Design and Implementation of Intelligent Management System for Urban Road Parking

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Abstract. In view of the problem of "parking difficulty" in the city, this paper puts forward the design of "urban road parking intelligent management system". Users can use the system to check the parking information in real time, find the parking space in time and return to the parking space quickly. Parking management departments can use the system to guide and help users to stop in time, thus improving the difficulty of parking, and then improve the problem of parking.

1. Background analysis

According to statistics from the Traffic Management Bureau of the Ministry of Public Security, the number of vehicles has reached 217 million by the end of 2017, of which 7 cities have more than 3 million vehicles, and it is estimated that there will be nearly 300 million parking Spaces by 2018. "Difficulty in parking" has become a problem faced by various cities. Through lessons drawn from foreign mature experience, parking management domestic has begun the research and application, and the automatic recognition of the car parking lot is realized by the interconnection of high definition video, the no parking, no card, fast import and export of the intelligent parking lot, the payment by mobile payment or member backstage after prepaid/pay are used. Through the accurate analysis of large data, the intelligent parking management system has the original unattended and subversive way of the road parking management, thus reducing the cost of charging and implementing price control measures. Domestic Shenzhen has implemented a trial based on the BeiDou location parking fees and management.

2. Functional analysis of urban road parking intelligent management system

Intelligent parking makes parking intelligent and humanized through modern management means, realizing the following functions:

- Network sharing data for the parking lot. It can build intelligent parking networking platform, realize parking guidance, parking reservation, electronic self-help pay, and have fast access to the parking lot.
- Various measures to prevent car theft. Through the license plate recognition, image comparison, dual card authentication, the theft of the car can be prevented.
- The unmanned service is gradually popularized. Let parking be “intelligent”, until unmanned
service is achieved.

- The mobile phone realizes the functions of parking space reservation, payment, and the locating of the car automatically.

3. **Ideas and framework for urban parking smart management system implementation**

The urban road intelligent parking system is a comprehensive solution of parking management in Intelligent City, which is composed of geomagnetic perception technology, video license plate recognition technology, information center intelligent processing platform and multi-channel information publishing platform. The system transfers parking information to the central intelligent information processing platform by using the geomagnetic parking sensor combined with mobile phone to complete the parking management and charge, and simultaneously realizes the "real time" acquisition of parking information, the application of mature, no gap covering 4G wireless network to the central intelligent information processing platform, and achieves parking management, charge management, supervision and management, parking berth letter. The data through the center, with the vehicle GPS, smart phone, voice service phone, Internet, parking guidance card and other channels can be combined to realize parking guidance and parking reservation and other public services.

![Urban road parking intelligent management system](image)

Figure 1. Urban road parking intelligent management system

As shown in Figure 1 above, the urban road intelligent parking system consists of three platforms: intelligent POS terminal information collection, information central intelligent processing and multi-channel information publishing platform.

Intelligent parking system architecture: The overall framework of the parking system is mainly composed of 8 parts, network and hardware layer, data layer, application support layer, basic application layer, extended application layer, data exchange layer, user authentication layer, and user layer. At the same time, it is considered the standard system of road parking and information security system construction. The system adopts a hierarchical structure system. The whole system is based on perfect standard system and information security system, and each layer is based on the services provided by its lower level. All users adopt single sign-on mode and enter the system after system authentication and authorization.

4. **The key technology of System implementation**

4.1. **RFID**

Radio frequency identification (RFID) technology is the most advanced fourth generation automatic recognition technology in the world. It has the characteristics of long recognition distance, high recognition accuracy, high recognition speed, strong anti-interference ability, long service life, and
penetrating non-metallic materials etc. It has a wide application range. The intelligent parking management system can effectively prevent the damage and interference caused by human factors to the parking lot by the remote passive radio frequency identification technology, and realize the intelligent scientific management of the parking lot of the building and residential areas, which can control the loss of costs, improve operational efficiency, and ensure the safety of the vehicle.

4.2. Sensor Technology
The magnetic sensor is a front-end sensing device of the ground guidance system, which will accurately lock the vehicle's stay and departure time and transmit it to the management system background, so as to induce the owner parking. In addition, as a new type of electronic timing charging device, the geomagnetic sensor is buried under the parking space. When the vehicle enters the parking space, the magnetic sensing line will cause the change of the magnetic field. The geomagnetic sensor will guide the vehicle to enter the parking space, at the same time, it start timing and prompt the service personnel nearby to pay for services. When the vehicle leaves the berth, the fee-paying service personnel shall be immediately prompted to handle the off-site treatment. In this way, parking people need not worry that parking is being timed. In addition, geomagnetic sensors can also realize parking guidance function. Through the comprehensive statistical analysis of the background system, on the display screen, the free parking space information in the vicinity can be provided to the public on the screen, so as to guide the citizens to choose the parking place reasonably.

4.3. Core algorithm of intelligent parking solution

4.3.1. "Floating" sensor fusion algorithm
The “ground” sensor fusion algorithm uses the X, Y, and Z axis geomagnetic data to establish the magnetic field feature vector at the current point in time. An Bayes classifiers with a positive distribution is used to classify the time point as a vehicle, there are no two kinds of vehicles, and the accuracy of parking detection reaches 98.9%.

4.3.2. "Cloud" artificial intelligence algorithm
In order to further improve the accuracy, the "cloud" server uses self-learning artificial intelligence algorithm to find the abnormal car position in time, and can reduce the "error probability" to almost 0. According to conservative estimates, the accuracy of the intelligent parking solution is 99.99%.

4.4. Database design based on cloud platform
Data sharing ensures that each subsystem can easily use data from the data center. Data center is not only a provider but also a consumer. It is a relative role, as a data provider in the scenario of data sharing. So the data sharing function provides data sharing service for the other application systems of intelligent parking management, realizes interworking with the data of the citizen card system, the traffic system, the public security system, and so on. It provides the basic data as well as other related business data, such as parking sites, real time parking spaces, and other related business data. The overall structure of the system data sharing is shown in Figure 2.
5. Management of intelligent parking management information platform

The urban road parking fee management system takes handheld POS terminal as the information collection terminal. It consists of three major functional platforms, parking management, supervision and management, and information query platform, as shown in Figure 3.

Parking toll POS access: the real-time collection and on-site charging of parking data are mainly realized through this interface. The main function of the transaction interface is to receive the transaction message data sent by the handheld POS terminal, and parse the message. According to the transaction type, the corresponding processing process is performed. After the processing is completed, the result package is returned to the POS terminal to complete the transaction.

Inspect POS terminal access: Inspecting POS terminal access mainly includes the following interfaces: regional information, regional site information, lot information, site parking information, parking details.

The data service sharing interface of the basic geographic information sharing platform: the interface is mainly used for data docking of the geographic information sharing platform.

Data interface of digital city management platform: It is mainly used for data connection interface of multiple existing application systems for the construction of digital urban management platform.

The intelligent parking management service construct platform. Service management platform includes site and parking management system, supervision and management platform, publishing system platform, parking fee system and so on.
6. Conclusions
This paper proposes to design urban road parking wisdom management system to solve the problem of “the parking difficult”. With RFID technology and sensor technology, it can guide the parking person to quickly locate the nearest parking lot empty space, and help users to reach the target parking lot smoothly according to the user's choice, and provide a variety of online payment methods to facilitate the user to pay for parking fees. In addition, users can also use the scoring function provided by the system to score, so as to provide reference for other users' choice and promote the subsequent development of parking lots. The road supervision department can use this system platform to coordinate the management of urban parking issues and reduce the “indiscriminate parking” caused by “difficult parking”, which will affect the normal operation of road traffic.

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