Dynamic License Plate Recognition System Based on Virtual Instrument

Yang Xu [1, a], Zhen Wang[2, b]

[1]School of Automation, Chongqing University of Posts and Telecommunications, Chongqing 400065, China;

[2]School of Automation, Chongqing University of Posts and Telecommunications, Chongqing 400065, China;

[a]xuyang@cqupt.edu.cn, [b]419782218@qq.com

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Abstract. This paper describes a dynamic license plate recognition system based on virtual instrument. In the process of stopping the vehicle, triggering a geomagnetic sensor, The host computer (PC) receive signal to control the intelligent ball machine acquisition vehicle image. Then the license plate is located by the method of combining color feature and edge feature. Secondly, Radon transform correction, character segmentation by vertical projection method. Finally, we propose a character recognition method based on vector machines. This system is simple, the algorithm is simple, a good user interface, and so on. The results showed that when the vehicle image capture, Radon transform better correction. During character recognition, select the appropriate penalty factor and gamma values, the recognition rate of over 90%.

Introduction

License plate recognition is an important part of the automatic vehicle identification technology, the technology in the intelligent traffic management has been widely used. However, due to vehicle license quality, cleanliness and the reasons for the external environment lights, bumpers, exhaust at the license plate recognition and other such difficulty increase. Thus, researchers at home and abroad to spend a lot of time researching the license plate recognition and have achieved certain results.

This paper presents a method of dynamic identify the license plates, the main advantage is in the level of the vehicle without stopping to take pictures directly in the process of stopping the camera to capture. Save time, reduce floor space, while achieving intelligent management. Secondly, in the character recognition and training in LabVIEW fully realized without calling MATLAB script node, it saves the running time of the program.

Design of system

When the sensor detects the vehicle, a signal is sent to the host computer, the PC receives the signal to control the camera and capture images. the host computer processed to identify the license plate number.

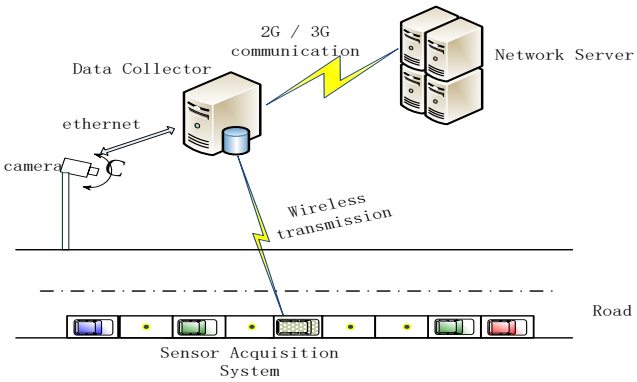

Fig.1 The overall architecture of the system

Data Acquisition Software Design

First call HCNetSDK.dll official document provided NET_DVR_PTZ Preset function to each parking spaces are set to preset point 1,2,3 .... When the host computer receives the signal of the vehicle, to the corresponding preset point snapped image. Its implementation process shown in Figure 2.

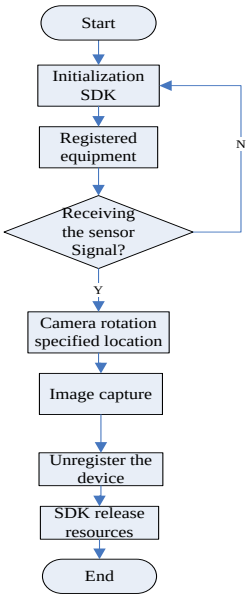

Fig.2 Data acquisition program flow chart

License Plate Recognition Software Design.

PC through the color threshold Roberts operator edge detection, morphological opening and closing operation after detection of the image rectangle to find the location where the license plate. Since the license plate aspect ratio is constant, it is possible to remove the false license plates. When license plate is not found, the original image is converted to grayscale images, through the license plate texture features to find the upper and lower boundaries of the license plate to locate the license plate. Since in the capture process, some distortion of the plate, so that needs to be corrected, this paper license plate corrected by Radon transform. Figure 3 is a flow chart of the license plate recognition.

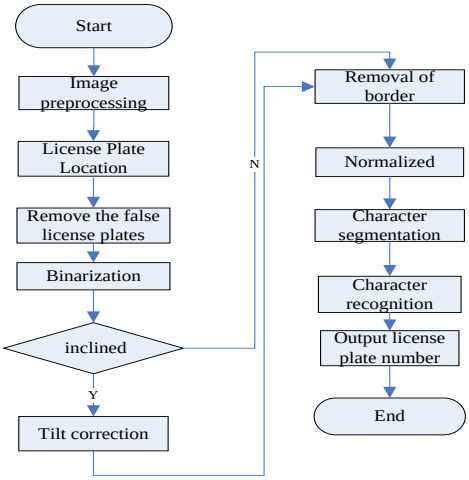

Fig.3 License Plate Recognition flow chart

License Plate Location Algorithm Analysis and Implementation. China has four kinds of license plates. In this paper, the method of combining color feature and edge feature is proposed to locate the license plate. Implementation process shown in Figure 4.

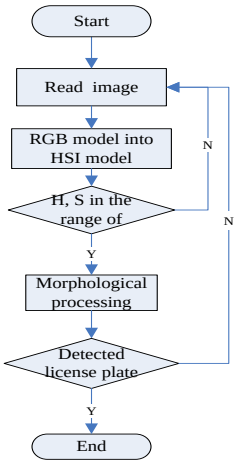

Fig.4 License Plate Location flow chart

Correction and license plate character segmentation implementation. The camera capture images will have a certain inclination. Figure 5 is a horizontal tilt of the plate. Figure 6 is a vertical tilt of the plate. In this paper, Radon transform is used to correct.

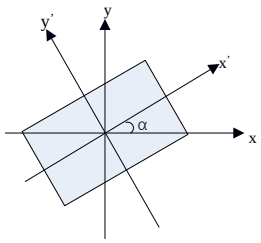

Fig.5 Horizontal tilt

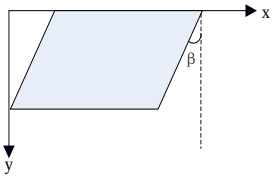

Fig.6 Vertical tilt

The essence of the Radon transform is the projection of the image in different directions. In mathematics, the sum is expressed in different directions. An N-dimensional mapping function $f\left(x_1, x_2, x_3, x_4, x_5, x_6 \cdots x_N\right)$ on the N-1-dimensional space is called a projection function on the N-1 space. Equation 1 for the Radon transform.

$$R_\theta\left(x\right) = \int_{-\infty}^{+\infty} f\left(x\cos\theta - y\sin\theta, x\cos\theta + y\sin\theta\right)dy \qquad (1)$$

The formula meets nature $R_{\theta+180^\circ}\left(-x\right) = R_\theta\left(x\right)$, Equation 1 shows the image of a point along θ Radon transform.

In this paper, the gray image is converted into an array and then the level correction. Set the horizontal rotation range of -30° To 30°. In this range, once every rotation, a horizontal projection. The number of pixels is 0, the maximum number of columns from the angle of tilt angle. Finally use the imrotate function to rotate. The principle of vertical and horizontal correction is the same. In this paper, the implementation of LabVIEW call MATLAB script node.

2. Character segmentation

Character segmentation first vertical projection of the license plate, and then according to the provisions of the state of the character of the license plate character and spacing of the character segmentation.

$$f_x\left(y\right) = \sum_{x=1}^{W} f(x, y) \qquad (2)$$

Equation 2 is the mathematical expression of vertical projection, the image size is H * W, H is the height of the image, W is the width of the image, $f\left(x, y\right)$ is gray value at any point. Figure.7 is a vertical projection waveform segmentation and character.

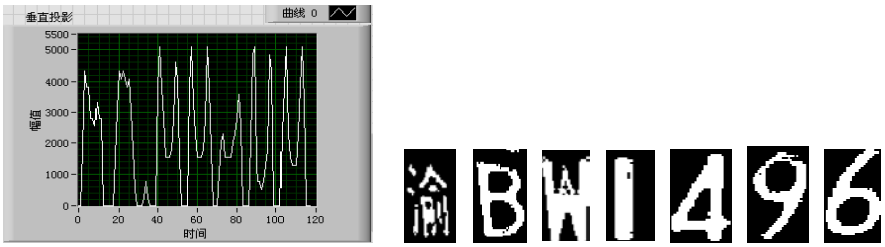

Fig.7 Vertical projector split character

Character recognition. This paper uses the SVM method to identify characters. LIBSVM provides ten different languages C, Java, MATLAB, LabVIEW and so on. By providing training and recognition functions. SVM-predict generally LabVIEW calls MATLAB to achieve, but this article is directly implemented by LabVIEW. So that the program more concise, higher operating efficiency. By calling subroutine shown in Figure 8 can train models, predictive models and cross-validation functions.

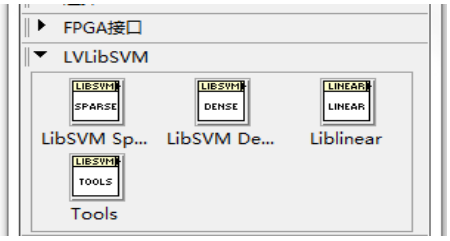

Fig.8 Identification Block Diagram

System Test Results

This is the experiment of image data from the image on-street parking car. According to "People's Republic of China motor vehicle license plate" (GA36-2014 standard), the license plate when there are 24 English letters (excluding I and O), 34 samples of Chinese characters, there are 10 digital samples. This article will be divided into three categories, the Chinese character library the letter and numbers library, the letters library.

Each class has 16 samples, a total of 544 samples, 200 samples of the test sample. Selection of different parameters in the vector machine identification effect will be different, as shown in Table 1 for the identification of the comparison. The error of the recognition is mainly the similarity of characters, such as D and 0. In order to solve these problems can only be a lot of training data and provide identification algorithm, which is the main direction of the next step of work.

Table 1 Comparison of different parameters recognition rate.

C	g	recognition rate
2^0	0.083	89%
2^1	0.001	92.5%
2^2	0.001	90.6%

Summary

This paper presents a license plate recognition system based on virtual instrument and LIBSVM. Mainly focus on the license plate positioning and correction. The experimental results show that the method is feasible and has good recognition ability for the license plate. Suitable for roadside parking and other places. The parameters of the training can be configured for small samples of the training has a good result, so that the accuracy of the recognition rate greatly improved.

Acknowledgments

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