checks whether the updates have been properly received. The files are typically downloaded in compressed format. They are decompressed at the service centre and inserted into the update store. Finally, the

MAUS system will give a confirmation about the result of the download, i.e. whether or not the update has been properly received and accepted. The confirmation is dependent on the transportation protocol being used for downloading the updates.

4.3 Version Control & Aggregation Management

It is enable to retrieve and store the latest version of a baseline map partition for a specific user. If there are multiple updates for the same event, these updates can be aggregated,

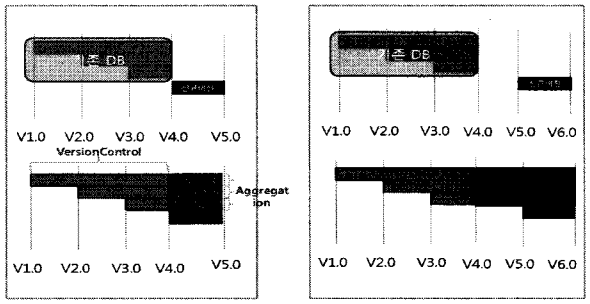

Figure 4. Version Control & Aggregation

For example, the versions of map are v1.0, v2.0, v3.0 and v4.0. if the latest version v5.0 is updated, Version Control Manager make updating map data V1.0→V5.0, V2.0→5.0, V3.0→V5.0, V4.0→V5.0 like figure 4.

Aggregation aggregate different update collections (=versions) of a same object. In the same object, when it faced the insert, change, change, delete, insert and delete, calculation was generated in the V2.0, V3.0, V4.0, V5.0, V6.0 and V7.0. Then, update information from v1.0 to v7.0 is none. If update information from v2.0 to v7.0 is only delete operation like figure 5. It is a role of aggregation management.

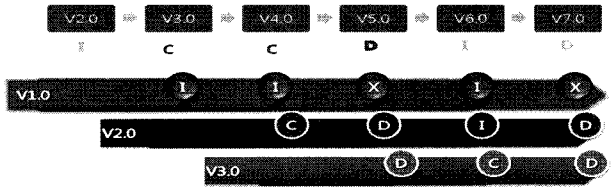

Figure 5. For example of Aggregation

4.4 Dependency Management

If a transaction has a buddy in a neighbouring partition, it is often enough to only process the buddy transaction instead of the whole update for the neighbouring partition. This, however, makes version control more difficult. It is important that, after processing of a set of updates, the in-vehicle map can be used again by the applications, that it is still consistent. If several update operations (e.g., split one road, add a new road, and define the relationships of the new road) need to be processed all before the map is consistent again, they should be grouped into one update transaction. Updates must be assigned to a layer and a partition. However, there can be dependencies between layers or partitions that make it necessary to update more than one piece of the map to keep the whole map consistent.

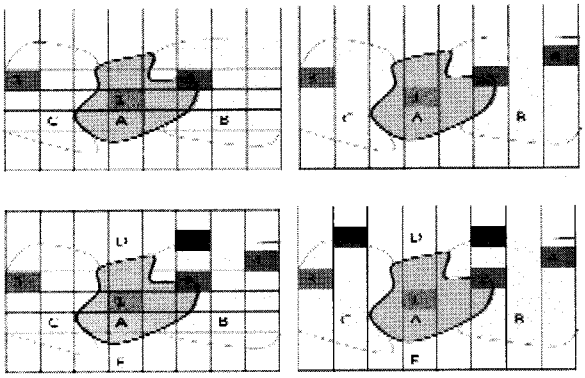

Figure 6. Update Dependency

4.5 Update Discovery Management

If Update user asks which baseline maps and update suppliers are supported, update discovery Manager manages inform what types of updates are available for a baseline map.

4.6 Update Provision Management

Update provision management has the delivery of the corresponding updates in the update exchange format. So, give access to the map updates with selection and filter criteria describes how an update user would request updates after he discovered that his baseline map is supported by the MAUS system.

4.7 Profile management

It allows setting and inspecting profile settings. It can get and set profile elements for one specific user. For example, profile is about user info, terminal info, map info etc.

4.8 Subscription management

It is to register and un-register subscriptions. Update registering check new map updates for applicable subscriptions

4.9 The Screen shot of Mobile Terminal

In the above, we show the component of map air update server. In figure 7, it shows the screen shot of Mobile terminal.

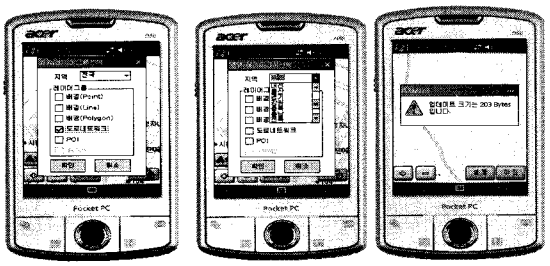

Figure 7. The screen shot of mobile terminal

5. CONCLUSIONS

As the navigation market is growing rapidly, there is in great demand that it is always kept up-to-date and dynamic navigation map data in mobile devices. The results of this project can be applied to core navigation technology supporting partial update of up-to-date navigation map in real time via CDMA, WiBro and so on.

According to development of wireless communication, location determination technology and mobile devices, mobile services get important now. One of important issues is to maintain up-to-date and accurate map in mobile devices because mobility is essential to mobile services. With the results of this project, users will have increased benefits as up-to-date and accurate map data. The results of this paper can give map air partial update service.

Reference

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[3] www.isotc211.org

[4] http://www.globaltelematics.com/telematics.htm

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[6] MCP-MAUS Service Protocols for Map Air Update [TTAS.KO-06.0129]

[7] MAUS-Terminal Service Protocols for Map Air Update [TTAS.KO-06.0130]

[8] http://www.etrico.com

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