Parking Lot Vehicle Positioning System and Management Method

Sun Yuwei[1,a], Tang Xiaofei[1,b,*], Gao Jiayi[1,c]

[1]*University of Science and Technology Liaoning, Anshan, China*
[a]*3270472473@qq.com, [b]dfdfdf66@163.com, [c]2114259894@qq.com*
Corresponding author

Abstract: *This design provides an intelligent parking lot management system based on the Internet of Things and its management method. The system includes a license plate acquisition module, a parking space information acquisition module, a path generation module, a server and a mobile terminal. The method includes acquiring the parking space and the license plate information located on the parking space; Generate a parking lot map; Obtain the information of the license plate to be inquired, and display the path from the inquired location to the parking space where the license plate is located, the path from this path to the nearest exit and the number of vehicles queuing at each exit. This design can effectively improve the utilization rate of the parking lot, reduce the time for the owner to find the car and go out of the parking lot, save the owner's time and bring convenience to the owner.*

Keywords: *parking lot, vehicle, positioning system, management method*

1. Introduction

According to the data of China Automobile Manufacturing Market Analysis, Forecast and Development Trend Research Report from 2017 to 2022 by China Commercial Industry Research Institute, since 2011, the automobile industry has benefited from the moderate recovery of the world economy and the introduction of automobile consumption encouragement policies in various countries, and gradually recovered. At present, there are about 1 billion cars in the world, with China accounting for 10%. China has become the second largest car owner in the world after the United States. With the rapid development of China's social economy and the rapid growth of car ownership, parking difficulty has become a common problem in the whole society. People not only have to worry about the crowded traffic on the highway, but also have to work hard to find a habitat for the stationary wheels [1]. The sharp increase of vehicles puts forward higher requirements for parking facilities and parking environment. The management and construction of parking lot has become an urgent task for the whole city and even the country, so it is particularly necessary to design an intelligent parking management system[2].

With the development of society, more and more people have private cars, and they will give priority to private cars when traveling. In order to adapt to this phenomenon, there are more and more parking lots in shopping malls, hotels and other public places, many of which are underground parking lots or multi-storey buildings. When people finish shopping, gathering and other activities in public places, it is often difficult to find their own cars because they forget the parking space information. At the same time, due to the large parking area, some parking lots have many exits[3]. Many car owners find it difficult to find a car after knowing the parking space information, and it is difficult to find the exit after finding the car, which not only delays the time but also increases the parking fee, resulting in a certain waste of resources[4].

2. Parking lot design

In order to make the purpose, technical scheme and advantages of this design more clear, this design will be further explained in detail with the attached drawings and examples. It should be understood that the specific embodiments described here are only used to explain the design, and are not used to limit the design[5].

This design provides an intelligent parking lot management system and its management method based on the Internet of Things.

In order to solve the above technical problems, this design adopts the following technical solutions: a smart parking lot management system based on the Internet of Things is designed, including: a license plate acquisition module is designed to identify and upload license plate information located in the parking space; Designed a parking space information collection module for collecting and uploading parking space information; Designed a path generation module to obtain parking lot layout information and vehicle positioning information, generate vehicle search paths and exit paths, and upload them; Designed a server to obtain license plate information and parking space information, and perform matching and uploading; And designed a mobile terminal for querying license plate numbers and displaying navigation information for corresponding parking spaces, car search paths, and exit paths [6].

A detector arranged on the parking space for detecting the presence of a vehicle; An image acquisition device which is arrange in that parking lot and use for shooting the automobile license plate located in the parking space; And a license plate recognition host for acquiring the pictures uploaded by the image acquisition device and the license plate, wherein the license plate recognition host uploads the license plate information to a server for storage.

The detector is electrically connected with the image acquisition device[7].

The image acquisition device is specifically a camera, and the image acquisition device is arranged between a plurality of parallel parking spaces for monitoring the plurality of parking spaces.

The parking space information acquisition module comprises a locator arranged in the detector and used for uploading the parking space information to a server.

The path acquisition module comprises a map acquisition unit for acquiring parking lot plane information and uploading it; The vehicle positioning acquisition unit is used for acquiring vehicle positioning information and uploading it; The first processor is used for receiving parking lot plane information and vehicle positioning information and generating a vehicle search path and an exit path; The pre-judgment unit is used for obtaining the inquired license plate information, pre-judging the number of vehicles queuing at each exit, and uploading.

The mobile terminal comprises a second processor, which is used for uploading the license plate number to the server and obtaining the matching parking space information; The display screen is used for inquiring and displaying the information of the parking space corresponding to the license plate number, the vehicle search path, the exit path and the number of vehicles queuing at each exit; The power supply device is used for supplying power to the second processor and the display scree[8]n.

The intelligent parking lot management method based on the Internet of Things comprises the following steps:

(1) Obtain parking space and license plate information located on the parking space;

(2) Generate parking lot maps;

(3) Obtain the license plate information to be queried, obtain the parking space information of the license plate, the path from the query location to the query parking space, the path from the parking space to the nearest exit, the number of vehicles queued at each exit, and display it.

3. The concrete realization of the parking lot

Next, the preferred embodiment of this design will be described in detail in combination with the parking space information identification and detection system in Figure 1.

The intelligent parking lot management system based on the Internet of Things is characterized by comprising a license plate acquisition module, a parking space information acquisition module, a path production module, a server and a mobile terminal, wherein the license plate acquisition module comprises a detector, an image acquisition device and a license plate recognition host, wherein the detector is an ultrasonic detector, the ultrasonic detector is installed at the front and upper part of a parking space, and the image acquisition device is a camera, taking a horizontally arranged parking space as an example, Wherein every three parking spaces share one camera (at most three parking spaces use one camera, and at least one parking space corresponds to one camera, so as to ensure that when the number of parallel parking spaces cannot be divisible by three, other cameras are used for the redundant parking spaces), and whether there is a car in the parking space is detected by using an ultrasonic detector. At this time, the existing mature technology, in this embodiment, the ultrasonic detector is connected with a plurality of cameras arranged horizontally, when the ultrasonic detector detects that there is a car in the

parking space, it triggers the camera to take pictures of the car in the parking space to ensure the real-time information. The license plate recognition host is connected with the camera by electrical signals, and the camera uploads the photographed picture to the license plate recognition host to recognize the license plate information in the picture and upload it to the server. The parking lot management system also includes a guide screen and a display screen, which are located above the parking lane. It is used to display the parking space of the parking lot, and an audible alarm is set on the display screen, that is, when the license plate recognition host uploads the recognizable license plate information in the picture to the server, the unrecognizable license plate information is alarmed by the audible alarm, and the information is uploaded to the display terminal of the management personnel of the parking lot to remind the owner whether the license plate is blocked or not, and when the camera cannot effectively capture the license plate information, the staff can check the cars in the parking space, and manually input the license plate information through the display terminal and upload it to the server for storage.
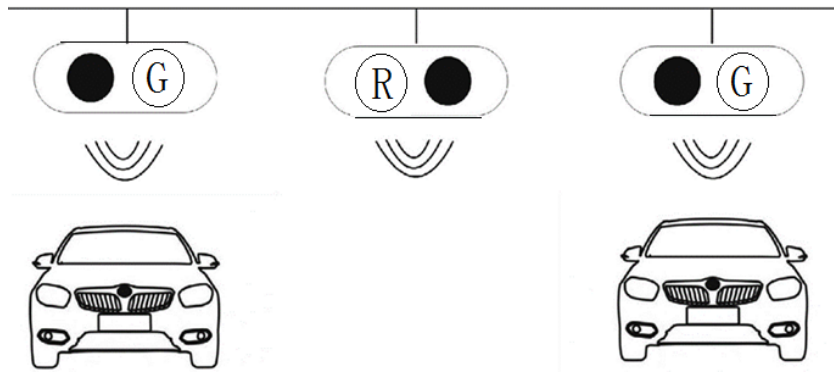

Figure 1: Parking space information identification and detection system

Among them, the ultrasonic detector model is TUS-300, which is an integrated structure of probe and parking indicator light. The communication interface adopted is RS485, the camera is a high-definition license plate recognition camera, and the model is LPR-0. The resolution or frame rate of high-definition video is 1920×1080 or 1600× 0, and 1 ~ 25 fps can be adjusted.

The parking space information acquisition module includes a locator, which is arranged in the ultrasonic detector and electrically connected with the ultrasonic detector. When the ultrasonic detector detects that there is a car parked in the parking space, the locator immediately uploads the signal to the server, and the parking space position information is stored in the server in advance, and each parking space information corresponds to a coordinate point. The server matches and stores the parking space information and the corresponding license plate information, and at the same time sends the positioning information of the parking space to the path generation module.

The path generation module comprises a map acquisition unit, a vehicle positioning acquisition unit and a first processor, wherein the map acquisition unit comprises a plane map acquisition unit, a calculation unit and a generation unit; the plane map acquisition unit is specifically a roller scanner; the roller scanner scans the plane map drawings of the parking lot, inputs them into the calculation unit, and manually draws the plane map drawings of the parking lot, Upload a plane map drawing of a parking lot to a plane acquisition unit, scan, digitally importing and uploading to a calculation unit, calculating each mark accord to that coordinates, map measurement and quantity characteristics of each point on the acquired map, carrying out parameter correction and correspondence on the coordinates, map measurement and quantity characteristics of each point, and then generating an electronic map through a generation unit and uploading the electronic map to a server, wherein the electronic map has been pre-processed and stored in the server, The vehicle positioning acquisition unit acquires vehicle positioning information in real time (that is, only one positioning information is obtained when the car is parked in the parking space), which is obtained through the locator, and then uploaded to the first processor, electronically tagged by the first processor, and uploaded to the server, where the electronically tagged vehicle positioning information is uploaded to the server and matched to the electronic map. The server inquires and locates the only corresponding parking space information and license plate information on the electronic map through the vehicle positioning information, and the electronic map and the mobile terminal are combined through GPS and Bluetooth to provide real-time positioning information service.

In addition, the route generation module also includes a pre-judgment unit, which records the inquired license plate information within a set time (in this embodiment, it is limited to fifteen minutes) to generate an information pool, and the information that has been inquired for more than fifteen minutes is

automatically deleted. For example, there are three exits in the parking lot used by this system, namely exit A, exit B and exit C. Within fifteen minutes, according to the inquired license plate and the given exit route information, Determine the cars that are queuing out from Exit A, Exit B and Exit C within this time period and record them in the information pool. When the owner inquires about the car information, he will display the route from the mobile terminal to the corresponding parking space and the route from the location of the car to the nearest exit, at the same time, take the preferred exit as the selected exit of the car, and display the expected number of cars queuing at each exit on the map for the owner to choose. When a car chooses an exit with a long route but few queues, it can click the route from the location of the car to the selected exit on the mobile terminal. In addition, the total storage amount of the information pool is n (limited to 15 in this embodiment). When it exceeds the storage amount within a limited time, the earliest data stored in the information pool will be deleted and replaced to ensure the timely feedback of the number of cars at the exit. The storage amount of the information pool can be increased or deleted later according to the usage of the whole parking lot.

The mobile terminal includes a second processor, a display screen and a power supply device, and the power supply device supplies power to the second processor and the display screen. The mobile terminal can be a fixed device placed at each elevator entrance or a hand-held mobile device (such as a mobile phone, ipad, etc.), which ensures that when people enter the parking lot through the elevator, they can quickly find the car through the mobile terminal, and the display screen obtains the license plate information input by people and uploads the license plate information to the second processor. The second processor uploads it to the server, receives the information of the corresponding parking space, the route from the mobile terminal to the corresponding parking space and the route from the location of the car to the nearest exit, and then feeds it back to the display screen, which helps the owner to find the car and the exit quickly, so as to prevent the owner from spending a long time looking for the exit in the parking lot due to the large parking lot and many exits, resulting in resource waste. Handheld mobile devices can navigate by downloading the two-dimensional code of this system, and the two-dimensional code can be pasted at various positions of the parking lot. Parking fees can be paid through the handheld mobile devices. When the fees are settled, it means that the position is empty, so it is convenient for the external display screen to display and give feedback in time to ensure the effective use of the internal space of the parking lot.

The intelligent parking lot management method based on the Internet of Things is characterized by comprising the following steps:

(1) Taking pictures of cars parked in parking spaces, acquiring parking spaces and license plate information located on the parking spaces, uploading the information to a server, matching and storing the information;

(2) Acquiring indoor parking plane map drawings of the whole parking lot, calculating each mark according to the coordinates, map measurement and quantity characteristics of each point on the acquired map, and then generating an electronic map of the parking lot;

(3) Obtaining the license plate information to be inquired, sending the information to the server last time, and the server inquires and feeds back the license plate information and parking space information, and generates a path from the inquired position to the parking space where the license plate is located and a path from the path to the nearest exit on the electronic map, and counts the preferred exit for inquiring the license plate information; if the preferred exit of the first car is A, recording the exit and the inquiry time as the first information stored in the information pool, And judging whether the time exceeds 15 minutes in real time, if it exceeds, deleting the message from the database in the information pool, and so on. When n cars are inquired, if the number of databases in the information pool exceeds 15, deleting the information with the earliest record time, recording the exits of the n cars and the inquiry time, and counting the number of cars queued at each exit according to the database of the information pool;

(4) According to the inquired license plate information, the route from the inquired location to the parking space where the inquired license plate is located, the route from the parking space to the nearest exit and the number of vehicles queuing at each exit are displayed.

4. Conclusion

With the strong support of the school-enterprise cooperation company, the intelligent parking lot management system has been running for more than four months, which is reasonable and normal from

the current running situation, especially in line with the current actual situation of the school. However, in the current Internet of Things and mobile Internet era, hardware devices are becoming more and more homogeneous, and the value of hardware devices needs to be realized more and more through software systems and Internet operating platforms.

(1) In order to strengthen the user's friendly experience and facilitate the user's inquiry, we can develop a mobile APP based on the parking lot management system, and set up an inquiry and reservation system. On the one hand, users can easily find the parking position on the parking lot inquiry system; On the other hand, the user can inquire whether there is a parking space in the parking lot at home or in the middle of the road, allowing the user to book the parking space within a specified time, so as not to find that there is no empty parking space when the user drives to the parking lot, which can greatly facilitate the user.

(2) In the near future, under the big data platform of the Internet of Things, a city or even a country will be regarded as an oversized parking lot, and an intelligent management system will be made to truly make a smart parking home. Through centralized control and operation of all parking lots, management loopholes can be reduced, labor costs and operating costs can be reduced, and the use and operating efficiency of parking lots can be improved, so that the parking spaces in the whole city and even the whole country can be shared, which can effectively solve the problem of disorderly parking in the city.

This is also the direction we will continue to explore and study in the future. I believe that through such a powerful software system and Internet of Things operating platform, we can not only greatly improve the image of the city, but also make great contributions to the construction of the city and the country. This design can effectively improve the utilization rate of the parking lot, reduce the time for the owner to find the car and go out of the parking lot, save the owner's time and bring convenience to the owner.

Acknowledgement

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