

Parking Management System Based on Image Processing Technology

Yaxin Xing, Yanbin Long

Liaoning University of Science and Technology, Anshan, China

Abstract: This project discloses a parking space management system based on image processing technology, which includes a parking space lock and a vehicle information matching system based on image recognition on the cloud. The parking space lock is set on the parking space, and the parking space lock includes a camera 6, a parking gear lever 1, a wireless data transmission module 2, a single chip computer 3, and a photoelectric switch sensor 7. The camera 6 scans the vehicle information in front of the parking lock and stores it as an image. The wireless data transmission module 2 is used to transmit the vehicle information image to the cloud-based vehicle information matching system based on image recognition. The single chip 3 can control the lifting of the parking gear lever 1. The vehicle information matching system based on image recognition in the cloud can convert the vehicle information image into license plate information based on the algorithm, and provide the corresponding control information after matching with the database to control the opening and closing of the parking space lock. This project has realized the convenient management of parking spaces, and solved the problem of low intelligence of traditional parking space locks.

Keywords: Image processing; Parking space; Management system.

1. Introduction

With the rapid growth of the number of motor vehicles and drivers, urban parking has gradually become a hot issue in large and medium-sized cities in China. While the whole society is experiencing the convenience brought by motorization to people's travel, the traffic problems such as difficulty in parking, traffic congestion and disorder also appear. At present, the chaotic parking order is one of the important reasons that affect the good operation of urban traffic. It is mainly reflected in: it is generally difficult to travel and park in cities; The phenomenon of evading fees and collecting fees without authorization is common; Illegal and disorderly parking on the road, resulting in traffic obstruction; The labor charge management cost is high and conflicts occur frequently.

As the car ownership is still increasing, the corresponding parking lot construction scale is also growing. The construction of various parking lots has improved the extremely tight situation of parking spaces in the urban area to a certain extent, but also brought about management problems of these parking lots. An effective parking management system will greatly reduce the above risks. The correct understanding and scientific management of parking system has become one of the important means to alleviate urban traffic problems. Most of the parking lots built in urban areas are provided by enterprises for their employees, so enterprise users are the main service objects of these parking lots. If the parking lot built by the enterprise itself is insufficient or even not built, enterprise users will often face the problem of difficult parking, which will not only cause the above problems, but also affect the enthusiasm of enterprise users to work to a certain extent.

However, most of the traditional parking locks are manual parking locks. No matter the owner enters or exits the parking space, he or she needs to get off to open or close the parking lock, which not only delays time, but also has the potential to cause traffic congestion. Although the current intelligent

parking space lock can prevent users from getting out of the car to unlock, it needs to download apps, register and other operations, and the use steps are cumbersome. Secondly, due to manual management, the parking price mechanism is difficult to implement quickly and uniformly. Parking fees are very effective parking management regulation indicators, but poor management will lead to public dissatisfaction and conflict, and the low degree of informatization of parking resources also increases the cost of parking management.

Due to the various problems of the parking space lock today, it not only reduces the parking efficiency, but also gives users poor satisfaction. In the peak period when parking efficiency is required to be high, if vehicles cannot enter the parking space in time, it is very likely to cause congestion and even accidents.

2. Project content

This project provides a parking space management system based on image processing technology and its management method, which is intended to solve the difficulty of traditional parking space lock operation and use; There are many problems caused by the lack of effective management in the modern parking lot. This project can realize the automatic matching and recording of parking spaces and vehicles, realize the convenient management of parking spaces, solve the problem of low intelligence of traditional parking lock, and have a broad application prospect in the scene of parking conflict between staff and outsiders.

The technical solution to achieve the purpose of this project is: a parking space management system based on image processing technology. The system includes a parking space lock, a vehicle information matching system based on image recognition on the cloud, the parking space lock is set on the parking space, and the parking space lock includes a camera, a parking gear lever, a wireless data transmission module, a single-chip microcomputer and a photoelectric switch sensor. The camera can scan the vehicle information in front of the parking lock within a preset angle and store it as an image.

The wireless data transmission module is used to transmit the vehicle information image captured by the camera to the vehicle information matching system based on image recognition on the cloud. The microcontroller includes an infrared data transmission module, and the microcontroller can control the lifting and lowering of the parking gear lever. The vehicle information matching system based on image recognition on the cloud can convert the vehicle information image transmitted by the wireless data transmission module into the license plate information, and give corresponding control information after matching with the database to control the opening and closing of the parking space lock.

The parking space management system also includes a parking space and vehicle information management system on the cloud. The parking space and vehicle information management system on the cloud can record and manage the information about the parking time and driving time of the parked vehicles on the parking space.

The photoelectric switch sensor is set at the front end of the parking lock.

The parking gear lever includes a left parking gear lever and a right parking gear lever distributed on both sides of the parking space lock. The left parking gear lever is raised and lowered through the left steering gear, and the right parking gear lever is raised and lowered through the right steering gear.

The parking lock also includes a power module.

A parking space management method of the parking space management system based on the image processing technology, including the following steps:

Step (1), the arrival of a vehicle is sensed through the photoelectric switch sensor, and the presence of the vehicle is confirmed;

Step (2), acquiring vehicle information through the camera and storing it as an image, and transmitting the vehicle information image captured by the camera to the cloud-based vehicle information matching system based on image recognition through the wireless data transmission module;

Step (3), the cloud-based vehicle information matching system based on image recognition uses image recognition technology to convert the vehicle information image into license plate information, and converts the license plate information into characters, which is compared with the allowable license plate number stored in the database in advance;

Step (4), if the vehicle license plate information matches the allowable license plate number stored in the database in advance, the vehicle information matching system based on image recognition on the cloud sends a signal to the MCU through the infrared data transmission module, and the MCU controls the parking gear lever to rise and the vehicle stops in the parking space;

Step (5), when the vehicle leaves, the photoelectric switch sensor detects that the parking space is free, the SCM controls the parking gear lever to rise, and the parking space lock is locked.

3. Parking lock structure

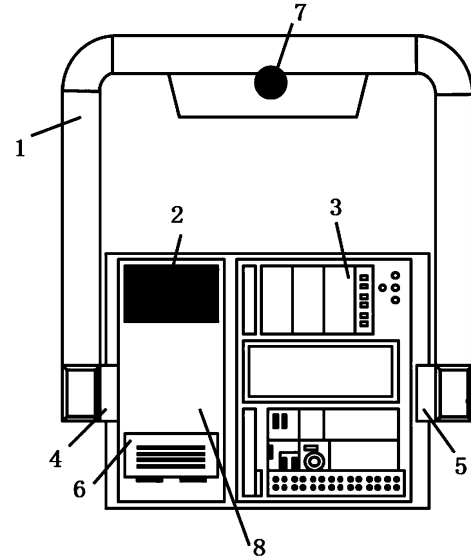


Figure 1. Structure of Parking Lock

As shown in Figure 1, the parking space lock structure is set on the parking space. The parking space lock includes a camera 6, a parking gear lever 1, a wireless data transmission module 2, a single-chip computer 3 and a photoelectric switch sensor 7. The camera 6 can scan the vehicle information in front of the parking space lock within a preset angle and store it as an image, the wireless data transmission module 2 is used to transmit the vehicle information image captured by the camera 6 to the cloud-based vehicle information matching system based on image recognition. The microcontroller 3 includes an infrared data transmission module, and the microcontroller 3 can control the lifting of the parking gear lever 1. The vehicle information matching system based on image recognition on the cloud can convert the vehicle information image transmitted by the wireless data transmission module 2 into the license plate information based on the algorithm, and give the corresponding control information to control the opening and closing of the parking space lock after matching with the database.

The photoelectric switch sensor 7 is set at the front end of the parking position lock. The parking gear lever 1 includes a left parking gear lever and a right parking gear lever distributed on both sides of the parking position lock. The left parking gear lever is lifted by the left steering gear 4, and the right parking gear lever is lifted by the right steering gear 5. The parking position lock also includes a power module 8.

In terms of the parking space and vehicle information management system on the cloud, it is gradually expanded from the partition to the block until eventually covering the entire region. Through a large number of scattered local servers, the corresponding enterprises, departments or individual users are initially responsible for their own unique parking spaces. When the distribution of the locking end of the parking space reaches a certain scale, it can be through the cloud data channel and mobile phone client, for example, WeChat or the APP unique to Cloud Lock integrates cloud locks distributed everywhere with local parking spaces and vehicle information databases, so as to establish a larger server network. The specific system architecture is shown in Figure 2. The cloud-based parking space and vehicle information management system can record and manage the parking time and departure time information of the parked

vehicles on the parking space.

4. Parking management system based on image processing technology

Vehicle information matching system based on image recognition, including parking lock and cloud. At the same time, for the parking lock end, the power supply is the power source for the normal operation of the intelligent parking lock control system, and its role is to convert various forms of electric energy into appropriate voltage and current to be transmitted to the corresponding hardware for use. The reliability of the power supply system is related to the stable operation of the entire control system. There are two common equipment power supply modes: grid power supply and battery power supply. Considering the wide installation range and scattered distribution of intelligent parking space locks, immature power supply conditions of the power grid and inconvenient construction, we choose to use rechargeable DC voltage stabilizing module for power supply. In order to make the power supply system stable and reliable, we introduce the idea of closed-loop control, regularly monitor the power supply health, notify the early warning, and let the local administrator charge or replace the power supply system structure.

5. Parking space management method

According to the above parking space management method of the parking space management system based on image processing technology, it is characterized in that it includes the following steps:

Step (1), the arrival of a vehicle is sensed through the photoelectric switch sensor 7, and the presence of the vehicle is confirmed;

Step (2), acquiring vehicle information through the camera 6 and storing it as an image, and transmitting the vehicle information image captured by the camera 6 to the cloud-based vehicle information matching system based on image recognition through the wireless data transmission module 2;

Step (3), the cloud-based vehicle information matching system based on image recognition uses image recognition technology to convert the vehicle information image into license plate information relying on algorithms, and converts the license plate information into characters, which is compared with the allowable license plate number stored in the database in advance;

Step (4), if the vehicle license plate information matches with the allowable license plate number stored in the database in advance, the vehicle information matching system based on image recognition on the cloud sends a signal to the MCU 3 through the infrared data transmission module, and the MCU 3 controls the parking gear lever 1 to rise and the vehicle stops in the parking space;

Step (5), when the vehicle leaves, the photoelectric switch sensor 7 detects that the parking space is free, the single chip computer 3 controls the parking gear lever 1 to rise, and the parking space lock is locked.

In the process of the license plate recognition system in this embodiment, license plate detection: analyze an image containing a license plate, and finally cut out a block containing only a license plate. The main purpose of this step is to reduce the amount of calculation in the process of license plate recognition. If the original image is directly used for license plate recognition, it will be very slow, so the detection

process is required. In this system, SVM (Support Vector Machine), a machine learning algorithm, is used to judge whether the intercepted map is a true "license plate".

Character recognition: the main purpose of this step is to carry out optical character recognition (OCR) from the license plate image obtained in the previous license plate detection step. The machine learning algorithm used is the multi-layer perceptron (MLP) model in the artificial neural network (ANN).

The process of the license plate detection system, through the license plate detection process, obtains many possible license plate blocks, classifies these blocks manually, gathers a certain number, and then puts them into the SVM model for training to get a judgment model of SVM. In the actual license plate process, input all possible license plate blocks into the SVM judgment model, Through the SVM model, the map blocks that are actually the license plates are automatically selected. After the license plate detection process is completed, we can get a part of the picture that we really care about -- the license plate.

Character recognition system process, in the process of character recognition, a license plate block will first be grayed and binarized, and then a series of algorithms will be used to obtain the segmentation block of each character of the license plate. After obtaining a large number of these character blocks, manually classify them, and then feed them into the MLP model of neural network (ANN) for training. In the actual license plate recognition process, seven-character blocks are put into the trained neural network model, and the specific characters represented by each block are predicted through the model. For example, "SuEUK722" is output in the picture, so a complete license plate recognition process is ended.

The above is only the preferred embodiment of the project, and is not used to limit the project. For those skilled in the art, the project can have various changes and changes. Any modification, equivalent replacement, improvement, etc. within the spirit and principles of the project shall be included in the protection scope of the project.

6. Conclusion

(1) This project uses image processing technology to identify license plates, and transmits the identification data to the terminal. Through comparing the relevant information in the database, it realizes automatic unlocking, so as to solve the problems caused by the cumbersome operation of the current parking space lock;

(2) This project records the time of vehicles entering and leaving the parking space in real time to accurately obtain the parking time of users and reduce the conflict between users and management personnel;

(3) This project has realized the convenient management of parking spaces, solved the problem of low intelligence of traditional parking lock, and has a broad application prospect in the scene of parking conflict between staff and outsiders.

References

- [1] Design and Implementation of LCD Control and Touch Screen MIPI Interface Based on MSM8X25Q [J]Jing Ling, Electronic Production, 2014 (07).
- [2] Design of face image acquisition system based on WinCE&CMOS image sensor [J]Chen Yan;Liu Pu;Wu Jingzhu;Wang Kedong;Guo Hong. Instrument Technology and Sensors, 2013 (12).

- [3] Application of improved template matching method in license plate recognition [J]Chen Wei;Cao Zhiguang;Li Jianping, Computer Engineering and Design, 2013 (05).
- [4] Discussion on China's intelligent parking lot system integration technology [J]Yang Biao, Public Safety in China, 2013 (09).
- [5] Design and Implementation of Embedded License Plate Recognition System [J]Huo Lingling;Xu Wenjun;Zhao Yunqing;Ma Xiangjie, Computer Technology and Development, 2013 (04).
- [6] Research on a license plate recognition software system [J]Chuyan;Shao Yan;Chen Liang;Ju Yongfeng, Electronic Design Engineering, 2013 (04).
- [7] An image super-resolution algorithm for license plate recognition [J]Yao Zhenjie;Yi Weidong. Journal of Graduate School of Chinese Academy of Sciences, 2013 (01).
- [8] Automatic identification algorithm of vehicle body mode [J]Gao Jianfeng;That scene is new;Wang Qiulin;Yan Yakun. Journal of Jilin University (Engineering Edition), 2012 (02).
- [9] Design of LED Chinese character display screen based on Proteus [J]Feng Huanting, China Science and Technology Information, 2011 (21).
- [10] A new adaptive license plate image location method [J]Li Bo;Zeng Zhiyuan;Zhou Jianzhong. Chinese Journal of Image and Graphics, 2009 (10).
- [11] A license plate location method based on gray scale change feature of binary image [J]Shan Jin;Zhou Juan. Journal of Chengdu Electronic and Mechanical College, 2009 (03).
- [12] Design of parking lot access control monitoring system [J]Ji Yuru;Wang Dezhong. Computer Knowledge and Technology, 2009 (09).
- [13] Research and Implementation of License Plate Character Recognition Technology [J]Sun Yanzeng;Zhang Qianjin. Microelectronics and Computer, 2008 (06).
- [14] Current situation and development trend of machine vision [J]Zhang Wuyi;Zhao Qiangsong;Wang Dongyun. Journal of Zhongyuan University of Technology, 2008 (01).
- [15] Research on edge detection technology in machine vision [J]Yao Fenglin, Zhan Haiying, Li Yuanzong. Mechanical Engineering and Automation, 2005 (01).
- [16] A fast license plate recognition method based on template matching and feature point matching [J]Xing Xianghua, Gu Guohua. Optoelectronics Technology, 2003 (04).
- [17] Image acquisition technology in machine vision [J]Liu Huanjun, Wang Yaonan, Duan Feng. Computer and Information Technology, 2003 (01).
- [18] Overview of machine vision technology and its application [J]Duan Feng, Wang Yaonan, Lei Xiaofeng, Wu Lizhao, Tan Wen. Automation Expo, 2002 (03).