PLATE RECOGNITION FOR MALAYSIAN VEHICLES USING STROKE ANALYSIS TECHNIQUE

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To my beloved wife, mother and father

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ABSTRACT

The Road Transport Department of Malaysia has endorsed a specification for vehicle plates that includes the font and size of characters that must be followed by car owners. However, there are a special plate number where this specification is not followed such as *Proton*, *BAMbee*, *Putrajaya*, *Tiara*, *Satria* and *Perodua*. This will cause problems in the recognition phase because existing systems will find difficulty in recognizing these plates. Therefore, this project is aimed of an implementing a recognition system that is capable of solving the mentioned issues using stroke analysis technique. The system is an offline system where the vehicle image is loaded manually from a directory. The loaded image is then pre-processed using image processing techniques. Consequently, the image is converted into a binary image. The plate region is extracted prior to characters extraction. All the characters then undergo thinning process before stroke analysis performs tracing and recognition of the characters. The system displays the output in readable text. The performance analysis has shown that the system is able to recognize Malaysian vehicle plate with more than 95 percent accuracy.

ABSTRAK

Jabatan Pengangkutan Jalan Malaysia telah mengeluarkan spesifikasi terhadap plat kenderaan termasuk bentuk dan saiz huruf yang mesti dipatuhi oleh pemilik kenderaan. Walaubagaimanapun, terdapat nombor plat yang istimewa yang mana spesifikasi ini tidak dipatuhi seperti *Proton*, *BAMbee*, *Putrajaya*, *Tiara*, *Satria* dan *Perodua*. Ini akan memberi masalah di dalam fasa pengecaman kerana sistem sedia ada akan menjadi susah untuk mengecam plat ini. Oleh itu, projek ini bertujuan menghasil satu sistem pengecaman yang mampu menyelesaikan isu-isu pengecaman yang telah disebut menggunakan teknik yang dipanggil analisa strok. Sistem ini adalah sistem tidak aktif dimana gambar kenderaan dimuat secara manual daripada sebuah direktori. Gambar yang telah dimuat ini kemudian diproses mengunakan teknik pemprosesan gambar. Akibatnya, gambar ini ditukar bentuk kedalam sebuah gambar binari. Bahagian plate ini diekstrak dahulu sebelum mengekstrak hurufnya. Semua huruf ini kemudian akan melalui proses pengurusan sebelum analisa strok melakukan penjejakan dan pengecaman daripada huruf ini. Sistem ini memaparkan keluaran dalam bentuk teks yang boleh dibaca. Analisa keupayaan telah menunjukkan bahawa system ini mampu mengecam plat kenderaan Malaysia dengan ketepatan melebihi 95 peratus.

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B	-	blue
$\hat{B}$	-	reflection of set B
$(\hat{B})_z$	-	translation of set $\hat{B}$ by point $z = (z_1, z_2)$
D	-	dimension
G	-	green
L	-	2^{bit}
R	-	red
z	-	displacement
$\emptyset$	-	empty set
$\cap$	-	intersaction
$\neq$	-	not equal to
$\subseteq$	-	subset

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CHAPTER 1

INTRODUCTION

Every vehicle has its own plate number that is unique. That uniqueness allows people to perform vehicle tracking. Hence, plate number recognition comes into the picture as a new area to be explored and has become popular since then. Plate recognition system consist of complex image processing technique perform to recognize characters printed on a vehicle plate. One of the vehicle plate recognition systems available worldwide is a system called License Plat Recognition (LPR). Other available systems are as Recognition of Vehicle Plate Number (RVPN), Automatic Number Plate Recognition (ANPR), Automatic License Plate Recognition (ALPR), Automatic Vehicle Identification (AVI), and Car Plate Recognition (CPR). Different researchers tend to give a different name for this type of system even though they have the same objective namely to recognize the plate number.

In this project, the recognition system is called a Real-Time Special Plate Recognition (R-TSPR) that is obviously in line with the special plate number of Malaysian vehicles which are not all following the specifications provided by the Road Transport Department of Malaysia. These special plate numbers only apply to Malaysian cars. They have many styles of “fonts” and “fancy” characters. Due to the non-compliant to standard, the standard techniques for plate recognition no longer work.

1.1 Applications

Most people think that LPR system is mainly used for law enforcement. This is no longer true since the LPR covers a quite wide range of applications due to the progress made automatic character recognition. These applications can be divided into two categories: local authorities and non-authorities applications. For local authorities, license plate recognition is required for the purpose of enforcement, border protection, vehicle thefts, automatic toll collection, speed trap, red light violation and perhaps traffic control and monitoring [1, 3, 5, 8]. For non-authorities, LPR system can also be applied for vehicle access control to restricted places [3, 8], parking control and probably for surveillance [8]. Some of the applications are discussed below.

Border protection and access control applications normally have databases that store all of the registered vehicles. Any vehicle that is not in the database record will not be granted access. For the application of vehicles theft and red light traffic violation, the system works differently. In this case the plate number recognition system is installed at a point around a suspected traffic light. Whenever a vehicle violates the red light, the system immediately captures the vehicle's image and then automatically issue electronic summon to the vehicle owner. If the vehicle's image captured is registered as a stolen vehicle, it will directly trigger the police to take action by giving all the required info.

Other important applications are the automatic toll collection and parking control systems. Both systems use the same concept. The only different is that for toll collection, it will calculate the fees based on distance travelled, whereas for parking control it will calculate the charge based on how much time the vehicle stays in the parking lot. The entrance gate will use the LPR system to record the vehicle plate number and the exit gate will use the LPR to calculate parking charge based on time duration for the recorded plate number. Automatic toll collection works slightly different from the existing Smart Tag system.

1.2 Problem statement

All the applications stated in the previous section has been implemented successfully in many developed country and Malaysia being one of the developing countries has also taken the step in implementing this plates recognition system. Nevertheless the existing LPR system fails to detect a certain Malaysian plate numbers which do not follow specifications provided by the Road Transport Department of Malaysia. These specifications include all the font and size of characters that must be followed by car owners. However, there are special plate numbers where these specifications are not met as well such as *Proton*, *BAMbee*, *Putrajaya*, *Tiara*, *Satria*, and *Perodua*. The existing recognition system are not adapted and trained for these plates and thus fail to recognize such plates.

1.3 Objective

The main objective of this project is to develop a recognition engine that will be able to recognize especially the special Malaysia plates based on the stroke analysis. In order to achieve the main objective, there are several sub objectives need to be accomplished. These sub objectives are to remove all unwanted objects on the car received image, to detect the plate number location, to extract every single character from the located plate, to study the characteristics or properties of the special plate number and to design an algorithm for the stroke analysis for character recognition.

1.4 Scope

Originally, the developed technique is meant only for Malaysia car plate. However, the system works equally well for Latin character based. In term of implementation, the recognition system takes offline image (still image from a directory, i.e. sample images) as the input. The sample images are likely to have minimum noise in which it is assumed that the images were captured using high quality image. In addition, the samples were captured right in front of the vehicle (perpendicular to the camera view with +/- 20^{o} offset). Even though the images captured are in color, the processing will be done on the gray scale and binarized images. The feature extraction for extracting plate character will be based on stroke analysis. Last but not least, MATLAB software has been used for the implementation of the entire system.

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