

## Research Article

### Research of Road Traffic Facilities System Based on GIS

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**Abstract:** In order to improve the labor efficiency and economic benefit of road traffic facilities system and reduce resource waste, a scheme of road traffic facilities system based on GIS is provided in this paper. In the new scheme, firstly, we proposed Visual C++ embedding MapX component to program for the visualization of data and function analysis of space, and constructed core table in database and established property database and space database to improve efficiency; then we put forward the system function of traditional traffic facilities such as data collection, construction and management of engineering and so on. The results show that the system can ensure the safety and smooth of traffic than ever.

**Keywords:** Database, GIS, system function, traffic facilities

#### INTRODUCTION

With the improvement of social productivity and people's life, transportation is playing an increasing important part in social life. Transportation demand and the number of cars are growing in both developing countries and developed countries, the road network system is facing the bigger presser than ever. The traffic facilities are very important in keeping traffic flowing smoothly, reducing traffic congestion etc. as an important management tools in traffic system. But the information of the traffic facilities is difficult to manage because of the characteristic of the huge amount of data, space, timeliness, and difficulties to describe, it makes people travel inconvenient because of lacking of effective management tools, which make the traffic facilities are hard to convey their own ideas. The chief reason is there would increase or reduce traffic facilities with the change of city like remodeling of road and so on, but it can't be carried out.

The information management and promulgating system of the traffic facilities based on GIS is a important branch of ITS, the main part of traffic safety system, and a effective way to ensure traffic safety, reduce traffic congestion as well as traffic accident rate. Combined with geography information platform, the system analyzes and displays static and dynamic traffic information, provides technique support for modern traffic management, and stores the traffic data with data storage technology for following research. There are many kinds of traffic facilities, but their structure of space is consistency, which is located by space of traffic facilities and described by point, line and plane in GIS (Huo and Hu, 2002; Jun-fu, 2006). The traffic facilities

are regarded as point, the road is regarded as line, road network is regarded as plane from geometry view; which can be expressed by data layer, application layer and presentation layer (Brimicombe, 2003). The data layer is used to establish and maintain database; application layer may call C/S or B/S structure through component technique to realize some functions such as the initialization of road traffic facilities, the search of road traffic facilities etc. and link traffic facilities in road network through point, line, plane; presentation layer offers user interface for inquiry, data input, data output etc.

The GIS has mighty space information operation, management and analysis function as well as collection, management and storage function of mass space and property information (Qin *et al.*, 2006; Li, 2006). So, we can use GIS to manage traffic facilities. In this paper, In order to improve the labor efficiency and economic benefit of road traffic facilities system and reduce resource waste, a scheme of road traffic facilities system based on GIS is provided in this paper. It would improve the safety and smooth of traffic.

**Development mode of system:** Component-oriented GIS is a new generation GIS system which adjusts to component development of software. It implements in a very practical way which promotes structured and safe system development. In this approach GIS functions are used in a standard programming environment and the resulting executable program can be run without any installed GIS environment. The system of traffic facilities based on GIS uses the professional GIS software Mapinfo to draw map for the basic functions of GIS and uses visual development tool Visual C++

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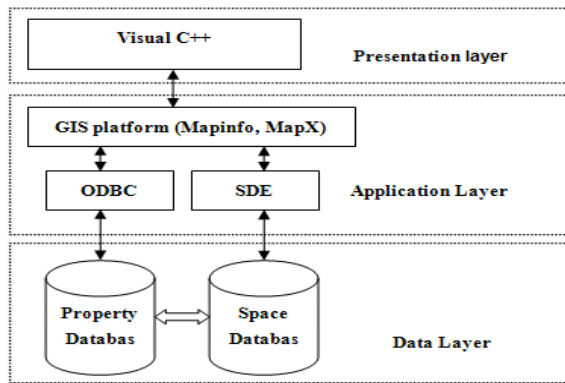


Fig. 1: Realization of system

embedding MapX component to program for the visualization of data and function analysis of space.

With familiar languages such as Visual C++, developers can quickly go to work, easily designing and implementing mapping features and functions (Zhang and Zhou, 2004; Zhang and Wei, 2000). The structure of system uses C/S and B/S, the former may improve running speed for administrator, the latter is convenient for public user to participate, the realization of system is shown in Fig. 1.

### CONSTRUCTION OF TRAFFIC FACILITIES BASED ON GIS

The realization of GIS must rely on the database. At present, the graphic data is managed by space database, the other data is managed by property database, which are linked through an objective ID or a pointer. So the design of databases includes establishment of space database and property database and the link of space database and property database. The road No, which is field name of match inquiry when it is located, is a string of the name of place. The location of central point of traffic facilities is determined by X coordinate and Y coordinate. The relation of the name of road and the traffic facilities is determined by map index number and ID number which provides the base for Bidirectional dynamic updating. The structure of the core table in database is seen in Table 1.

- Establish of property database. Some property data is created in property table with the space information. All kinds of fields of traffic facilities was added in the property table, and the information of traffic facilities such as width, length, color etc. is inputted, then the database is established. The design of property database is seen in Fig. 2.
- Establish of space database. The space data includes the data structure based on vectors (graph

Table 1: Structure of the core table in database

Field name	Type	Length
Road No	Long	8
Road	Char	502
Adjacency road	Char	502
X coordinate	Double	16
Y coordinate	Double	16
Z coordinate	Double	16
Map index number	Long	10

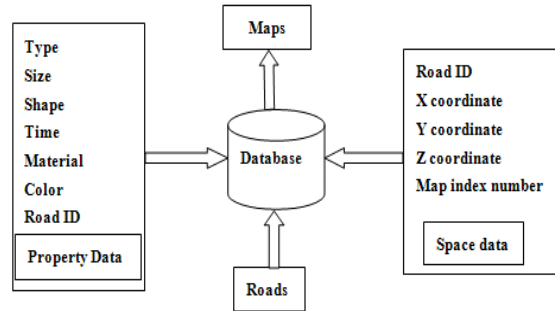


Fig. 2: Design of database

and lattice (pictures). The modern GIS combines with the two kinds of data structure or uses the mixed structure. The location of traffic facilities is expressed by points; the road is expressed by the lines; the road network is expressed by plane; they constitute the three basic essential factors to express the styles of geographical space.

### MAIN FUNCTIONS OF SYSTEM

The road traffic facilities system based on GIS is very strong and has many functions. The system function is seen in Fig. 3. In this paper, some main functions are described as follows:

- **Data collection:** The system can edit all data of traffic facilities, inquiry graphic and property data, inquiry route inquiry, gather statistics, locate the conflict point etc.
- **Construction and management of engineering:** The change of road network is reflected on maps of the system. The point, line and plane by influenced are located through the range of change to realize off-site monitoring. The advance control is carried out according to the business process. The system shows the progress and real-time management of increasing and reducing the traffic facilities.
- **System management:** User power management, data maintenance, function maintenance, device information set, password modification and system configuration are included in the functions of system management.
- **Maintenance of place name:** The system can provide functions of inputting, modifying and

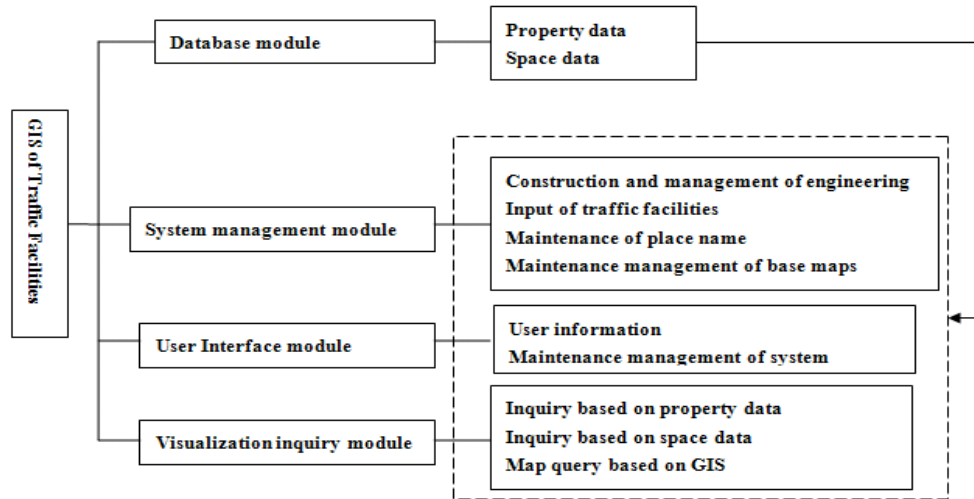


Fig. 3: System function structure

deleting of place name and functions of dynamic show location of name through management of city's place name in order to locate traffic facilities.

- **Maintenance management of base maps:** The system can provide functions of splicing graph, superimposition of vectors graph and lattice pictures and functions of inputting graph, changing graph, operating graph, outputting graph and managing and updating map database so on.
- **User information:** User must participate in the management of traffic facilities so that they can propose to the setting of the traffic facilities according to their views to help correlative department manage dead space effectively.
- **Maintenance management of system:** The system can provide functions of user management, maintenance of system public data, setting of system parameter, maintenance Log and automatic backup so on.
- **Map query based on GIS:** In this part, a tool encapsulated inside MapX is adopted to make users locate, zoom and move the digital GIS map, and information of units and roads can be displayed on the map. Basic data and other data can be queried through clicking relevant unit on the map,. Moreover, various statistic and analysis figures can also be displayed or printed.

### CONCLUSION

GIS has been applied to this basic traffic management system. Especially with visualized digital map, users can grasp the use this system easily. The framework and functions of system are illustrated, and then network environment and data sharing model is solved, which may help traffic department innovate

manage and technology, improve the labor efficiency and economic benefit and reduce resource waste. How to use data mining model in this system and display its results to users on the map is the development direction of this system in the future.

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### REFERENCES

- Brimicombe, A., 2003. GIS, Environmental Modeling and Engineering. Taylor and Francis, London.
- Huo, H. and F. Hu, 2002. Application of GIS in transportation information management system. *Comput. Eng.*, 5: 215-216.
- Jun-fu, J., 2006. Application of GIS in urban planning information system. *Shanxi Architect.*, 32: 369-371.
- Li, Y., 2006. Design and Realization of Urban Public Traffic Quire System based on Component GIS. Kunming University of Science and Technology, Kunming, Yunnan, China.
- Qin, M., Z. Cui, Y. Cui and Y. Cui, 2006. ICenterview: Urban traffic surveillance and management system. *Comput. Appl. Softw.*, 2: 28-29.
- Zhang, J. and Y.H. Zhou, 2004. Database Technique on Urban Planning. Wuhan University Press, Wuhan, China, pp: 104-105.
- Zhang, S. and M. Wei, 2000. Fuzzy search technique on databases. *Electr. Automat.*, 5: 23-24.