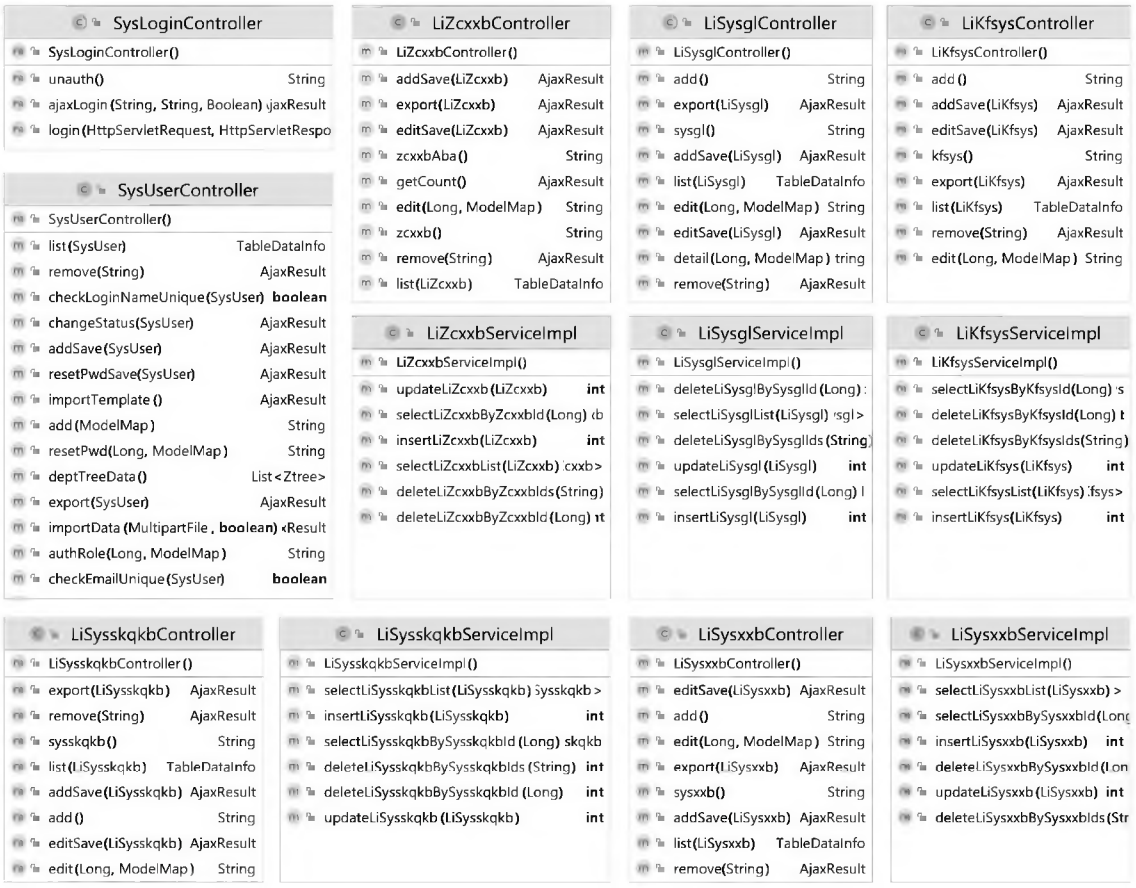

Figure 4 – Application class diagram

Reference

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DEVELOPMENT AND OPTIMIZATION OF THE VEHICLE PARKING MANAGEMENT SYSTEM

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Abstract. *This paper discusses the key issues in the design of an intelligent parking lot management system. The system is developed to improve the management efficiency of parking lots and provide car owners with a convenient parking experience.*

Keywords: smart parking lot, management system, vehicle management, parking space monitoring, user interaction.

With the continuous increase in the number of vehicles in cities, parking lot management faces many challenges. Traditional parking lot management methods are inefficient and prone to problems such as difficulty in finding parking spaces and congestion of vehicles entering and leaving. To solve these problems, it is of great practical significance to design an intelligent parking lot management system. At present, many parking lots still adopt a combination of manual management and simple electronic equipment. When a vehicle enters the parking lot, a parking card is issued manually and the entry time is recorded; when a vehicle leaves the parking lot, the information is checked manually and the fee is charged. This management method has many disadvantages: on the one hand, manual operation is slow and it is easy to cause congestion at the entrance and exit during peak hours; on the other hand, it is difficult for car owners to obtain parking space information in the parking lot in real time, and they need to blindly search for parking spaces in the parking lot, wasting time and energy. At the same time, it is difficult for parking lot managers to accurately count and analyze the use of parking spaces, which is not conducive to the rational allocation of resources. Based on the above situation, it is necessary to develop an intelligent parking lot management system, using advanced technical means to realize the automated management of vehicle entry and exit, real-time monitoring and guidance of parking spaces, and efficient user interaction functions, thereby improving the overall operational efficiency of the parking lot. The users of the intelligent parking lot management system mainly include car owners and parking lot managers.

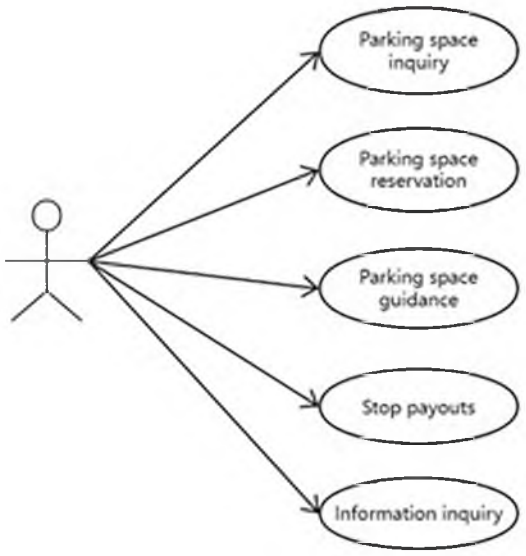

Figure 1 – Car owner use-case diagram

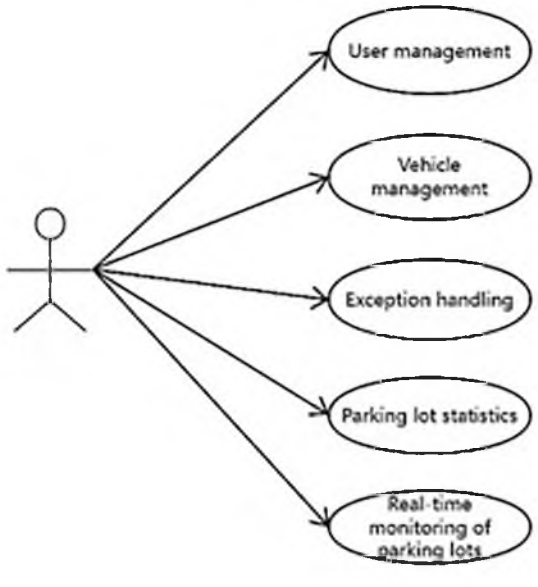

Figure 2 – Parking lot manager use-case diagram

The following functions are available to the car owner:

– Check the real-time remaining parking spaces in the parking lot through the mobile application or the inquiry terminal at the parking lot entrance.

– Before entering the parking lot, book a parking space in advance and get parking space location navigation.

– When a vehicle enters the venue, the license plate number is automatically recognized and the barrier is quickly lifted to allow it to pass without having to stop and pick up the card.

– In the parking lot, you can quickly find reserved or available parking spaces through the parking guidance system.

– When exiting the parking lot, the parking fee will be automatically settled, and multiple payment methods are supported, such as WeChat Pay, Alipay, UnionPay, etc.

– Parking records can be viewed on the mobile app, including entry time, exit time, parking fees and other information.

Parking lot managers can use the following features:

– Real-time monitoring of parking space usage in the parking lot, including the number and specific locations of occupied and vacant parking spaces.

– Query and conduct statistical analysis on vehicle entry and exit records, and generate various reports, such as daily/monthly/yearly vehicle flow reports, income reports, etc.

– Manage system user permissions, add or delete administrator accounts, and set different operation permissions.

– Set and adjust parking lot charging rules, such as adjusting charging standards for different time periods, setting free parking duration, etc.

– Receive system alarm information, such as abnormal parking space occupancy alarm, equipment failure alarm, etc., and handle them in a timely manner.

The intelligent parking lot management system mainly includes the following core classes:

Vehicle: records basic information about the vehicle, such as license plate number, vehicle type, etc.

Entry Record Class (EntryRecord): records vehicle entry time, license plate number, entry gate and other information.

Exit Record Class (ExitRecord): records vehicle exit time, license plate number, exit gate, parking fee and other information.

FeeRule: defines charging standards for different time periods and vehicle types.

System Administrator: manages various parameters and user permissions of the system. The system data is stored in the database, including vehicle information, parking space information, entry and exit records, charging rules, etc. The database uses a relational database, such as MySQL, to ensure data integrity and consistency. Vehicle entry and exit information is obtained through license plate recognition equipment, and parking space status information is collected through geomagnetic sensors or ultrasonic sensors installed on the parking space. These data are transmitted to the system server in real time for processing and storage.

The system will automatically identify the vehicle's license plate number through license plate recognition technology, and determine whether the vehicle has reserved a parking space or whether it is a monthly card user. For vehicles that have reserved parking spaces, the system automatically guides them to the reserved parking spaces; for vehicles that have not reserved parking spaces, the system allocates vacant parking spaces for them according to the real-time status of the parking spaces, and provides navigation guidance. When the vehicle leaves the parking lot, the system automatically calculates the parking fee based on the parking time and charging rules. The owner can choose to pay online or pay in cash at the toll terminal at the exit. During the system development process, the stability and security of the system were fully considered. Encrypt data transmission to prevent data leakage; regularly back up the system to deal with sudden failures and ensure that data is not lost. At the same time, the system has good scalability, which is convenient for subsequent function upgrades and optimizations.

By designing and developing an intelligent parking management system, we can effectively solve the problems existing in traditional parking management, improve the management efficiency and service quality of parking lots, and provide car owners with a more convenient parking experience. In the future, with the continuous development of technology, we can further introduce technologies such as artificial intelligence and the Internet of Things to realize intelligent and unmanned management of parking lots and enhance the overall competitiveness of parking lots.

Reference

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DEVELOPMENT AND OPTIMIZATION OF THE CAMPUS MANAGEMENT SYSTEM

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Abstract. *This project aims to design and implement an archive management system to simplify the management and access of archive information by users and improve the efficiency and security of archive management.*