The Design and Application of the Trans-Department Traffic Safety Comprehensive Evaluation and Decision Support System

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Abstract—**According to the trans-department demand in traffic management, we put forward the trans-department traffic safety comprehensive evaluation and decision support system framework on the basis of analyzing traffic management problems. Then we develop the trans-department traffic safety comprehensive evaluation and decision support system. This paper introduces the system overall design, including system overall structure, function structure and system logical framework. Second, this paper introduces the function of each subsystem. At last, this paper introduces the system applications.**

Index Terms—**Trans-department, road traffic safety, comprehensive evaluation, decision support, system design.**

I. INTRODUCTION

In recent years, with the development of socio-economic, the amount of vehicle increased rapidly. This put enormous pressure on the road traffic safety. We write a corresponding investigation report after investigating part of the traffic police department, office of province traffic hall, highway management department and other units. We know that there are many practical problems in our country road traffic management at present by studying and analysis the survey data, such as the information which is not free, mechanisms which is not clear, system which is different, the backward technology, etc.

From the angle of information interaction, the management information between road traffic management departments is serious asymmetry. Although the management departments have the requirements of data exchange, the various departments have almost no formation Institutionalized system of information exchange as a result of system and policy level, technology and other issues. And they cannot provide efficient, science means of modern management for traffic management. From the deep level of information use, the information remains in the original state. They don't comprehensively use the information further

from the point of traffic safety management and traffic service. The lack of systematic integration of resources and information sharing standards results in lack of effective supporting means of traffic safety management in the field of macro decision-making and business management. So they cannot provide the necessary services to the public. The cooperative management of people, car and road, traffic safety management and service level cannot meet the government management and the public service needs.

Under the organization of the Ministry of Science and Technology, Ministry of Public Security, Ministry of Transport, we develop the trans-department traffic safety comprehensive evaluation and decision support system. This paper mainly introduces the structure, function and application of the system.

II. SYSTEM OVERALL DESIGN

A. System Overall Structure

On the basis of the analysis and integration of the typical department traffic safety data, the trans-department traffic safety comprehensive evaluation and decision support system use the integrated traffic safety information resources to carry out traffic safety integrated visualization and spatial matching display, traffic safety tendency statistical analysis, safety facilities and technical means effect evaluation technology research, the model of road safety state assessment, the model of road safety measures and technical means to effect evaluation. So the system can provide foundation for fault classification and comprehensive prevention, and provide safety management decision support to government departments.

The overall system architecture is shown in Fig. 1.

B. Function Structure

According to the system overall architecture, we know that the system comprises 9 subsystems. They are integrated query subsystem, video surveillance subsystem, system management subsystem, integrated display subsystem, decision support subsystem, the security state assessment subsystem, data maintenance subsystem, safety facilities assessment subsystem, statistical analysis subsystem. The system's functional structure is shown in Fig. 2.

C. System Logical Framework

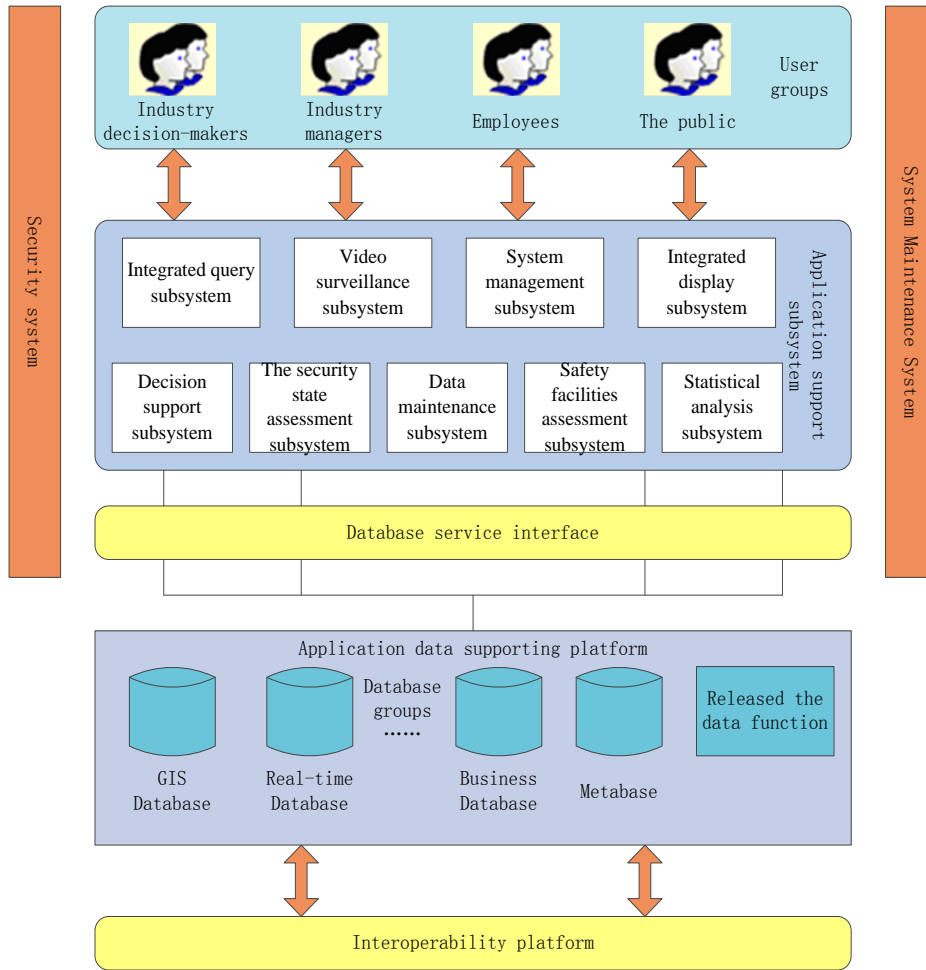The logical framework of the system is shown in Fig. 3.

Fig. 1.The trans-department traffic safety comprehensive evaluation and decision support system overall structure.
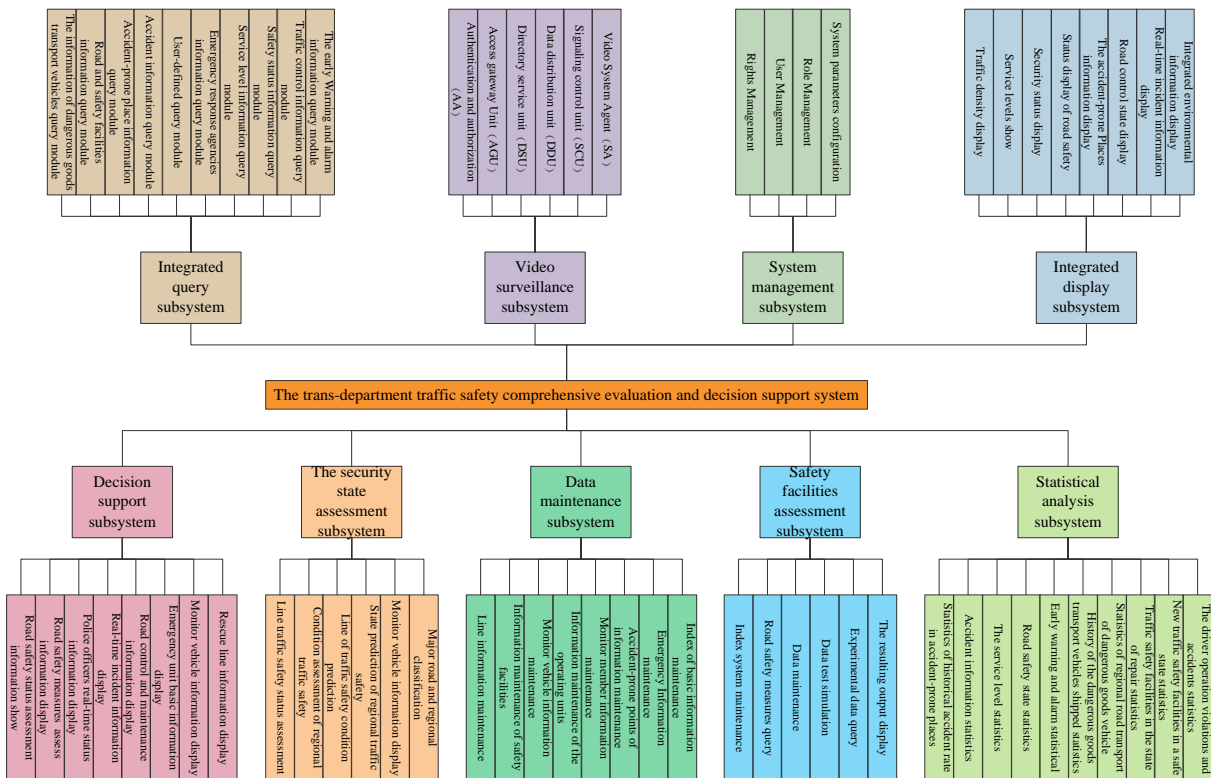

Fig. 2. The trans-department traffic safety comprehensive evaluation and decision support system function structure.
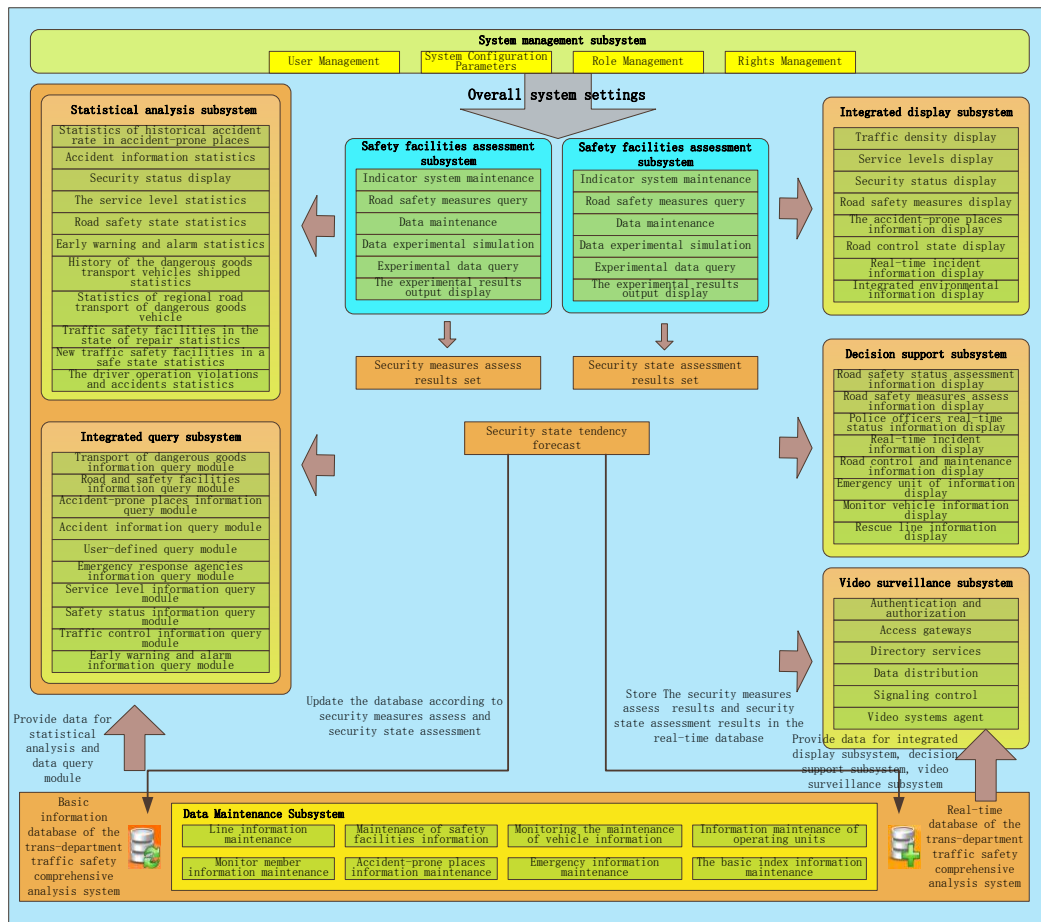
Fig. 3. The trans-department traffic safety comprehensive evaluation and decision support system logical framework.

III. SUBSYSTEM FUNCTIONS

A. Integrated Query Subsystem

We can use integrated query subsystem to inquire a variety of information. For example, we can inquire the information of dangerous goods transport vehicles, accidents information, the accident-prone place information, road information, the information of security measures, emergency response agencies information, service level information, traffic control information, security status evaluation result information, early warning and alarm information composite query. In addition, the system provides flexible custom query and the function of constructing the SQL statement. The integrated query subsystem mainly shows the form of a list, and Map operation is also involved in some modules.

B. Video Surveillance Subsystem

The video surveillance subsystems comprise the authentication and authorization, access gateways, directory services, data distribution, signaling control, video systems agent. Video terminal interactively completed access to resources in the different video systems by AA, the SCU and DDU video. Video management terminal complete the management and maintenance of the system by AA and AGU. SA was set up in the video system used to complete video system interoperability and the information exchange between the regional nodes and video system.SA also can achieve the interconnection of the video system. SA need to report resource information which is collected from the video

system to the regional nodes.SA need complete the exchange of regional nodes and video signaling. And the SA need forward the video-related data and information within video systems to the regional nodes of the DDU.

C. System Management Subsystem

First, rights management module is the management module permissions, including on the basis of permission to add, delete, modify, and other operations. Second, the user management module mainly manage the user basic information, including the user ID, name, password, gender, age, phone number, address, household register, nationality, unit photo number, department and Email. Role permissions package is a combination of a variety of basic permissions, including the role to add, delete, modify, and role-based permission settings. Menu management is to manage the basic information about the contents of the menu, menu layout, menu link, menu pictures, the target pane and language. System parameters configuration is to configure the security state assessment and safety facilities impact assessment model and algorithm parameters.

D. Integrated Display Subsystem

Integrated display subsystem function is to show the road area and line information, the information of road safety facilities, traffic control information, traffic information, traffic accident information, the security state assessment results and the level of service.

The integrated display subsystem shows the following eight kinds of information: the traffic flow density, level of

service, security condition assessment, condition assessment of road safety measures, accident-prone places information, traffic control, real-time incident information, environmental information. We can select one or more of the information to be displayed.

E. Decision Support Subsystem

The user can select the viewing area and the query conditions according to his needs，then the decision support subsystem display the information within the selected area on the map.

F. Security State Assessment Subsystem

Security state assessment subsystem comprises the module of the road line of traffic safety assessment and prediction[1], the module of assessment and prediction of the regional transportation security status[2], the basic information of the key lines and zoning evaluation maintenance module.

G. Data Maintenance Subsystem

Data maintenance subsystem includes line information maintenance, maintenance of safety facilities information, maintenance of commercial vehicles information, monitoring the maintenance of vehicle information, information maintenance of operating units, driver information maintenance, accident-prone places information maintenance, emergency information maintenance, the basic index information maintenance.

H. Safety Facilities Assessment Subsystem

Safety facilities impact assessment subsystem has 6 Functions, including indicator system maintenance,[3] algorithm to maintain, map roads query, the experimental data input and output, the experimental data stored query, the experimental results output display[4]. The subsystem display forms are graphics, lists, spatial GIS information.

I. Statistical Analysis Subsystem

The statistical analysis subsystem function includes ten modules, and they are statistics of historical accident rate in accident-prone places, accident information statistics, the service level statistics, road safety state statistics, early warning and alarm statistics, history of the dangerous goods transport vehicles shipped statistics, statistics of regional road transport of dangerous goods vehicle, traffic safety facilities in the state of repair statistics, new traffic safety facilities in a safe state statistics, the driver operation violations and accidents statistics.

IV. SYSTEM APPLICATIONS

In this paper, we use the traffic flow density display function for an example to introduce the application of this system.

A. Functional Description

According to the results, the system displays the traffic density in the current road. According to the traffic density, the system will mark the map with different kinds of color.

(1)The system provides the basic operation of the map, including zooming in, zooming out, hawkeye, the previous view, the after view. (2)Click on a road line, and the traffic flow density will be displayed in the list of data below the interface. The form of a histogram can be auxiliary display. (3)The system will display the real-time incident information, the traffic control information and the integrated environmental information in the right of the data list at the same time.

B. Input Data

(1)Space vector data, the basic data of road line; (2)Sections of information sheet, sections number;(3)Real-time traffic data table, unit time traffic, average speed, the proportion of the car models, occupancy, traffic flow density

C. Output Data

The system will output space vector diagram, traffic flow diagrams and traffic flow density diagrams.

D. Relational Database Tables

The system needs two tables, and they are road infrastructure information sheet and real-time traffic flow data sheet.

V. CONCLUSION

By early full investigation, analysis and research, we build the trans-department traffic safety comprehensive evaluation and decision support system framework on the basis of full understanding of user needs. At last we realize the system development. The various functions of the system meet the needs of users very well. It solves the problems of trans-department in traffic management. And it provides a powerful tool for multi-department in the road traffic management.

REFERENCES

[1] C. Zhang, Y. Wang, and L. Jia, "Evaluation method of regional traffic safety condition based on the inter-department information," *Chinese security science journal*, vol. 20, no. 10, pp.152-158, Oct. 2010.

[2] X. Su, "Research of super highway traffic safety evaluation system based on the inter-department information," M. S. thesis, Beijing Jiaotong University, Beijing, China, 2011.

[3] Y. Wang, H. Zhang, K. Zhang, *et al*., "Research on effect evaluation method of road safety measures facilities," *Highway*, pp. 145-150, 2011.

[4] Y. Wang, H. Zhang, and Z. Wang, "System design and implementation of assessing the effect of road safety facilities and technical means," in *2011 International Conference on Computer, Electrical, and Systems Sciences, and Engineering (CESSE 2011)*, Wuhan, 2011, pp. 334-338.

[5] P. Metal, *et al*., "The world report on road traffic injury prevention[R]. Geneva," *World Health Organization*, 2004

[6] S. Li, Y. Lin, Z. Xu, *et al*., "The urban traffic control system design and development based on the prediction," *Logistics technology*, vol. 28, no. 12, pp. 148-152, 2009.