Analysis of Intelligent Parking Lot

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Abstract. In 2015, China's new registration of vehicles reached 23.85 million, a net increase of 17.81 million vehicles, are the highest level in history. In the past 5 years, the proportion of motor vehicles has increased from 47.06% to 61.82%. Parking spaces are less, has become a problem can not be ignored. On the other hand, as technology developing, chips, sensors, rapid develop, we can combine super computer and other advanced analysis tools and "cloud" and other new computing model, turn infinite data into valuable intelligence, the establishment of intelligent parking lot, has become very urgent and feasible. This paper analyzes the present situation of parking lot in our country, discusses the necessity of building intelligent parking lot, and carries on SWOT analysis of intelligent car park, finally discusses the case and improves the management level of parking lot.

The Current Situation of Parking Lot in China

With the development of society and economy and the improvement of people's living standards, the rapid growth of motor vehicles has led to a sharp deterioration in traffic, the end of 2015 the national motor vehicle ownership 279 million per 100 households with 31 private cars. "Parking difficult" problem is inevitable, the shortage of parking spaces has caused people to concern the issue of berth. At present, domestic and foreign scholars focus on parking guidance research outside the parking lot, but will guide the driver to the entrance to the parking lot on the end, while the study of the internal guidance of the parking lot is relatively less, the majority of parking still rely on the guidance of the pilot or the driver find the location blindly, a small number of parking to improve the utilization of the parking spaces provide the current number of empty spaces remaining at the entrance, but did not provide specific location information, the driver entered the venue only can rely on the road signs on their own to find empty parking spaces, greatly affected the parking efficiency. In the initial stage, the lack of a system can be integrated scheduling parking management system, information dissemination system is too single, parking management system are mostly static induction, the lack of reserve resource regulation, focusing on management, the overall lack of practice behind other countries.

The Necessity of Intelligent Parking Applications

1. The revenue and reducing expenditure: China's land resources are scarce, "cutting" is the fundamental, the throttle is to optimize the allocation of resources;
2. Intelligent parking lot: to improve the use of the car park, reduce the number of vehicles parked to reduce emissions of harmful gases to facilitate owners to find cars more quickly, but also to achieve the rational use of favorable resources;
3. The current artificial cash charging methods: labor-intensive, low efficiency, will be easy to cause financial loopholes or loss of funds, traffic flow will affect the passage of time and more efficient.

The SWOT Analysis of the Intelligent Parking Lot

**Advantages:** (1) To facilitate system deployment. The traditional parking lot parking location is chaotic, the use of intelligent parking system to facilitate the flexible deployment of the acquisition node, the real "one car one card one position".

(2) To save costs and improve management efficiency. Intelligent parking using digital operation, in order to achieve automatic vehicle identification and information management, establish a unified parking management system to improve vehicle traffic efficiency and security, and statistical data out of the vehicle to facilitate the management staff scheduling to reduce management personnel of labor intensity, so as to improve work efficiency, avoid artificial management loopholes, save manpower costs, improve the indoor parking fee system.

(3) To enhance the security of the parking lot. The system adopts the management mode of "one-car-one-card-one-position". From the vehicle entering the parking lot until the vehicle leaves the parking lot, all the data related to this vehicle are related uniquely with the ID number of the card. Through this unique ID number, we can integrate information such as user, car model, vehicle license plate, vehicle color and vehicle image, vehicle entering and leaving time, designated parking number, parking path and fee payable in the database to query and storage. This will charge management, parking guidance and vehicle identification data security monitoring subsystem based on the same data platform, to provide a comprehensive security monitoring mechanism that can effectively monitor the parking spaces from time to time for the owners to provide timely and effective security, enhance the security of the parking lot.

(4) Rational use of effective resources. Parking intelligent, saving about 70% of the parking time to help drivers quickly find an effective parking lot and park car quickly, reduce the number of vehicles parked, reduce the amount of harmful gas emissions, achieve rational use of effective resources and reduce illegal parking, standardized parking.

**Disadvantages**

The present situation of intelligent parking in China is in its infancy, it lacks a co-ordination scheduling parking management system and the system of way of releasing information is too single. Parking management systems are static induction and lack resource regulation and practice. What’s more, it focuses on management and information processing facilities and technology need to be further consolidated. It is failing to use a variety of hardware and software equipment and appropriate science and technology.

Because there is no perfect intelligent parking system in the country, we can take advantage of its incomplete concentration and before monopoly gimmick has formed a competitive structure, we need to spend more manpower to allow consumers to improve their Product awareness. Only in this way, we can gain a large disk occupies a seat in the market economy and strive to occupy market share.

**Opportunities**

With the economic development and the improvement of the living standards of people, car
owners are more and more common and people are increasingly demanding on the parking lot to achieve intelligent parking. So, the establishment of a unified parking management system is the inevitable trend of the future development.

There are large population and large market demand in China and there is no perfect domestic intelligent parking system in China. So, competitive pressure is small. As long as we grasp the opportunity of development, we will be getting better and better.

The irrational arrangement of urban planning and road construction in our country has led to the increasing congestion of urban roads, So, solving the traffic jam, requiring effective fast parking, improving the parking efficiency and realizing smart parking are the inevitable requirement of the development of each city.

Threat
In the face of the immaturity of information technology, the development of intelligent parking system will be a variety of obstacles. Not only that, it is also very easy to follow in the early stages of development, so it is necessary to build the special and unique parking system. In this way, we can stand in an unbeaten position in the fierce market competition.

The Case of Intelligent Parking Lot Analysis
Taking advantage of the Internet to establish a complete sets of parking system as an example.

Search System
With the development of technology and economy, the legitimate and legitimate parking of the vehicle has become an indispensable issue for the future development, so the first event is how to make the owner efficiently in the vicinity or a specific location to find their favorite parking spaces.

(1) Location Information
In the major commercial parking, roadside parking lot and can allow the rental of residential parking and other things using the Internet of things information collection, transmission, processing and application of the principles of planning-related information collection. Which can be positioning information architecture is divided into four layers: the perception layer, transport layer, processing layer and application layer, as shown in Fig. 1:
Optimization of intelligent parking will be canceled at any time near human services, this time on the need to update the system-related data in real time. At this point, in the need of relating to the relevant sensing technology. Each chain garage sensing may not be the same, so in addition to the application of sensor knowledge, there are large databases and other related applications combined. A sensor is a device that can detect and sense external information and convert the information into measurable electrical signals or other forms of signals according to certain rules, by transmitting the converted signal output to other devices.
Will be out of the positioning of the garage into the empty parking spaces, large data re-arrangement screening. This requires that the WSNs be distributed on sensor nodes and gateway nodes in different spaces, or can be deployed inside or around the sensed objects, so as to detect and collect the attributes of the sensed objects at any time. And each node can realize simple data storage and processing, and receive data from other nodes. The nodes communicate with each other through the wireless network so that all nodes collect and process the information in the coverage area of the sensor network in a cooperative way. Of the data converged to the gateway, through the transport layer to the computer system. Then you can meet the conditions of the vehicle into the appropriate garage. While the sensor can effectively respond to whether the phenomenon of illegal parking for the traffic and customers play a role in monitoring, can greatly reduce the unreasonable allocation of personnel and so reduce the waste of human resources.

Figure 2. A flow chart of the app.
(2) Information processing

The customer booking information for timely processing, in a timely manner to make an effective response, you can filter out effective parking spaces. But also to support customers in the running on the way to choose a reasonable parking place, according to the distance from the length of time to stop the relevant incentives or reminder. If the customer cancel the order maliciously, may according to the distance destination distance, the effective time length, cancel the reason rationality to carry on the rewards and punishments matters. And so on intelligent optimization of the information processing process, require a strong wireless signal propagation effect support, so the need for the surrounding major parking space for complete signal measurement, effectively prevent possible interference factors such as damage, timely repair or enhance the signal.

Outbound Storage System

Ultrasonic Parking Detector

The information acquisition module periodically collects the parking information in the parking lot and the information of vehicles entering and leaving the parking lot, and then transmits the information to the information analysis and processing module via the information transmission module. The latter analyzes the data, extracts the latest parking spaces, the number of vehicles and other information available to the information release module, release module through a variety of ways to release information to guide users to stop. The use of APP for two-dimensional code scanning, and relevant vehicle to install RFID automatic identification tag is for double insurance.

The temporary parking needs of vehicle owners in the vehicle when the manual extraction of temporary cards in the vehicle out of the library to manually credit card to calculate the parking time and parking fees. The main work flow of the system is as follows:

(1) Vehicle storage:

Vehicles into the parking lot channel, the entrance of the RFID reader to detect vehicles, vehicles equipped with RFID electronic license plate can be achieved without stopping fast access, RFID reader access to vehicle information, the Including transaction data such as time, license plate number, lane number, RSU (electronic equipment installed in the road test), OBU (electronic equipment installed in the car), and other information to the Operations Management Center. Vehicles that do not have an RFID electronic license plate enter the parking lot using a temporary parking card device.

(2) Parking:

Vehicle parking is completed, installed in the parking space directly above the ultrasonic parking spaces detector has been detected in the parking spaces have been occupied, the occupation of information through the wireless sensor network transmission to the information analysis and processing module.

(3) Vehicle from the library:

The vehicle from the parking spaces, the parking detector to detect the parking spaces have been empty, collecting this information; vehicles from the parking lot exit, the exit of the RFID reader to detect vehicles, On the RFID tags, collecting vehicles from the library information. All collection information is transmitted to the information analysis and processing module, the processing module automatically calculates the parking time, parking fees and complete the deductions. The RFID card reader can obtain the vehicle information and send transaction data including time, license plate number, lane number, RSU number, OBU number and other information to the operation. Management Center (intelligent parking
networking platform); not installed RFID electronic license plate vehicles using the traditional way of manual charges. Or use an APP scanning payment.

**Information Maintenance**

In the major functional modules needed to be done, on the appropriate information maintenance, the establishment of relevant information system.

**Conclusion**

Using the information system, the intelligent parking lot can manage information for cars in and out of data. System can quickly and timely get the related data, clear specification. Intelligent parking lot a truly achieve a car a card. It not only improves the efficiency of the parking lot, also solves the problem of parking difficulty.

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