Application Study on Dynamic Monitoring Platform of "Tourist Buses, Passenger Buses and Vehicles Transporting Dangerous Goods" Transportation Process Based on Safety Closed Loop

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Abstract: Aiming at the problems that " Tourist Buses, Class III and above Passenger Buses and Vehicles Transporting Dangerous Goods" related to industry and enterprise information management systems' data standards are not unified, information is not shared between businesses and integration is difficult. This paper puts forward a dynamic monitoring platform of "Tourist Buses, Class III and above Passenger Buses and Vehicles Transporting Dangerous Goods" transportation process based on the Safety closed loop. The platform can standardize the sharing and exchange of data between different information management systems, form a cross-department and cross-enterprise safety closed loop monitoring system to avoid blind zones in safety supervision. Application results show that the platform can further improve comprehensive management capabilities.

1. Introduction

In recent years, the number of " Tourist Buses, Class III and above Passenger Buses and Vehicles Transporting Dangerous Goods" in China has increased dramatically. A very large proportion of traffic accidents occur among road traffic accidents, especially heavy traffic accidents with massive deaths, severe injuries and huge economic losses. Therefore, the level of road safety supervision urgently needs to be improved [1]. The supervision and management of " Tourist Buses, Class III and above Passenger Buses and Vehicles Transporting Dangerous Goods" is related to the safety of people's lives, property and social stability [2]. Industry managers need to start from various aspects, combine industry characteristics with actual conditions, formulate effective management measures, pay close attention to the scattered resources, strengthen the capacity of supervision, dynamically grasp, and reduce the losses of society [3, 4]. The traditional problem of "Tourist Buses, Class III and above Passenger Buses and Vehicles Transporting Dangerous Goods" is that it's difficult in real-time monitoring and punishment control. The various systems that have been built are relatively

independent which makes data integration and dynamic security supervision difficult. At the technical level, some researchers use unified exchange data elements and code sets to avoid the problems of data type and data format between systems, and standardize heterogeneous data to solve the problem of "information island" [5]. The intelligent supervision and management of "Tourist Buses, Class III and above Passenger Buses and Vehicles Transporting Dangerous Goods" can provide technical support conditions for the safe operation of vehicles and reliable emergency protection, high-quality transportation management services for the public [6].

In order to solve the problems that the various current systems of "Tourist Buses, Class III and above Passenger Buses and Vehicles Transporting Dangerous Goods" are relatively independent in Yunnan Province which makes data integration and dynamic security supervision difficult, this paper puts forward a dynamic monitoring platform of "Tourist Buses, Class III and above Passenger Buses and Vehicles Transporting Dangerous Goods" based on the Safety Closed Loop. The platform uses information and intelligent means to carry out "data collection, resource integration and unified management". Thus we can truly implement the main responsibilities for production safety of transportation enterprise and the duties of industry supervision. By realizing the safety supervision target, the level of road transportation safety supervision and management could be greatly improved.

2. Working Principle of Platform

A platform can enhance the exchange and sharing of related business data through methods such as data architecture innovation, application and data value-added innovation, and management innovation [7]. The platform closely integrates the Informatization development needs of road transportation safety. The platform integrates system resources which are not related to each other in the existing enterprise side and industry management side. We collect the basic information of vehicle owners, vehicles, enterprises in each system and dynamic information in various business processes. We integrate all types of information systems of industry management departments, transportation companies, passenger and freight stations into the safety closed-loop management through unified data sharing and exchange standards. At last, we provide decision-making and analysis support for industry managers to achieve standardization, informationization and process management of safety supervision. The working principle of platform is shown in Figure 1.
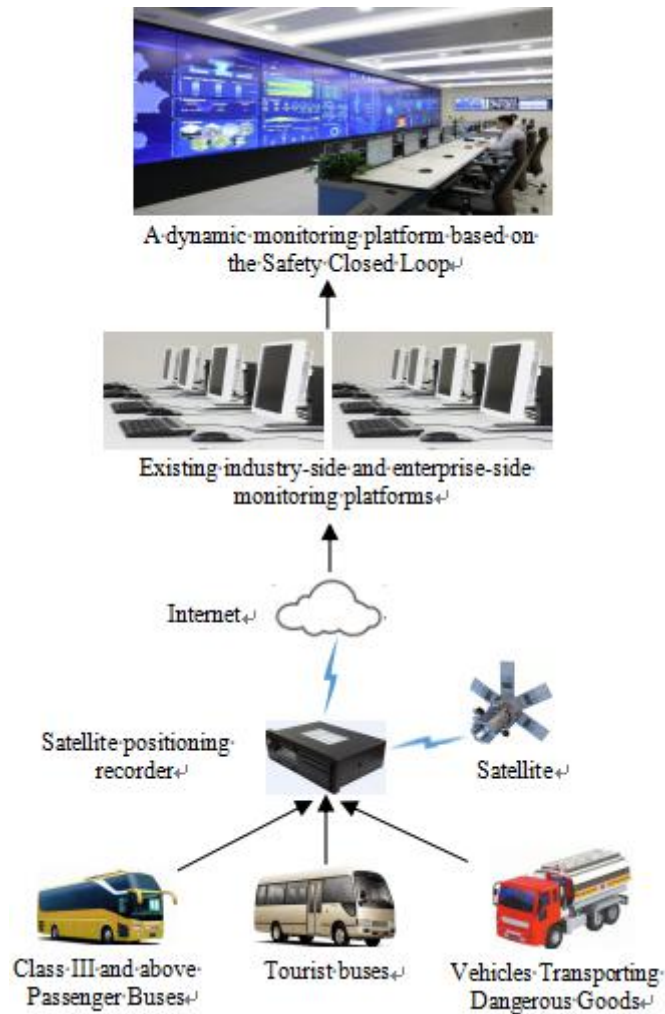
Figure 1: The working principle of platform.

3. Architecture Design of Platform

The platform classifies and manages the static data of vehicle owners, vehicles, vehicle enterprises in various existing systems, as well as dynamic operating data of Tourist Buses, Class III and above Passenger Buses and Vehicles Transporting Dangerous Goods. The platform correlates and exchanges the same data items in different systems. According to business needs, the platform performs data association on different types of data items to realize data interaction of heterogeneous databases. On the basis of data classification, we establish permission control for data users to prevent unrelated personnel from using related data and avoid competing users from accessing other companies' data. At the same time, we implement real-time alarming and handling of abnormal conditions to meet the needs of uninterrupted operation of safety closed-loop supervision. Through the construction of the platform, it changed from single "business system management" a "business system + data interaction dual drive system management", which enables data to be aggregated, processed and analyzed to provide support for the coordination and management of various aspects of industry supervision. The architecture design of platform is shown in Figure 2.
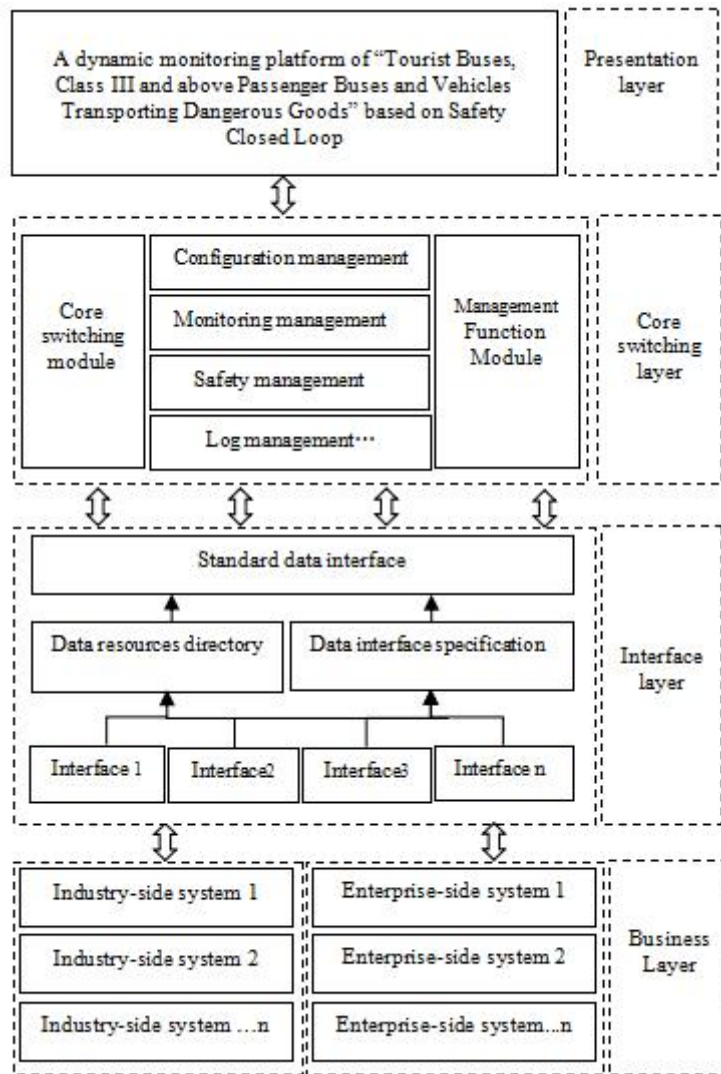
Figure 2: The architecture design of platform.

4. Function of Platform

The platform focuses on the "Admission supervision before leaving the station, Supervision on the way, and Punishment supervision" regulatory requirements for "Tourist Buses, Class III and above Passenger Buses and Vehicles Transporting Dangerous Goods". We develop standard data exchange interfaces to achieve data exchange between the platform and multiple target subjects.

4.1. Admission Supervision before Leaving the Station

The platform correlates and exchanges the information of vehicle owners, vehicles and vehicle enterprises in the existing systems of the transportation companies. The transportation management department examines and approves its qualifications. After passing the examination and approval, the transportation enterprise obtains the qualification for sending vehicles on the road, and the information of qualified vehicle owners, vehicles and vehicle enterprises is put into the warehouse. Through the establishment of electronic files of vehicle owners, vehicles and vehicle enterprises, it is able to master the qualification expiration of vehicles and drivers in time, and to warn of their

dangerous behaviors, so as to effectively implement the responsibility of safety entities for transportation companies.

Before the vehicle is dispatched, the platform will automatically check the information such as the company's operating license, vehicle and driver qualifications, and automatically lock drivers and vehicles which do not meet the regulations. In order to achieve the purpose of "delivering vehicles online, examining and approving online", transportation enterprises strictly operate in accordance with administrative permits. Transportation management department can actually control the problem vehicles.

In addition, "Tourist Buses, Class III and above Passenger Buses and Vehicles Transporting Dangerous Goods" must be routinely inspected before departure. The platform verifies its results through effective information such as vehicle inspection, maintenance, etc. pushed by the existing enterprise routine inspection system. Vehicles that fail the routine security inspection or have no valid routine security inspection data will not be able to dispatch, thereby reducing human interference. At the same time, the analysis and application of the vehicle routine inspection data can be realized, and the same problem that repeatedly occurs in the same vehicle can be used as a Major security risk to provide early warning. The prior admission supervision flow chart is shown in Figure. 3.
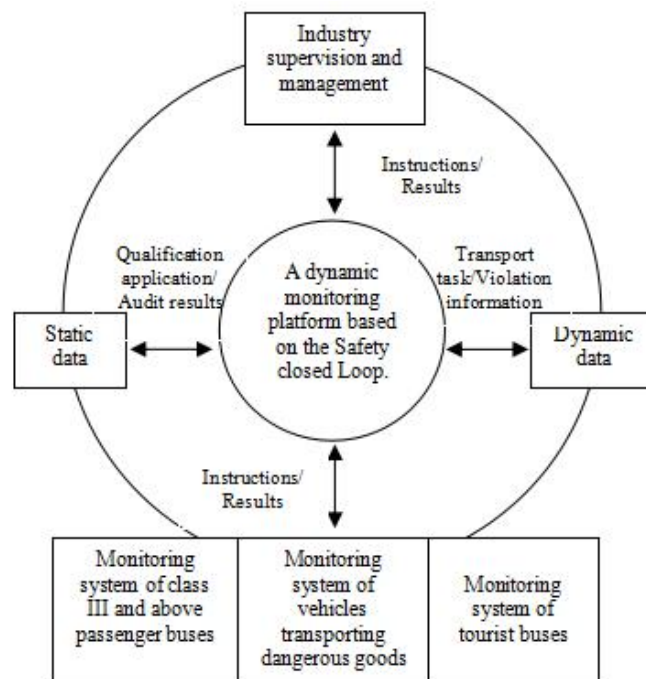

Figure 3: The prior admission supervision flow chart.

4.2. Supervision on the Way

The platform supervises vehicles on the road. Industry managers can view all the dispatch information and satellite positioning information of vehicles in transit on this platform. When vehicles have violations such as over-speed and over-range driving, the system will provide real-time alarm. By comparing the established vehicle operation trajectory with the actual line, it is possible to timely warn and rectify violations of laws and regulations such as vehicle line channeling operations. At the same time, industry managers can obtain real-time video of operating vehicles, control the real-time conditions of vehicles and timely discover the bad driving behavior of drivers. After the

monitoring on the way is completed and the actual operation data of the vehicle is obtained, the platform can be used to summarize and analyze the illegal activities.

Here we take supervision of vehicles transporting dangerous goods on the way as an example. It is the same as supervision of tourist buses and class III and above passenger buses on the way. The flow chart of supervision on the way is shown in Figure 4.
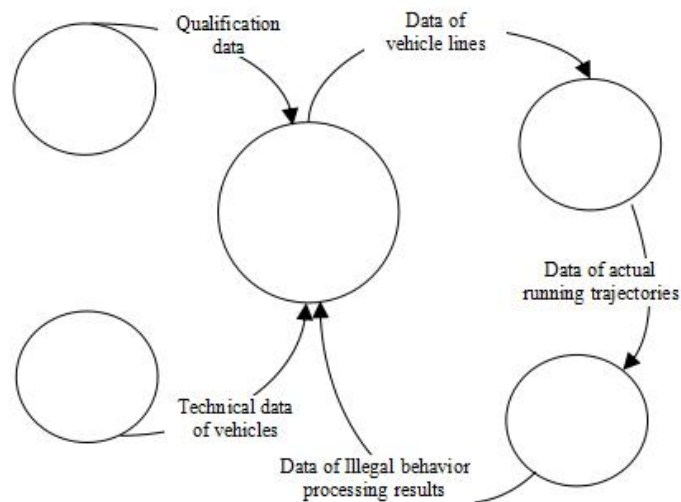

Figure 4: The flow chart of supervision on the way.

4.3. Punishment Supervision

The platform can simultaneously analyze and deal with various types of violations. Enterprises only need to verify their violations and notify the driver to accept punishment within a specified time. For those drivers who refuse to accept the punishment, the platform will automatically limit their departure, urge the driver to take the initiative to accept the punishment in time, and ensure that all violations are recorded and handled in time. It can improve the timeliness and accuracy of punishment.

5. Application and Comparison

The platform was successfully applied in 16 prefecture-level cities and 131 county-level road transport management agencies of Yunnan Province. The safety data of more than 30,000 "Tourist Buses, Class III and above Passenger Buses and Vehicles Transporting Dangerous Goods" and more than 700 transportation enterprises were all included in the platform for supervision.

According to the statistics, since the application of this platform, the number of " Tourist Buses, Class III and above Passenger Buses and Vehicles Transporting Dangerous Goods " accidents decreased from 67 in 2016 to 47 in 2018, and its decline rate is 29.85%. The traffic deaths of " Tourist Buses, Class III and above Passenger Buses and Vehicles Transporting Dangerous Goods " decreased from 112 in 2016 to 45 in 2018, and its decline rate is 59.82%. The number of people injured in the " Tourist Buses, Class III and above Passenger Buses and Vehicles Transporting Dangerous Goods " accidents dropped from 140 in 2016 to 26 in 2018, and its decline rate is 81.43%. As shown in Figure 5, the number of accidents, the traffic deaths and the number of people injured in accidents are decreasing year by year. It indicates that the platform is significantly effective.
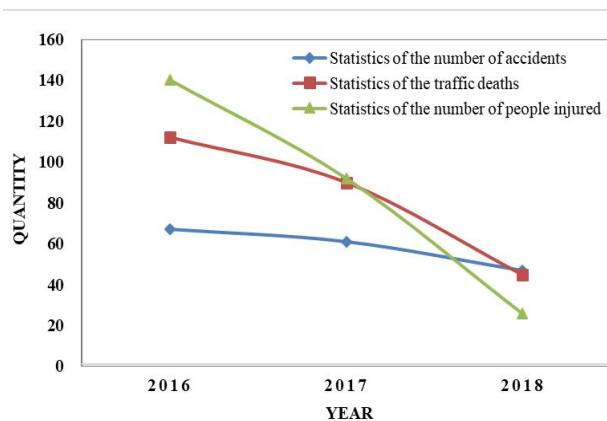
Figure 5: The comparison before and after application.

6. Conclusions

This paper proposed a dynamic monitoring platform of Tourist Buses, Class III and above Passenger Buses and Vehicles Transporting Dangerous Goods based on the Safety closed loop. The platform integrates data resources of various heterogeneous systems, realizes the interaction of data between the systems, forms the coordination of government and enterprise affairs management, effectively guides transportation enterprise to carry out risk self-identification and self-control, and provides a basis for daily supervision for industry management department. The application results verify the effectiveness of the platform, which can greatly improve the safety supervision efficiency and comprehensive ability of transportation processes.

Acknowledgments

References

[1] T Liang. *Study on the Key Technologies of Safe Supervision for Commercial Vehicle Operations Supported by Information Technology [D]. Chongqing University. 2012.*

[2] C Xiaoni, G xiaowei. *Exploration and Analysis of Intelligent Supervision Platform for "Two Kinds of Buses and A Kind of Vehicle Carrying Dangerous Goods" Vehicle in Transportation Safety Production [J]. Highway. 2019, 64(08): 255-259.*

[3] W Jin. *How to Improve the Supervision of "Two Kinds of Buses and A Kind of Vehicle Carrying Dangerous Goods" [J]. Economic Research Guide. 2016(17): 172-173.*

[4] C Xiaotong. C xiaochong, L shuisheng and Z zhijie. *Dynamic Supervision System for "Two Kinds of Buses and A Kind of Vehicle Carrying Dangerous Goods" Vehicle on Expressway [J]. China ITS Journal. 2017(07): 142-143.*

[5] L Yibo. *Data Exchange Method for the Heterogeneous E-government Platform [D]. Beijing University of Posts and Telecommunications. 2018.*

[6] Z Linni. *Intelligent Warning and Dynamic Management and Control System for "Two Kinds of Buses and A Kind of Vehicle Carrying Dangerous Goods"[J]. China ITS Journal. 2018(07): 127-129.*

[7] Z Shujie. *Application of Big Data Information Sharing and Exchange Platform in Hebei Expressway. [J]. China ITS Journal. 2018(12): 80-82.*