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Integrated Management System of Expressway Intelligent Service Area

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Abstract. Different from traditional service areas, intelligent service areas can better adapt to the construction of expressway networks and meet the high-level needs of the current society for service areas. Based on big data analysis and machine vision technology, a new intelligent service area management system for the expressway has built in this paper, which covers staff management, intelligent washroom, vehicle flow and passenger flow analysis and statistics, intelligent parking guidance, and senseless refueling payment, and other functions, which can promote the synchronous improvement of service area supervision and management and service quality.

Keywords. Expressway, service area, intelligent transportation, planning and design

1. Introduction

Due to the fully closed operation nature of expressway, the driver and passenger on the expressway are cut off from contact with the outside world [1-3], therefore the expressway service area as an important part and subsidiary facility of the expressway, assumes the important role of providing services for the passengers driving on the expressway and the expressway management personnel. With the construction of national and local expressway networks [4,5], the number of service areas is fast increasing, however, the traditional management of service areas is difficult to meet the current social needs, resulting in problems of congestion during peak periods or excessive staff in service areas during low peak periods.

According to the current social service needs, an integrated management system for smart service areas is proposed in this paper, which could be better improved the supervision ability and service level of service areas, facilitate standardized and intelligent management of staff, and enhanced the convenience for drivers and passengers.

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2. Service Area Intelligent Management Requirements

Service areas, whether as infrastructure or tourist destinations, need to take good management demand as the main reference factor to control the normal operation of a large number of people flow or traffic flow. Meanwhile, a better management can also improve the satisfaction of people who is driving on expressway with the service area, so the continuous improvement of information management, combined with resource conditions to seek the expansion of service area functions will further meet people's high-level demand for service areas.

2.1. Basic Information Management

The management of the service area is mainly to analyze the characteristics of staff and alarm to correct behavior problems, so as to achieve reasonable management and realize the intelligent operation of the service area.

Due to the particularity of the geographical location of each service area, resulting in the mobility of the service object will be different. Unlike foreign service areas, which are equipped with large shopping centers and other entertainment facilities, the domestic expressway service areas usually focus on convenience, so there are very few customers who go to the service areas to consume purely for the purpose of consumption, which determines the singleness and one-time service objects in the operation and management of service areas. At the same time, the passenger flow of the expressway changes with holidays and seasonal changes, showing an unstable development and periodic fluctuation trend, while the economic benefits of the service area mainly depend on the passenger flow of the expressway, and the economic expenditure mainly depends on the fixed wages of the employees. In general, if the passenger flow is large, the economic benefit of the service area is good, otherwise, the economic benefit is poor. The service content of each service area, such as business scope and service quality, is different, which also leads to the instability and volatility of service efficiency. Therefore, it is particularly important to record the basic information such as the name, address, time of use, management organization, contact person, merchant information and parking space information in detail, so as to support the function of adding, deleting, correcting and querying, so as to better manage each service area.

2.2. Staff Information Management

Reasonable management of the staff in the service area could be further improved the standardized operation of the intelligent service area. The basic information management function of the staff in the service area should include the personnel name, age, ID card, mobile phone number, face photo, work type, organization, and other information records. It should also support the addition, deletion, correction, and query of personnel information, as well as the import and deletion of batches.

In staff behavior regulation, for example, security guards, cleaning staff and restaurant health and restaurant service personnel outfit, behavior regulation and abnormal behavior, the traditional "man to man" regulatory system cannot real-time supervisory staff's behavior, leading to the behavior of the individual staff problems was not correct, it is difficult to meet the demand for service level.

The same problem also appears in the bathroom, the traditional regulatory system with fixed scheduling methods, cleaning personnel check-in, and cleaning washroom

sanitation. However, when there is more passenger flow, it occurs a shortage of staff, which leads to washroom sanitation being poorer. When there is less passenger flow, it results in the staff too much, which leads to a waste of resources. Therefore, rational intelligent management is needed to achieve the full scheduling and utilization of resources.

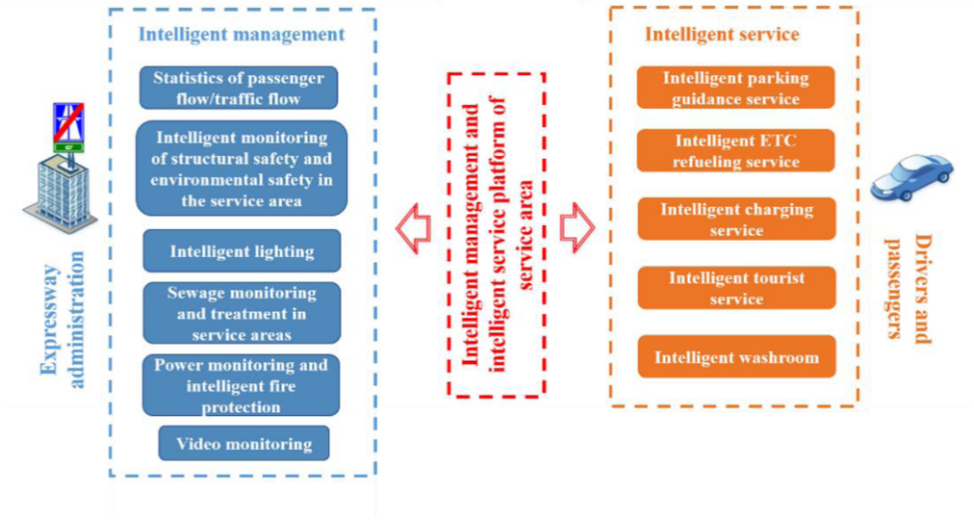

Figure 1. Technical solutions for the overall system.

3. The Focus of the Planning and Design of the Intelligent Service Area Based on the Hierarchy of Needs

Based on the above analysis of the demand for intelligent service area management and intelligent service, the intelligent upgrade of service area operation management, driver service, and commercial operation is realized in this paper through all-factor perception, big data analysis [6] and artificial intelligence [7] application, in order to improve the safety, efficiency and intelligence level of the service area. The overall system of technical solutions is shown in Fig. 1. In this paper, we focus on the part of expressway management, and the other part of overall system is introduced in our other paper.

3.1. Staff Behavior Analysis and Management

The staff of service area in the case of long-term work will inevitably appear personal behavior problems. It should be noticed that an appropriate amount of staff should be arranged to better serve when passenger flow group entering the expressway in the peak and low-peak periods of traffic flow in the service area.

Figure 2. Staff behavior trajectories.

Based on the application of visual intelligent analysis, the behavior supervision of staff such as security, cleaning, cooks, and restaurant service personnel will be strengthened. The system supports the dressing, behavior, behavior track supervision and abnormal behavior alarm functions of security personnel, restaurant sanitation and restaurant service personnel and cleaning personnel, as shown in Fig. 2. In terms of washroom operation management, the cloud platform is used to realize the statistics of the number of personnel in the cleaning area, real-time location displays, departure analysis, personnel information viewing and real-time alarm reminders.

3.2. Management of Intelligent Washroom

In management of washroom, the statistics of washroom passenger flow is realized based on infrared sensing, and the intelligent shift scheduling function for cleaning operations based on passenger flow data, as shown in Fig.3. It supports the face recognition check-in function of cleaning personnel, and supports the record and query of check-in information, including check-in date, check-in personnel, check-in time, etc. It can fully mobilize the enthusiasm of employees with the better solution in the integration of human resources, etc., which solves the drawbacks of our traditional management mode “man to man” and systems managing people.

Figure 3. Intelligent washroom technology solution.

Drivers and passengers can easily grasp the use of washroom and service quality in service areas along the route through third-party applications, which is convenient for reasonable planning of washroom time during the trip. On the guidance screen in the service area, a map is displayed to guide the user to easily find the nearest washroom. At the same time, it displays the quantity, distribution and occupancy of men's, women's, mother and baby rooms, third washrooms and disabled washrooms, environmental quality indicators, such as air temperature and humidity, air status, and green environmental protection status of overall sewage discharge standards, etc., for managers to grasp the internal situation of the washroom in real time and notify the staff to clean, clean, maintain, and supply consumables in time for the washroom. If users are dissatisfied with the washroom, they can scan the QR code in the washroom to raise opinions and complaints about the dirty and messy public washroom, and the responsible custodial service staff can be prompted in time and quickly corrected.

4. Conclusion

Expressway service area is a necessary result of the development and the supporting facility of expressway industry, it not only drives the expressway passenger vehicles and the highway law enforcement management personnel to provide service at the same time, but also increased the employment opportunities, and improves the area economic benefit and social effect, which is becoming the window of cities in the promotion. With the rapid development of computer technology, the service area that adopts intelligence operations could be further improved services, in order to provide quality services for all kinds of vehicles and passengers on expressways, which could be also reduced the peak unnecessarily crowded jam to ensure the safety of driving personnel, and increased the economic benefits of the expressway investment company. Based on big data analysis and machine vision technology, a new set of intelligent service area comprehensive service platform system has constructed in this paper, which could be further promoted

the supervision and management of expressway service area and improved the service quality.

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