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Design of Chinese License Plate Recognition and Parking Billing System based on AI

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Abstract: The system is mainly divided into four parts: interface design, license plate collection, license plate recognition and data management. In the license plate collection, the camera is used to collect the video of the license plate when it is in and out, and the frame analysis of the video stream is completed by calling OpenCV in Python. In terms of license plate recognition, Baidu AI is used. The image recognition method of the platform realizes the recognition of the license plate. In terms of data management, the time of vehicle entering and leaving the parking lot is recorded in the form of a table, and the charging information is automatically generated in combination with the charging rules to achieve automatic charging. The results show that the design can improve the economic benefit of the depot, improve the service quality and enhance the user experience.

Keywords:License plate location; License plate recognition; OpenCV; Time and charge

1. INTRODUCTION

With the acceleration of the urbanization process, the number of cars is also growing rapidly. But in this case will bring a lot of problems, such as traffic congestion and so on. The introduction of parking billing management system solves the problem of traditional IC card parking system. The system uses advanced license plate recognition technology to replace the traditional IC card technology, so that the fixed vehicle can pass without stopping, the temporary vehicle does not need to get off the car to swipe the card, and the system will automatically recognize the license plate and release it when it comes out [1]. License plate recognition system realizes automatic recognition of license plate number through image processing, image recognition and other technologies. The core technology of license plate recognition system is image processing and pattern recognition. Image processing technology is mainly to enhance and segment the image to improve the accuracy of license plate recognition [2]. The pattern recognition is mainly through Baidu AI recognition, so as to automatically recognize the license plate number. The metered system charges people based on their parking time after the license plate is recognized.

Baidu AI refers to artificial intelligence (AI) related technologies and services developed and provided by Baidu. Baidu has invested a lot of resources in the field of artificial intelligence, involving multiple aspects of technology and applications, including natural language processing, image recognition, speech recognition, machine learning and so on. The Baidu AI Open Platform is a developer-oriented platform that offers a range of AI services and tools that enable developers to easily integrate Baidu's AI technologies into their own applications. Baidu Brain is the core of Baidu's AI open platform, providing multiple AI services and API, including natural language processing (NLP), image recognition, speech recognition, and more. Developers can use these services through the Baidu Brain platform to accelerate the intelligence and innovation of their applications.

2. METHODOLOGY

2.1 License Plate Recognition

First, register an account on the official website of Baidu AI Open platform and configure the parameters of Baidu AI development platform, including App ID, API Key and Secret Key [3]. The preceding parameters are saved in system text files for easy parameter modification and saving. Then, select the recognition type and determine the recognition mode. Finally, the pictures captured by OpenCV will be uploaded to complete the packaging, sending and receiving of the picture data, and the data returned by Baidu AI open platform will be analyzed and displayed [4].

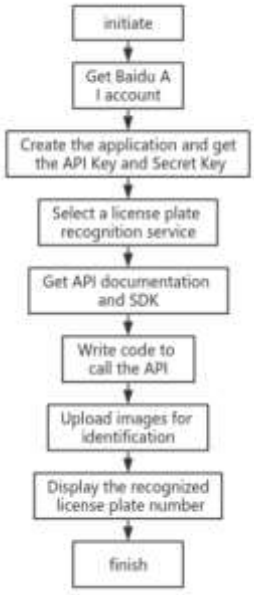

Figure. 1 Flowchart of vehicle license plate recognition implemented by Baidu AI platform

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Baidu AI platform uses Access token to achieve authentication. The main purpose is to obtain access token parameter Access token, which contains information such as the user's identity and permission and must be carried when requesting the API interface URL. Before using an interface, you must obtain the Access token parameter. By obtaining the Access token and carrying the Token in the API request, the user identity and permission are authenticated, ensuring the validity of the API request. In actual applications, you need to store the Access token properly and obtain it again when it expires or becomes invalid [5][6].

2.2 Time and Charge System

This system takes into account the difference in payment methods between the owners and users of parking lots who need to park frequently for a long time and the ordinary customers of temporary parking, so the system designs two different parking methods for ordinary users and members. The process for vehicles to receive parking services in and out of the parking lot is roughly shown in Figure 2.

For owner cars and temporary cars, the system has different rates. Based on the data such as entry time and exit time, the parking fee is automatically calculated and displayed on the screen [7]. This article is charged by time, temporary parking is charged by time, and the owner's car can park for free within the validity period.

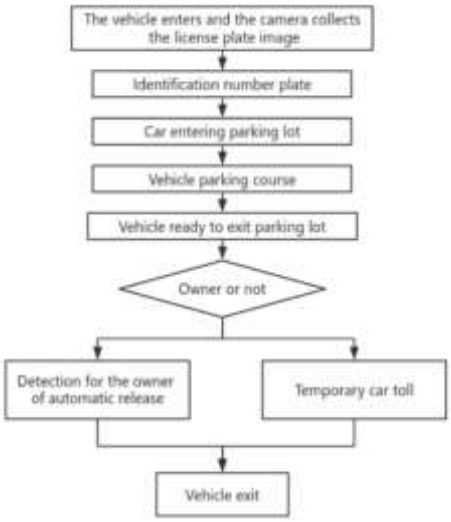

Figure. 2 Vehicle timing and billing process

2.3 Database System

The database system can improve the efficiency of the system and ensure the security, integrity and consistency of data. In this paper, Excel tables are used to store user related information and license plate data, and Excel files are operated through openpyxl library in PyCharm [8]. This method can flexibly write code to process and manage license plate data, can easily write data to different worksheets or different cells, provides a rich method to set cell style, font, color, border and other attributes, can also be data processing and analysis, such as screening, sorting, calculation and other operations on the data. Ability to create charts to visually present data information. This paper designs three tables to display the vehicle-related information of the parking lot.

Parking lot Vehicle table: This table is a database table used to record information about existing vehicles in the parking lot in real time.

Owner's vehicle information table: This table is used to manage the basic information of the owner, to facilitate the parking lot personnel to effectively manage the owner, its main information includes the owner's license plate number, the owner's membership card validity period.

Parking lot history table: This table records the information of vehicles entering and leaving the parking lot in the past for historical data analysis and statistics. The main information includes the license plate number, entry and exit time and cost of vehicles entering and leaving the parking lot[9].

Through the design and management of these data forms, the information and data of vehicles in the parking lot can be effectively recorded and managed. This will help the normal operation of the system and provide accurate data support for parking meter billing.

Table 1. Database related information table

Form name	Major key	Other information
Car park list	Parking serial number	License plate number; Approach time
Owner vehicle information sheet	License plate number	Membership cards start and end time
Parking lot history	License plate number	Vehicle entry and exit time; Parking expense

2.4 Interface and Program

This system is written based on real-time camera application program, including the main camera area and the display frame after setting the recognition camera area contains an identification button.

Table 2. Introduces the main functions

Function name	Function introduction
Write String ()	Write a string function that writes App ID, API Key, and Secret Key values to a text file for storage
Read String ()	Read string function, read App ID, API Key and Secret Key values from a text file, convenient for subsequent calls
time_cmp ()	Compare the appearance time with the card validity period to determine whether the owner needs to charge
priceCalc ()	Used to calculate parking time
Utf8ToGbk ()	A data format conversion function that takes a UTF-8 string, decodes it to Unicode, and encodes it to a GBK string.

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3. EXPERIMENTAL RESULTS

The computers used in this article are AMD A12-9720P RADEON R7, 12 COMPUTE CORES 4C+8G 2.70GHz; The programming language used in this article is Python, the development system is Windows 10, the code is written on PyCharm, version 3.9.

The main interface of system operation is shown in the Figure 3.

Figure. 3 Running the main interface

When foreign cars and owner cars enter the parking lot, the license plate is recognized, and the interface is as follows:

Figure. 4 Entrance map of foreign car and owner car

When the foreign car and the owner car leave the parking lot, the time will be charged, and the interface is as follows:

Figure. 5 Charging diagram of outside car and owner car

The system will display 100 total parking Spaces and remaining parking Spaces on the interface. When a vehicle enters the parking lot, its license plate number and entry time will be displayed, and its identification information will be displayed below, mainly including license plate number, entry and exit time, prompt information, etc.

4. CONCLUSION

The AI-based Chinese license plate recognition and billing system design integrates license plate recognition and timing billing functions. In this paper, OpenCV library is used to realize the pre-processing of license plate image, and then the method of Baidu AI is applied to license plate recognition. The results show that the method can recognize the license plate effectively and accurately, achieve a high recognition accuracy and show a good effect, but in some cases, such as bad weather, damaged or dirty license plate, the recognition accuracy may decline. Further, the system realizes the function of automatic timing and charging when the vehicle comes out. The system realizes the automation of parking lot management and improves the operation efficiency of parking lot effectively. Through the automatic recognition of license plates, users do not need to manually enter information, and through the automatic timing and charging of vehicles, users do not need to wait, providing a more convenient and efficient parking experience.

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