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Research on Real Time Traffic Information Data Model and Its Data Transmit[1]

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Abstract: Real-time of geographic information system for transportation (GIS-T) is one of the essential conditions to alleviate the traffic jam and guide the traffic flow rationally. In order to make it convenient for sharing and maintaining data, this paper structures the independent real-time traffic information database, seamless merging real-time traffic information and GIS data through data fusion method. In order to realize this purpose, the paper research on baseline network data model, baseline network is composed of base points and baselines. Base points are exclusive locating on the road network, which can be determined in field, and also can be resumed. Baseline is line element, which replaces traffic event, the baseline locate road network by the point, and therefore, it is easy to realize data share for various linear reference system. According to the data model, designing structure and introducing data transmit flow of the Geographic Information System for Transportation.
Key words: Data Model; Data Fusion; GIS; Traffic Information

1. INTRODUCTION

As the development of traffic management and geographic information system (GIS), using GIS is leading the trend in traffic management system to enforce the management affectivity[1][2][3]. Geographic Information System for Transportation (GIS-T) can be used in equipment management, traffic planning, intelligent traffic, and navigation. But GIS-T is not a simple combination of GIS and traffic information system.

Traffic network has location character. GIS can operate, manage and analyze spatial data effectively.

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Thus, it is necessary to use GIS in traffic network analysis. GIS can not only manage spatial data, but also provide analysis tool for traffic network analysis model, and show and export analysis results. GIS has great development in resource, environment, surveying and architecture in the recent decades. But the application of GIS in traffic area has been limited in building and managing road database. Even the application of GIS in urban traffic area can just realize static road section searching and indexing[4][5]. Along with the fast development of car navigation and monitor technology, static GIS database can't reflect real time information in traffic network. This weakens the effect of car navigation application.

GIS-T is the application and extension of GIS in traffic area; also it's a combination of GIS and traffic information. As an effective technology to solve nowadays urban traffic problem, GIS-T should have not only the character of GIS, which can store, manage and update urban traffic network spatial database, but also should be able to provide technology support for urban traffic route planning, car management, car navigation, car dispatch and travel plan. Therefore, GIS-T has not only three dimensional objects' location and attribute, but also the ability to update real time data [6][7]. The paper research on baseline model and data transmit in order to realize real time GIS-T.

2. DATA MODEL IN GIS-T

The largest obstacle in putting traditional GIS into GIS-T is the node-arc topological structure relied on maps[8][9]. So, we should separate the real time traffic information and GIS, make it independent of the traditional GIS structure, and design a uniform and independent benchmark [10]. Additionally, since Chinese GIS market is disorder, we also should separate the real time traffic information and GIS so as to realize data share. In order to realize it, we set uniform baseline network object in our model. Just like Fig.1, GIS-T data model adopts the two independent models: GIS model and baseline model, these two models can be combined by data fusion.

Baseline network is composed of base points and baselines. Base points are exclusive locating on the road network, which can be determined in field, and also can be resumed. Baseline is line element, which replaces traffic event and overlays certain one road or certain roads in road network. It is continuous, directional, and without embranchment, connecting base points. Baseline is composed of point array, the baseline locate road network by the point, therefore, it is easy to realize data share.

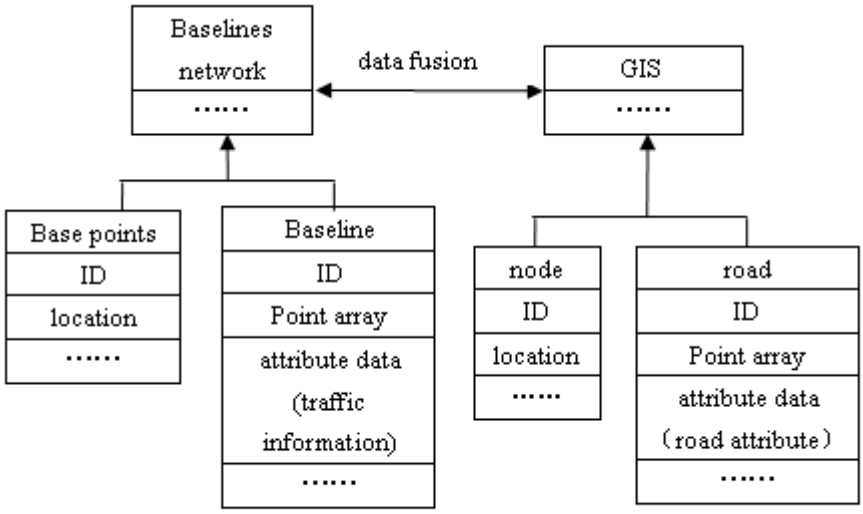

Fig.1. Baselines Network of GIS-T

In navigation system, optimization route (including distance shortest, time shortest, oil-spending least), critical route, and traffic flow analyses are all based on spatial analyses of GIS-T, which often related to topological network. Since baselines are corresponding to roads in GIS networks, we can integrate GIS road networks and baseline networks in spatial analysis, in which GIS can provide topological network and baseline networks can provide the passing weight of the roads in topological networks.

GIS-T uses linear reference method [11][12] to locate traffic information (enforcement, traffic accident, traffic congestion, road pavement, etc.). Linear reference method can implement transform form real time traffic information to baseline networks, based on routes and routes reference points.

Advantages:

- ✧ Manage real time traffic information and GIS data independently, it is easy to develop motion real time traffic information database.
- ✧ Since baselines networks is composed of points array, and overcome the data scale effect, it is easy to realize date share.

3. PARTITION OF GIS-T STRUCTURE

GIS-T, acting as a supporting system to storage and applications on geographical and traffic information, is one of the core modules of the whole traffic information platform [13]. Through sharing database, we can manage and dispatch traffic information on the uniform platform, which supports real time data collection, transfer, processing, prediction and dynamic show, service information management and extraction, GIS traffic application information dispatch and GIS information visualization. In Fig.2, we divide GIS-T into two parts, full traffic information platform (GIS-T-F) and user terminal (GIS-T-U).

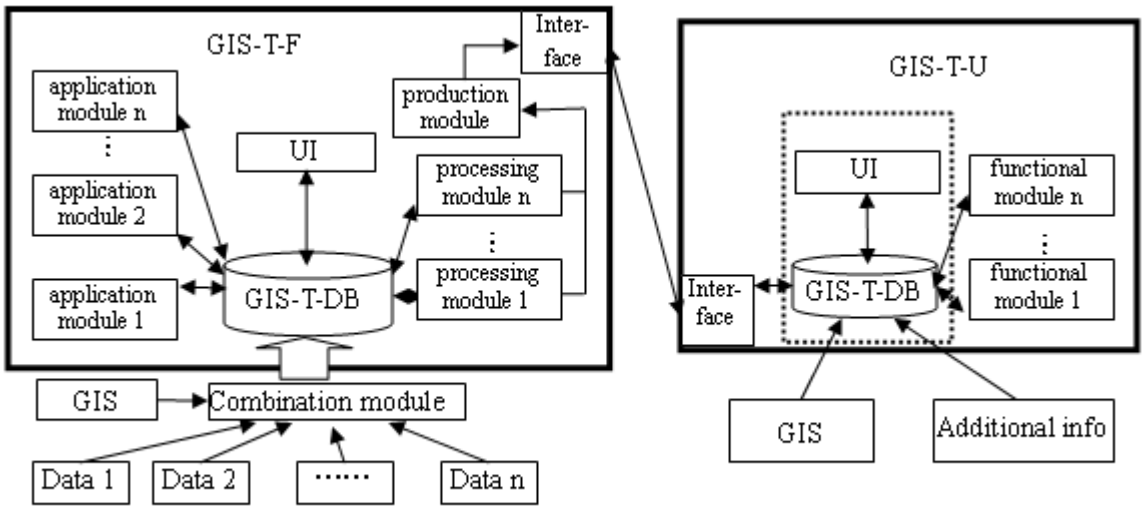

Fig.2. GIS-T-F and GIS-T-S

Fig.2 shows that great differences exist between GIS-T-F and GIS-T-U. GIS-T-F focuses on application and processing of the real time traffic information, fusion of multi-source data, and customization, for example, we use traffic flow prediction model to analyze the real time traffic information and predict the real time traffic flow. GIS-T-U is mainly do the realization of the function, including planning best route (including distance shortest, time shortest, oil-spending least), intelligent

navigation, displaying real time traffic information status on fixed large screen, searching real time traffic information in information booth.

1、 4. Data Transmit in Real Time GIS-T

Data transmit in real time GIS-T can be divided into two parts: one is inside data transmit, the other is outside data transfer.

1) 4.1 Inside Data Transmit

Inside data transfer means transfer traffic information to traffic supervisors and system technicians. Real time traffic information, from processing and analyzing, is transferred to every level of traffic headquarters, related government departments and system technical management terminals.

2) 4.2 Outside Data Transmit

Data transfer system in real time GIS-T is composed of traffic information service center, traffic information publishing and transfer system, and mobile and fixed service terminal. Traffic information service center includes road status information and basic geographical information collection and updating module, GIS-T, road status information processing and multi-source data combination module, traffic flow abduction module, and traffic information real-time publishing module. Traffic information publishing and transfer system includes wireless data transfer protocol based on GPRS, GSM, CDMA, and 3G, wireless data broadcasting protocol based on paging station and digital audio broadcasting. User terminals include handhold mobile terminals, car mobile terminals and fixed terminals. Fig.3 shows System structure.

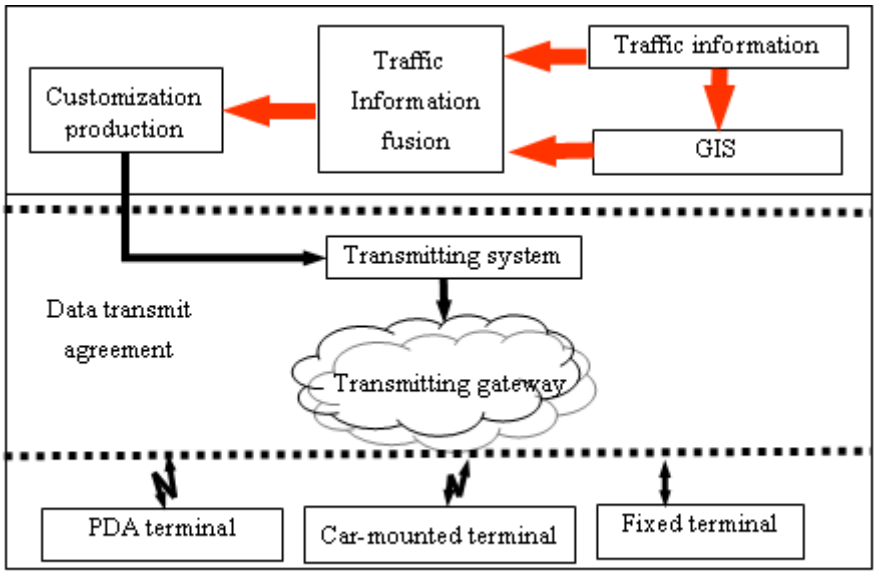

Fig.3. Information Transmitting System

Fig.4 depicts detailed operation flow of data transfer among mobile terminals. The left black thick solid frame is the sketch map of the software structure of the terminals in car. The right top black thick broken line frame is the sketch map of the software structure of dynamic traffic information platform. We can do module outside design and inside design according to modules partition, related processing flow and the relations with hardware. There are three main methods to transfer real time traffic

information:

- ✧ Wireless traffic information publishing platform
- ✧ Wire and wireless request to traffic information net
- ✧ Wire and wireless download from traffic information server

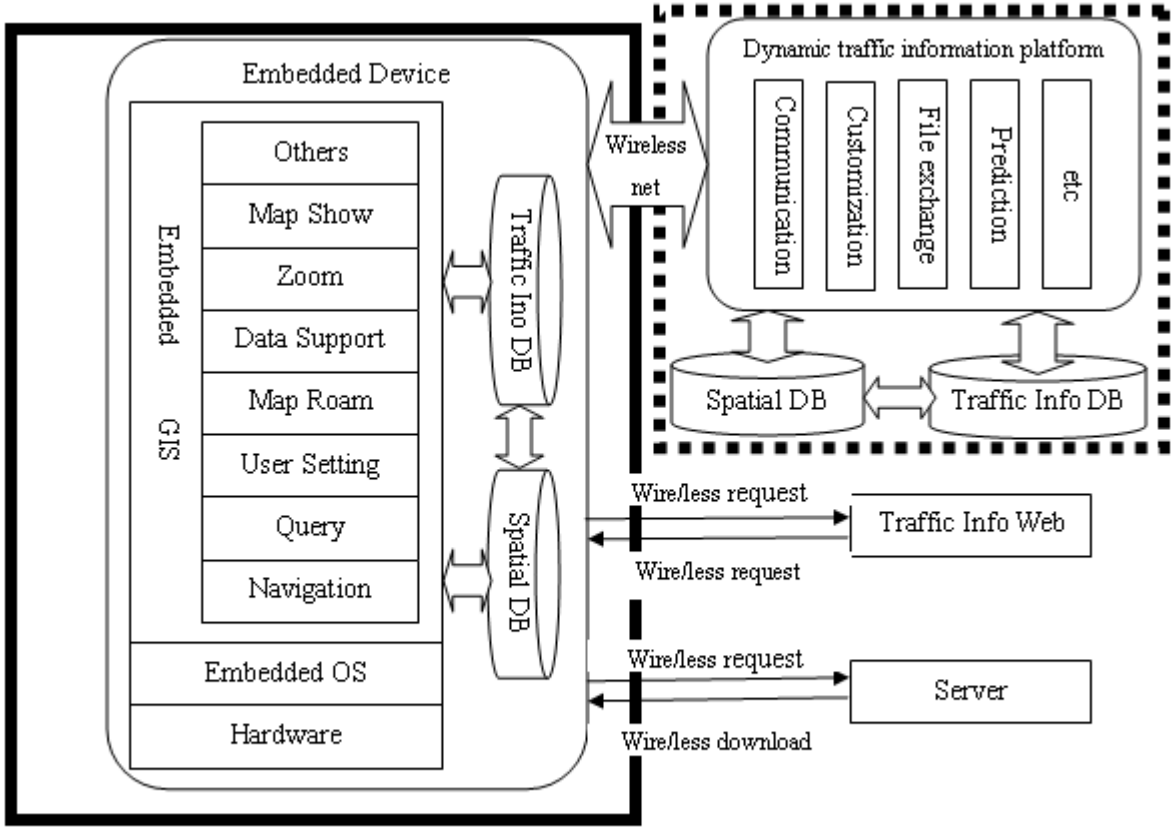

Fig.4. Detailed operation flow of data transfer among mobile terminals

5. CONCLUSIONS

In this sample paper, we have presented the baseline network data model and designed structure of the Geographic Information System. Using motion database have managed real time traffic information in order to realize real time Geographic Information System for Transformation. It is important to develop prototype[5][14] system of Geographic Information System for Transformation.

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