

# Research on GIS System of Urban Road Traffic Safety

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**Abstract:** GIS system can effectively improve the urban road traffic safety management level, but also can reduce traffic accidents. In this paper, the urban road traffic safety GIS system is studied, and the main technology of the system development is put forward. In the paper, the author also introduces the methods of collecting, inquiring and updating the road traffic safety information. Finally, the author puts forward some new methods of accident management based on GIS system of road traffic safety.

**Keywords:** Urban road traffic; Safety analysis; Thematic information; Geographic information system (GIS); Accident management

## 1. Introduction

Road traffic is not only an important guarantee for national economic construction and social development, but also directly related to the vital interests of each traffic service object. Therefore, to ensure the safety and smooth road traffic is the fundamental requirements of participants. How to use advanced management methods and techniques to improve the level of urban road traffic safety management, which requires the support of advanced scientific and technological means. At present, China's road traffic management is very backward, at the same time, China lack of advanced modern traffic control methods and safety management system. At present, most of the urban road traffic management is mainly dependent on artificial, at the same time, a large number of statistical data can not play its role in the analysis and forecast, dynamic scheduling and real-time control.

Geographic Information System (GIS) has the characteristics of combining spatial data with attribute data. GIS system can combine terrain data, road data, traffic data and traffic accident data to provide an intuitive query and statistical interface. Therefore, the GIS system can provide an effective command platform for traffic control department.

## 2. Application of GIS in Road Traffic Safety Management

In recent years, China has reduced the rate of road traffic accidents by means of science and technology, one of the important methods is to apply the GIS system to the road traffic safety management. GIS system is composed of computer hardware, software and geographic information data, while the GIS system can effectively obtain, store, update, operate, analyze and display all

geographic information. GIS system is generally composed of 5 subsystems:

- (1) Data acquisition and processing system;
- (2) Data storage and database management system (DBMS);
- (3) Data conversion system;
- (4) Data query system;
- (5) Data output system.

It can be seen that the data will have a direct impact on the potential, cost and efficiency of GIS applications. In addition to static graphic data, graphic topology data and characteristic data and attribute data, GIS system can also get real-time dynamic information of the road through GPS, camera and road monitor.

## 3. Road Traffic Safety GIS System

The GIS system can make full use of the functions of GIS data input, data management and visual output, and can get the data of urban road change. GIS system can manage all kinds of facilities system. By using the function of GIS system query and analysis, we can analyze and study the road traffic safety problem in multi-level and multi angle. The GIS system combines vehicular communications and road information display, which can be used to warn motorists and pedestrians in advance.

### 3.1. System Structure

The main function of urban road traffic safety GIS system is divided into three parts:

- (1) Collect, query and update road traffic safety information;
- (2) Analysis and forecast of traffic accident information;
- (3) Management of traffic accidents.

Its specific structure is shown in Figure 1.

### 3.2. Data Organization

The information in the GIS system is composed of geographic information, and the accuracy of the data will directly affect the accuracy of analysis and decision-making. Basic geographic information includes: the existing map, the whole field of digital mapping, satellite images, aerial photos, survey data, the existing data files and databases, etc..

In addition to the basic geographic information, urban road traffic safety GIS system also includes thematic map information. Different types of data can be used to represent different aspects of traffic safety, so the selection of data must meet the principles of practicality, effectiveness and scalability. It mainly includes the following aspects:

(1) The road network information includes: name of the road, whether it is a one-way street, the speed limit of the road section, the length of the road and the time required for the speed limit on the road.

- (2) The road information includes the direction of the road, the number and width of the road, the occupation of the road, the bus system, etc..
- (3) The information of traffic facilities includes the intersection, the location of the lights and traffic signs, the location of the bus, the position of the display screen, etc..
- (4) The information related to the traffic accident includes the location of the accident prone area, the terrain condition, the location of the traffic accident and the attribute information of the traffic accident.

The information in the GIS system can be organized into a special layer. Each layer has a theme, and each layer contains both spatial and attribute data. Each feature point in the layer can be determined and described by coordinates and attributes. According to the characteristics of urban road traffic safety management in our country, the thematic map of GIS system can be divided into several layers as shown in the following Table 1.

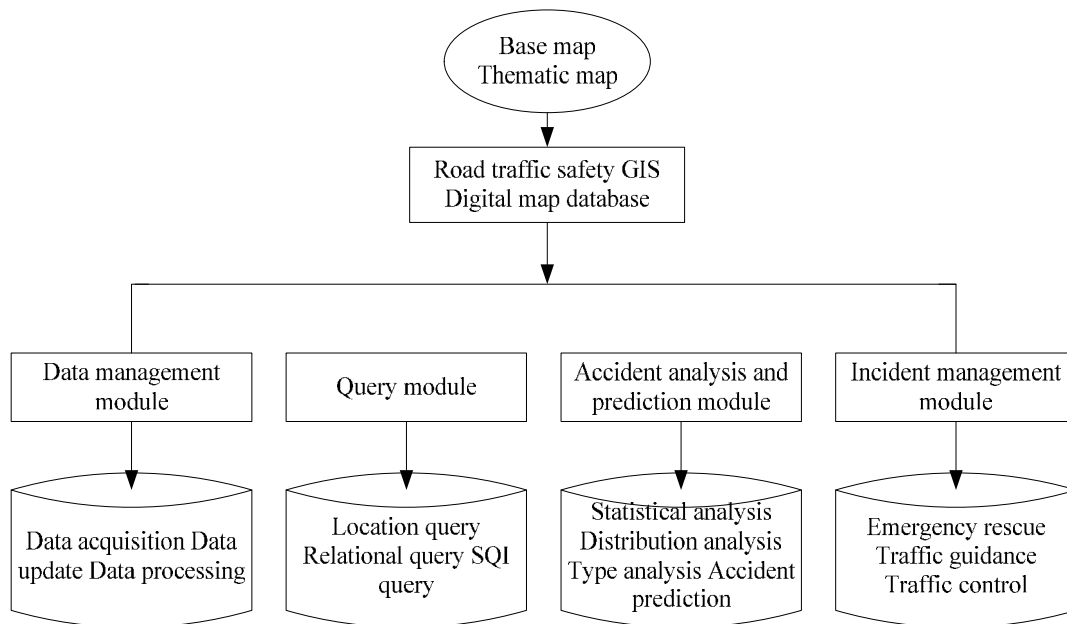


Figure 1. System structure

Table 1. Thematic Map Layer

Category	Characteristic	Type	Safety
Road layer	Name, starting point and boundary	Traffic flow direction, road capacity, road use information and road characteristics	Average annual accident rate, traffic violation rate and road safety level
Intersection layer	Name and type of intersection	The number of intersections and the amount of traffic at intersections	Average annual accident rate, traffic violation rate and safety level of intersection
Traffic facilities layer	Identification of traffic signs and signals	The function of traffic signs and lights and the traffic control information	The importance of traffic signs and lights on traffic safety and their impact on safety

### 3.3. Data Analysis and Utilization

Data space analysis includes static and dynamic data analysis. Static data analysis refers to the analysis of the inherent data in a certain period of time, such as the analysis of the regional distribution of traffic accidents. This analysis will analyze the characteristics and frequency of traffic accidents in a certain area, and through the establishment of mathematical models to analyze the related factors of traffic accidents.

The results of the analysis can be output in the form of a graph or report, and the results are provided to traffic managers and traffic participants. Dynamic data analysis can also be called online analysis, which can provide more convenient and more practical road traffic safety evaluation. Dynamic data analysis can help decision makers to take appropriate and prompt emergency assistance programs and traffic control measures, and dynamic data can also provide warning information for traffic participants using information communication equipment and display vehicle on the road.

### 4. Conclusion

City road traffic safety system using GIS technology can provide powerful means and technical personnel for road traffic management command, which plays a very important role in ensuring the safety of road traffic control and real-time scheduling.

### References

- [1] Praveen Kumar, GIS based advanced traveler information system for Hyderabad city [J].IEEE Intelligent Transportation Systems, 2003(1): 497-501.
- [2] Ioan Chisalita, An in-vehicle approach for improving tragic safety through GIS utilization, Systems, Man and Cybernetics [J].IEEE international,2002:1792-1797.
- [3] Town Haiyan, Wang Wei. Study on urban traffic safety management based on [J] GIS. Transportation and computer, 2002 (3): 6-9.
- [4] Wu Lun. Geographic information system [M]. Beijing: Publishing House of electronics industry, 2002.
- [5] Yasuyula Akazawa, Driving Safety Support System[J], IEEE Vehicle Electronics ,1999(6):834-838.