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Car Plate Recognition based on UMACE Filter

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Abstract— **In this work, the Automatic Parking and Retrieval System (APRS) is proposed to overcome the parking space problem. This system will save space, time, environment and security. The main part that involves in this system is car plate identification and recognition. The plate recognition is used as an identity number to park the car into the available parking space or slot. Therefore in this paper, car plate recognition based on Unconstrained Minimum Average Correlation Energy (UMACE) filter is discussed. Peak to Side lobe Ratio (PSR) is used as a performance measure via the sharpness of the correlation peak. The implementation involved only two stages, as compared to conventional method that consisted of segmentation stage of character. Over hundred images are used as database to evaluate the method and results showed that the proposed method is able to classify car plate with good accuracy.**

Keywords- APSR; detection; UMACE; PSR; recognition

I. INTRODUCTION

Urban city in Malaysia, as Kuala Lumpur, George Town and Johor Bahru are facing a common problem in parking spaces. The problems also arise at private buildings, hospitals and universities. To overcome the problem an intelligent parking system is proposed. The design of the system is mostly like assembling an automatic storage and retrieval system (ASRS) or specifically named as Automatic Parking and Retrieval System (APRS). Therefore, APRS is the solution for parking large amount of cars in extremely limited space. Process of parking and retrieving of cars can be implemented automatically. This system enables parking of cars, floor after floor and thus reducing the space used. One of the most important and reliable features that can be utilized for implementation of APRS are the license plate recognition as depicted in Figure 1.

This research focused on license plate recognition which comprised of detection and recognition stage.

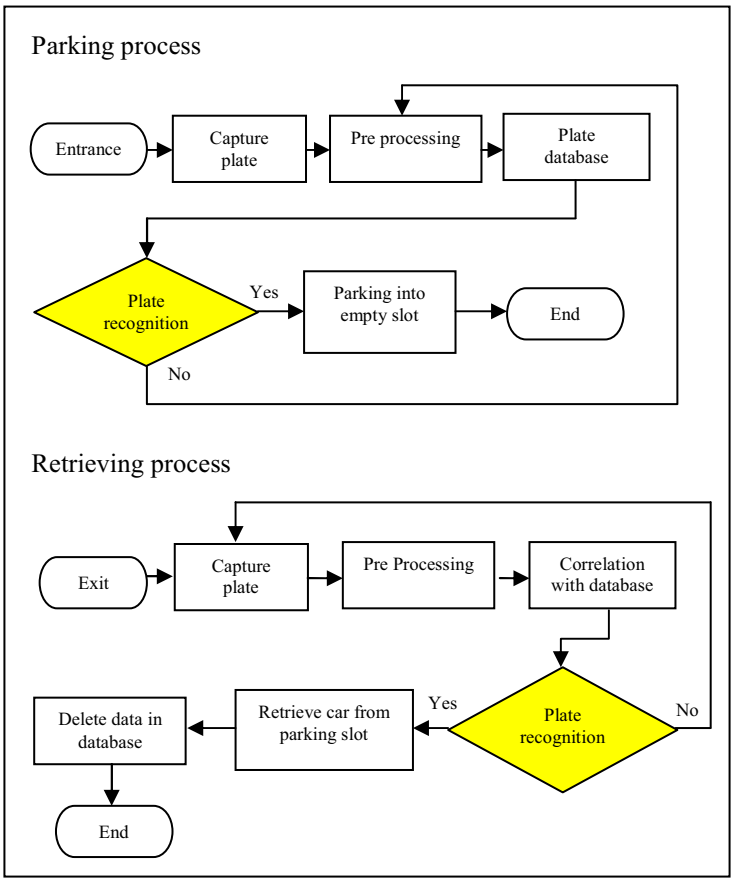

Figure 1: General Overview of propose APRS

II. LITERATURE REVIEW

Recently, there are various methods and techniques of car plate recognition that have been studied and performed by other researchers. Most of the worked done comprised of three stages namely car plate detection followed by segmentation and character recognition as shown in Figure 2.

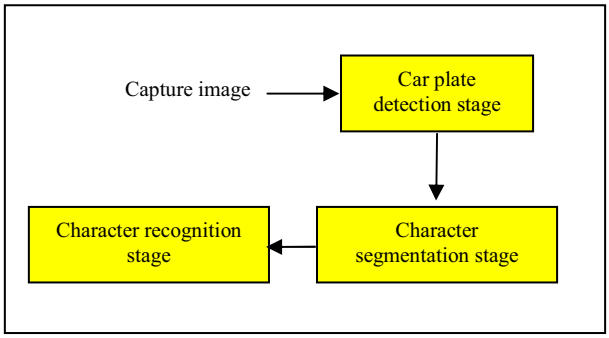

Figure 2: Three stages of car plate recognition

Deb K et.al used a sliding concentric windows (SCWs) method for detecting candidate region [3]. This method transformed the Red, Green, and Blue (RGB) image into Hue, Saturation, and Intensity (HSI) model. The hue was used to verify green and yellow license plate while to verify a white license plate the intensity was applied. Further, Kasaie and Monadjemi, performed the morphological method and attained good accuracy rate [4]. This technique focused on the plate rectangular shape with respect to rectangular structural element. Other than shape, aspect ratio and size of the plate are tested for all regions, also to reduce the noise.

The Support Vector Machine (SVM) method proven robustness and high accuracy to recognize the character reported in [1]. SVM applied on the strength of high accuracy to locate the position of license plate, and use the shape contexts which can resist the skew and deformed situations to recognize characters. Other than that, the combination of Adaboost and SVM classifier also reported in [8]. The following stage after license plate detection is plate segmentation. In this stage the license plate is filtered for enhanced the image and removed the noise. The dilation operation is applied to separate the close characters. Then the horizontal and vertical projections are applied for finding the character region as done by work in [5] [6] & [7]. Finally, the character recognition is in the last stage of the license plate recognition. Template matching [4] [5] [7] is an effective algorithm for recognition of characters. However, the input images must be equal-sized with the database characters for best similarity is measured to be achieved.

However, the application of UMACE and MACE filter in plate recognition has not been explored widely by the researcher. Unconstrained MACE (UMACE) filter is a variant of the original MACE filter. UMACE will maximize the average correlation values at the origin without constraining the image.

The equation for UMACE is:

$$h = D^{-1}m$$

Where D is the average power spectrum and m is the Fourier transform of the average training image.

III. METHODOLOGY

In this section, the method utilized in this research will be elaborated. Firstly, the image is captured by a digital camera and 2D image will go through the process as shown in Figure 3.

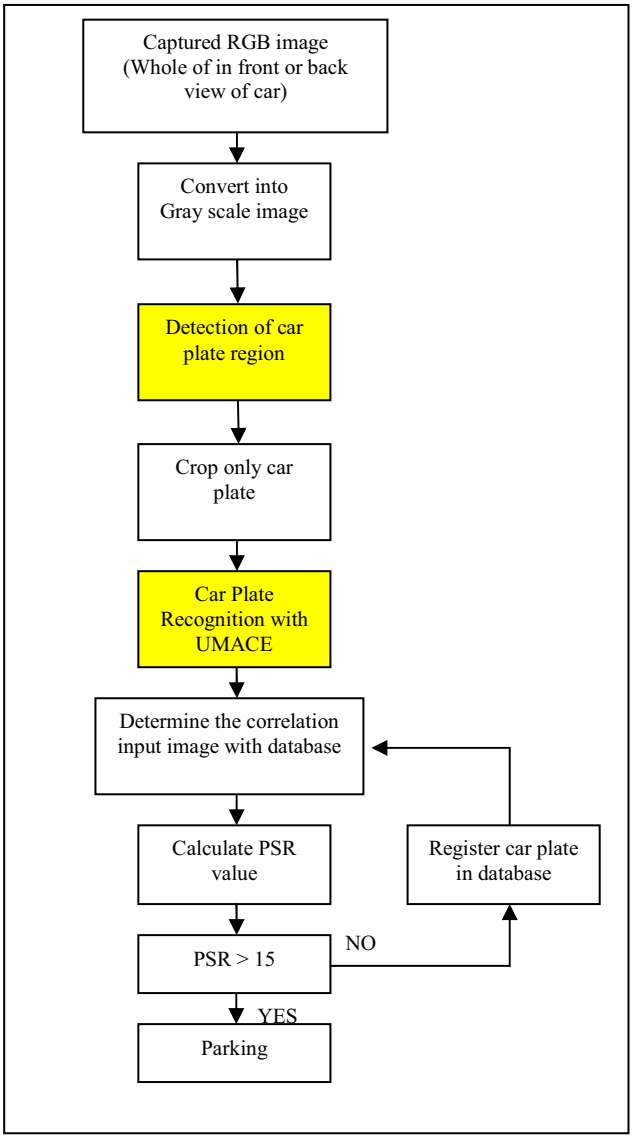

Figure 3: Overall flow Chart of Methodology

Algorithms are developed for the two stages highlighted in the overall flow of car plate recognition system. At the pre processing stage, the image taken from a digital camera in RGB is converted to grey scale for license plate with white background and black characters whilst license plate with black background and white characters will be inverted. For the initial stage, several licence plate images

with different properties namely various locations, illumination, distance, angles and view are used to evaluate the developed algorithms for detection and recognition of car plate.

As mention, 108 images are used as database in this study. Firstly, 27 true class images are divided into three categories. First category, consisted of 9 image with various illumination, followed by second category are another 9 images added with Gaussian noise and finally the third category are added with Gaussian blur as depicted in Figure 4. These images are synthesized to evaluate the performance of the UMACE filter for recognition based on the PSR value.

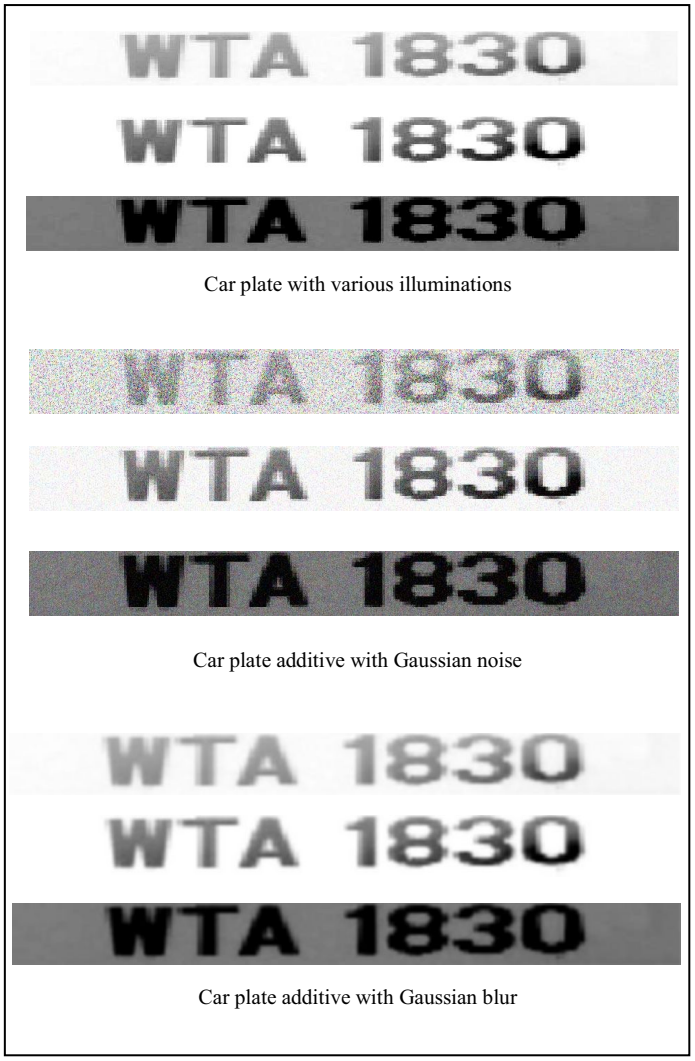

Figure 4: Car plate with various illuminations, noise and blur images.

IV. EXPERIMENTAL AND RESULTS

In this section, the capability of UMACE as car plate recognition is discussed. As explained, the car plate that is registered in the database must indicate PSR value of more than 15. Next, in Figure 5, the correlation output that exhibited a sharp peak is shown to indicate that the car plate is registered and is allowed to park. On the other hand, in Figure 6, the correlation output in response to car plate that is not registered in database is illustrated. The output has no discernible peak and PSR value only -1.344.

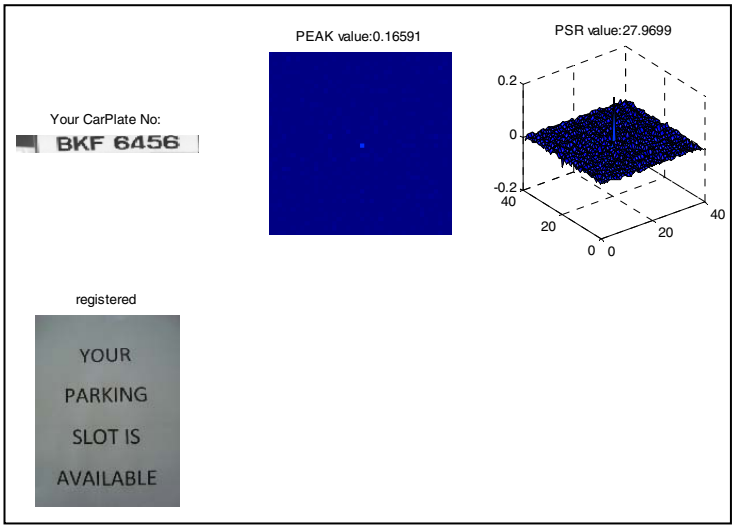

Figure 5: Correlation output for authentic input.

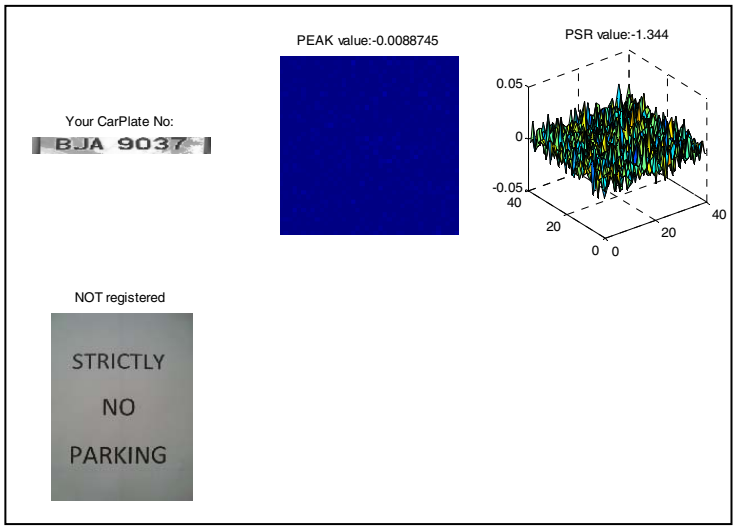

Figure 6: Correlation output for impostor input.

Further, the PSR performance is evaluated based on 27 images categorized as true plate class as defined earlier. From these 27 images, 3 images (1, 4 and 8) are selected as training images. As shown in Figure 7, 2 of the training images for the true plate class produced the highest PSR value. Although PSR value for non training images are lower, the PSR values are higher than any false plate PSR values.

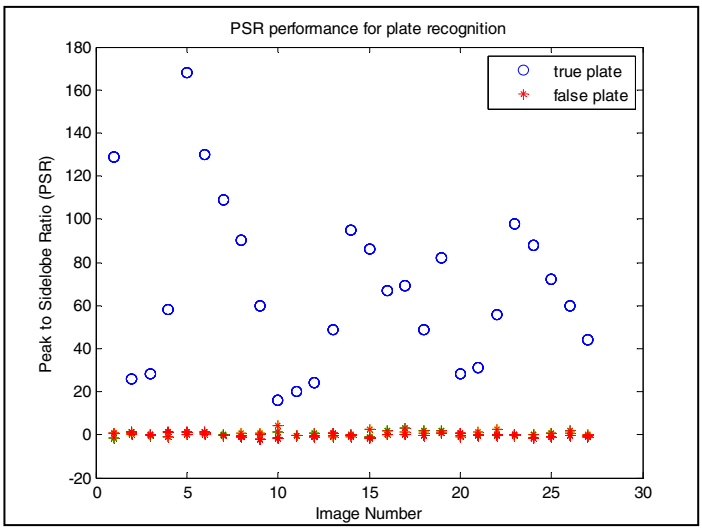

Figure 7: PSR performance for plate recognition.

V. CONCLUSION

As a conclusion, the initial result of the license plate recognition based on the proposed method using UMACE is validated. Results attained proven that the license plate detection is succeeded based on various images with different effect of condition used as the database. It is also observed that for the detection stage, the results obtained will affect the recognition stage since imperfect detection will cause unsuccessfully recognition of the plate. More images of car plate need to be added as database to confirm that the proposed method can be employed in the Automatic Parking and Retrieval System (APRS).

REFERENCES

[1] I-Chen Tsai, Jui-Chen Wu, Jun-Wei Hsieh,and Yung-Sheng Chen, "Recognition of Vehicle license Plates from a Video Sequence, "*IAENG International Journal of Computer Science*,36:1, IJCS_36_1_04,Advance online publication:17 Feb 2009.

[2] Deepak Malani, Anant Malewar, "Introduction to Video analysis using MATLAB," www.nex-robotics.com.

[3] Kaushik Deb, Hyun-Uk chae and Kang-Hyun Jo,"Vehicle License Plate Detection Method Based on Sliding Concentric Windows and Histogram, "*Journal of Computers,Vol. 4, No.8, August 2009.*

[4] S.H. Mohades Kasaei, S.M. Mohades Kasaei and S.A. Monadjemi, "A Novel Morphological Method for Detection and Recognition of Vehicle License Plate," *American Journal of Applied Science* 6 (12):2066-2070, 2009, ISSN 1546-9239.

[5] Serkan Ozbay and Ergun Ercelebi, "Automatic Vehicle Identification by Plate Recognition," *World Academy of Science, Engineering and Technology* 9 2005.

[6] Ossalan Osiris Vergara Villegas, Daniel Gonzalez Balderrama, Humberto de Jesus Ochoa Dominguez and Vianey Guadalupe Cruz Sanchez, "License Plate Recognition Using a Novel Fuzzy Multilayer Neural Network," *International Journal of Computers,* Issue 1, Volume 3,2009.

[7] Choudhury A. Rahman, Wael Badawy and Ahmad Radmanesh, "A Real Time Vehicle's License Plate Recognition System," *Proceedings of the IEEE Conference on Advanced Video and Signal Based Surveillance* (AVSS'03) 0-7695-1971.2003.

[8] Wing Teng Ho, Hao Wooi Lim and Yong Haur Tay,"Two-stage License Plate Detection using Gentle Adaboost and SIFT-SVM," *2009 First Asian Conference on Intelligent Information and Database Systems, 2009.* 978-0-7695-3580-7/09 © 2009 IEEE.