DESIGN AND PROTOTYPE IMPLEMENTATION OF AUTOMATIC PARKING SYSTEM

Henni Endah Wahanani[1], Yisti Vita Via[2] , I Made Suartana[3]
Informatics Department, Faculty of Industrial Technology, UPN "Veteran" Jawa Timur, Surabaya
henni_endah@yahoo.com[1], yistivita@gmail.com[2], made.suartana84@gmail.com[3]

Abstract

Parking system became a necessity for public places especially in big cities. For reasons of efficiency of human resources, the automatic parking system was developed. Automatic parking system is a parking system without any human intervention as a system operator. To create a fully automated system, requires a mechanism automatically recording the vehicle's identity and security mechanisms to prevent acts of theft. Vehicle plate number recognition is a method of image processing to recognize license plate number and vehicle color recognition as an additional method, to provide an additional vehicle identity. The use of two recognition methods to make the system work automatically. To add security features to the system multifactor authentication is applied. This paper presents a study, design and prototyping of automatic car park system. Where plate number recognition and color recognition are adopted to make full automatic system. The use of technologies such as RFID and microcontroller is needed in the future to implement real systems that is completely automated. The design of this system is expected to provide the efficiency of human resources.

Keywords: automatic parking system, prototype, recognition, plate number

1   INTRODUCTION

Parking lot facilities is an absolute necessity for public places such as hotels, office buildings, shopping malls and others. Nowadays many parking lot facilities in public places has been using information technology. Automatic parking system is quite popular and widely developed, automation parking system here aims to reduce the human resources involved in the operation of the system and the future will provide enormous efficiency. Automation systems by use of information technology would not only provide efficiencies, but it also lead to new problems. The new problem of how to make the system completely automated without any human intervention as an operator by considering the security of the system.

Automatic parking system which has been developed as well as in a research disciplines such as: the use of development of automatic vehicle number plate detection system using image processing technique [1], [2] and [3]. The development of automated parking systems using vehicle number plate recognition, generally lack pay attention to security issues in recording vehicle information. Another studies of automatic parking system is by integrate the system by the use of a microcontroller [4]. In addition,the development of

an automatic parking system is also much to discuss parking positioning as research[5].

In this research the development of an automatic parking system focuses on the automation of vehicle data recording ,using license number plate recognition, with an additional security aspect. The system is developed by using license plate number recognition technology and color recognition technology, as a vehicle data recording mechanism. So the operator does not need for process entrance and exit vehicle into the parking area. To complete the security mechanisms in this study implement multifactor authentication (what do you know, what do you have and what do you are). Encryption mechanism is also added to prevent data forgery.

2   LITERATURE SURVEY

2.1 Number Plate Recognition

Number plate recognition is a method that uses optical character recognition on images to read vehicle registration plates. Most of the number plate detection algorithms fall in more than one category based on different techniques. To detect vehicle number plate following factors should be considered:
a.   Plate size: a plate can be of different size in a vehicle image.

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b. Plate location: a plate can be located anywhere in the vehicle.
c. Plate background: A plate can have different background colors based on vehicle type. For example a government vehicle number plate might have different background than other public vehicles.
d. Screw: A plate may have screw and that could be considered as a character.[7]

Actually, number plate recognition system consists from four separate stages of the process. First of all, capturing image, in the second stage the processing of the input image and roughly locates the potential number plate regions. Further, in the third stage, character plate number and the number is extracted, especially from the state of a complex with a variety of noise sources. Finally, plate number and character are segmented and recognition is carried out, as shown in Figure 1.
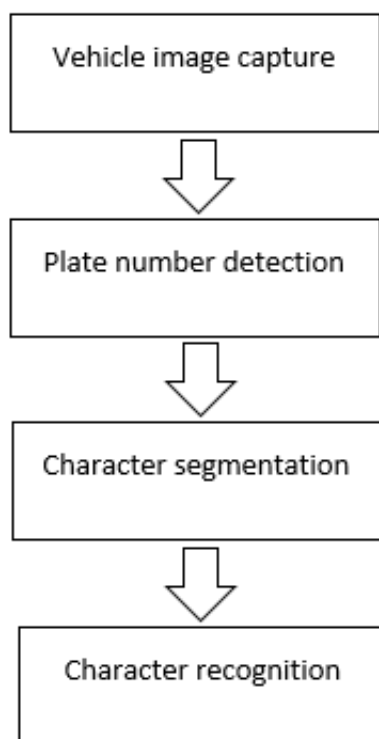

Figure 1 method number plate recognition

Segmentation is one of the most important processes in the automatic number plate recognition, because the next process of the algorithm depends on it. If the segmentation process fails, the character can be divided into two parts, or two character scan merge together. We can use the horizontal projection for the number plate segmentation, or one of the more sophisticated methods, such as segmentation using neural networks. Figure 2 shown illustration character segmentation.

To recognize the character we have to perform feature extraction which is a basic concept to recognize the characters. Feature extraction is the process of transforming data from the bitmap representation in the form of description, which is more suitable for computer. Character recognition should be invariant to the type of font users, or deformation caused by askew. In addition, all instances of the same character must have the same description. The explanation is a vector of character values of numbers, called a description or pattern [6].

Figure 2 Illustration character segmentation[8]

2.2 color Recognition

Color color is one of the implementation of digital image processing. Color recognition aims to identify the colors in the image. A color recognition methods including methods of learning. To recognize the RGB color components (red green blue).Color image is analyzed from RGB color space point of view. Each pixel in the image consists of three color channels known as RGB components. The range of values of each of this components lies within 0 to 255.

3 METHODOLOGY

The purpose of this study was to develop a prototype system to record the identity of vehicles entering and exiting the parking area automatically, which is equipped by security mechanism. Automation system developed using the mechanism of the vehicle number plate recognition and vehicle color recognition as a substitute for manually recording process when the vehicle entered the parking area, and the same mechanism is used to identify vehicle when exit the parking area. The system is also equipped by security mechanism to prevent unwanted actions such as theft and data forgery. User authentication and encryption is the mechanism used for security.

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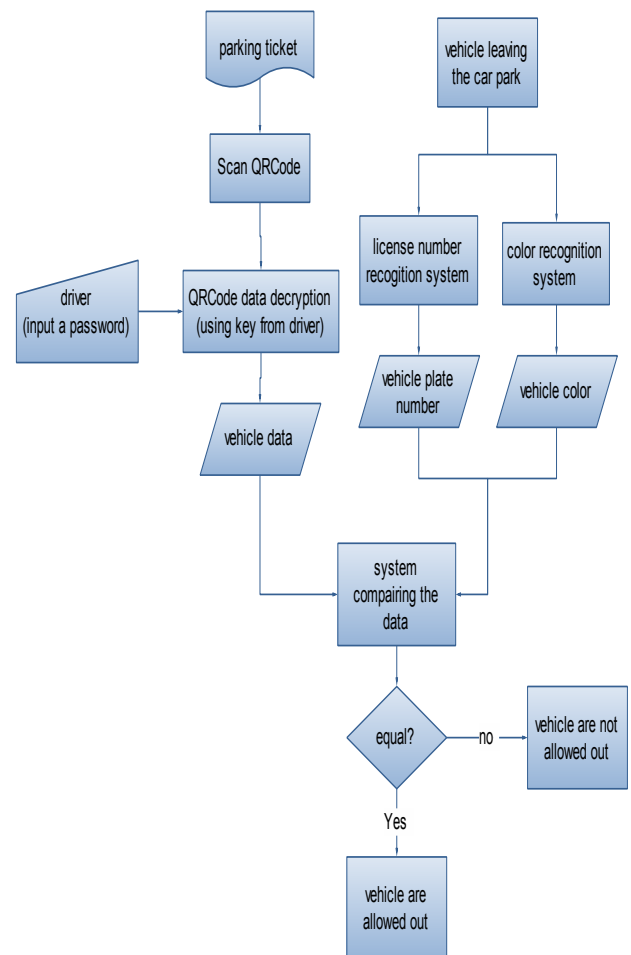
3.1 Design sistem

Following are the steps involved:

- Vehicle entering the car park
- Vehicle leaving the car park
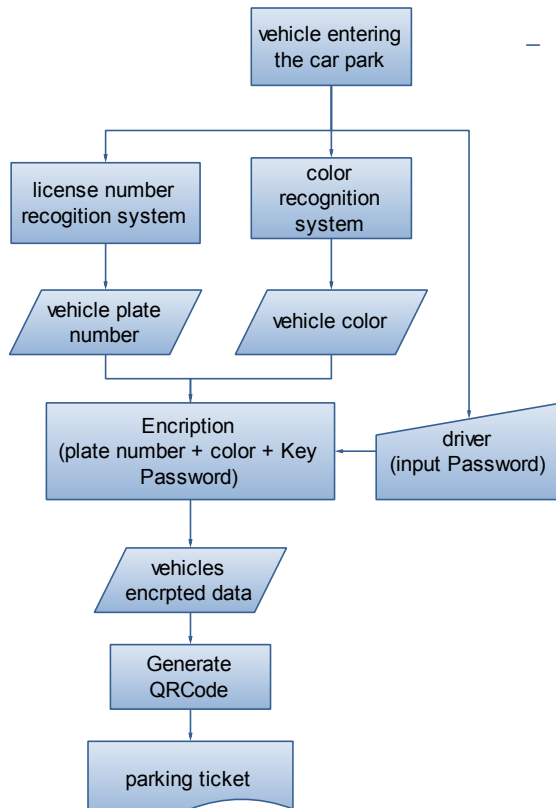
Figure 3 Vehicle entering the car park

Figure 4 vehicles exit from car park

The vehicle parking entrance flow in this work is shown in the Figure 3. The system starts from the vehicles entering the parking area, the system will perform license plate recognition and vehicle color recognition. The results of the recognition process is used as vehicles identity data. For data safety, the data will been crypted. Vehicle identity data that has been encrypted will be printed as a parking ticket that use QR Code.

The vehicle parking exit flow in this work is shown in the Figure 4. The system starts from the vehicle will leave the parking area. Users scan the QR code and the system will read the vehicle data from QR Code. Data from QR Code compared with the vehicle identification data using the same mechanisms as the parking entrance. Vehicles will be allowed to leave the parking area if the vehicle identification data are equal to the data in QR Code

3.2 Vehicle data collection

Function of this module is to get the vehicle data: license plate numbers and colors automatically. This data will be used for the parking entrance and exit. This study used two methods of data collection for a vehicle. First: vehicle license plate recognition method for record the number plate of the vehicle with the input image from camera capture in real-time. Second: methods color recognition for recording vehicles color with image input from camera capture in real-time.

4   RESULTS AND DISCUSSIONS

The proposed system is developed using C# and EmguCV [5]. LibraryEmgu CV is a cross platform .Net wrapper to the OpenCV image processing library. Allowing OpenCV functions to be called from .NET compatible languages such as C#, VB, VC++, IronPython etc. The wrapper can

be compiled in Mono and run on Windows, Linux, Mac OS X, iPhone, iPad and Android devices.

Results from prototype implementation of automated parking systems shown in the Figure 5 and Figure 6.

Figure 5 Sistem for entering park lot

Figure 6 Sistem for exiting park lot

From Figure 5, it can be seen the system for recording the vehicle when entering the parking area the system will detect the number of vehicles and vehicle color. The results of the identification of the vehicle in the form of a QR Code as a parking ticket.

From Figure 7, when the vehicle left the parking area, identification conducted to comparing the data on the parking ticket to the vehicle's identity is recorded in real-time

Data recorded on the vehicle entered the parking area printed on parking ticket using the QR code, in order to make the process faster data readout. Illustration of the QR Code as a parking ticket it can be seen in Figure

Figure 7 Prototype parking ticket

5 CONCLUSIONS

In this paper, design and prototype automatic parking system based plate number recognition, color recognition and symmetricencryption algorithm for security has been presented. The design and prototype system proposed to recognize vehicle information automatically and use that information as the vehicle identity entrance and exit to the parking area. This system also provide friendly Graphical User Interface (GUI).

As future improvement, optimization of the method those used in automatic parking system, the goal from optimization method is to find the optimal method in order to obtain optimal results from license plate recognition and vehicle color recognition.

6 REFERENCES

[1] Sulaiman et al. "Development of Automatic Vehicle Plate Detection System". IEEE, Malaysia, 2013 IEEE 3rd International Conference on System Engineering and Technology:130-135, 2013, 978-1-4799-1030-4

[2] Sirithinaphong et al. "The Recognition of Car License Plate For Automatic Parking System". Australia, Fifth International Symposium on Signal Processing and its Applications, 1999

[3] Tian et al. "Research of Automatic Parking System Based on License Plate Recognition". China, Nort China University of technology Beijing

[4] Yen Lee et al. "Microcontroller Based Automatic Parking System". IEEE, Taiwan, Proceedings of the 2012 International Conference on Machine Learning and Cybernetics:875-879, 2012, 978-1-4673-1487-9
<http://www.emgu.com/wiki/index.php/Main_Page>accessed on 2August 2014

[5] Kranthi et al. "Automatic Number Plate Recognition". IJoAT, India, International Journal of Advancements in Technology, 2011, ISSN 0976-4860

[6] Chirag Patel et al. "Automatic Number Plate Recognition System (ANPR): A Survey". International Journal of Computer Applications (0975 – 8887), 2013

<http://en.wikipedia.org/wiki/Automatic_number_plate_recognition>accessed on 2August 2014