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VEDA edges based car licence plate detection using canny's algorithm

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Abstract --One of the latest and fastest cars circulating us, having data about those cars will help to prevent criminal offence including traffic violations. Having in my mind, this project having latest key enhancements of image processing domains, here one algorithm used here uniquely is Canny's algorithm. Other some algorithm like VEDA, Winer's adaptive thresholding values, and latest segmentation and region extraction, so on. Using these latest technologies and algorithm enhances detecting car license plate in greater manner. Using smallest cameras will help to reduce the implementation cost in hugely. Having database will lead to identify the complete details about the car and owner of it. To achieve low cost and least processing time is the motto of this project. This project could be used in various environments like police petrol, automatic car parking and ticket collecting machines. The proposed CLPD method can work to detect the region of car license plates. The method shows the total time of processing one 352x288 image is 47.7 ms, and it meets the requirement of real time processing. Under the experiment datasets, which were taken from real scenes, 579 out of 643 images were successfully detected. Meanwhile, the average accuracy of locating car license plate was 90%. In this work, a comparison between CARPET and the proposed CLPD method for the same tested images was done in terms of detection rate and efficiency. The proposed CLPD method can work to detect the region of car license plates. The method shows the total time of processing one 352x288 image is 47.7 ms, and it meets the requirement of real time processing. Under the experiment datasets, which were taken from real scenes, 579 out of 643 images were successfully detected. Meanwhile, the average accuracy of locating car license plate was 90%. In this work, a comparison between CARPET and the proposed CLPD method for the same tested images was done in terms of detection rate and efficiency.

Index Terms: Car license plates, canny algorithms, VEDA, HDD, Edge detection, Extracting from VEDA

I. INTRODUCTION

Having plenty of application like crime prevention, toll collection, and traffic survey. Can't expect to install every nook and corner the costliest, bulkier and sensitive devices like CCTV, IR sensor setup. Easy solution for this problem using web camera instead of high end cameras with having powerful algorithm to get certain picture of car license plate without lot of noises, enough to identify the license number. Implementing car plate detection explained in following proceedings. Usually, a CLPDRS consists of three parts: License Plate Detection (LPD), character segmentation, and character recognition. Among these, LPD is the most important part in the system because it affects the system's accuracy.

There are many issues should be resolved in order to create successful and fast Car License Plate Detection System (CLPDS), for example poor image quality, plate sizes and designs, processing time, and background details and complexity. The need for car identification is increasing for many reasons such as crime prevention, vehicle access control and border control. To identify a car, features such as model, color, and License Plate (LP) number can be used. In vehicle tracking systems, cameras are used and installed in front of policemen cars in order to identify those vehicles. Usually, numerous vehicle tracking and pursue systems use outstanding cameras, and this leads to cost increment of the system both hardware and software.

Since many methods have been proposed in various Intelligent Transportation System (ITS) applications, the CLPDRS is usually based on image acquired at 640×480 resolution. An enhancement of CLPD method performance such as reduction of computation time and algorithm complexity, or even build of LPR system with lower cost of its hardware devices, will make it more practical and usable than before. This paper proposed a method for car license plate detection in which a web-camera with 352×288 resolution is used instead of a more sophisticated one. In this work, the web-camera is used to capture the images and then off-line process is performed in order to detect the plate detection from the whole scene image

II. SYSTEM SPECIFICATIONS

System's flow chart illustrated here in fig-1, which consists of various algorithms and new implementation like VEDA, HDD and so on. the AT process will be evaluated first. Then, the accuracy and the computation time of VEDA are compared to

Sobel operator. Finally, the performance of the proposed CLPD method is evaluated. To carry out this evaluation and analysis, VEDA and Sobel are separately used for extracting vertical edges. In the first valuation, the CLPD method has been built as the following steps ULEA->VEDA->HDD->CRE->PRS->PD; in the second evaluation, the CLPD method has been built as follows: ULEA->Sobel->HDD->CRE->PRS->PD. VEDA is proposed and used for detecting vertical edges, the proposed CLPD method processes low quality images produced by a web-camera which has a resolution of 352×288 with 30 fps, and the computation time of the CLPD method is less than several methods. In this paper, the color input image is converted to gray-scale image and then, adaptive thresholding is applied on the image in order to constitute the binarized image. After that, ULEA is applied in order to remove noise and enhance the binarized image. Next, the vertical edges are extracted by using VEDA. The next process is to detect the license plate; the plate details are highlighted based on the pixel value with help of VEDA output. Then, some statistical and logical operations are used in order to detect candidate regions and search for the true candidate region. Finally, the true plate region is detected in the original image.

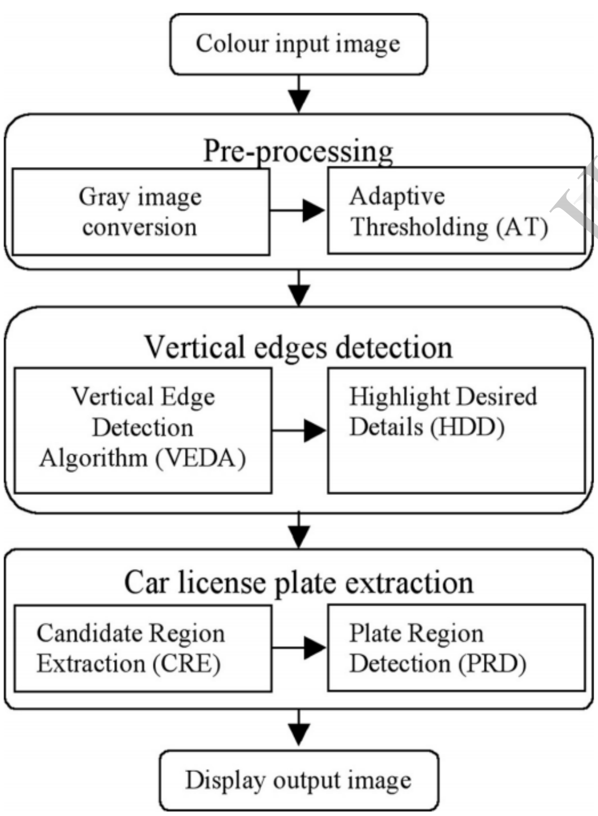

Fig-1 System Specification

A. Adaptive Thresholding

Adaptive Thresholding, after color input image is converted to gray scale, an adaptive thresholding process is applied in order to constitute the binarized image. The researchers in have recently proposed real-time adaptive thresholding using mean of a local window, where local mean is computed using integral image. In order to get a good adaptive threshold, the method proposed in is used. The Technique of AT: The adaptive thresholding technique used in this work is just a simple extension of Bradley's and Wellner's methods. The idea in Wellner's algorithm is that the pixel is compared to an average of neighboring pixels. Specifically, an approximate moving average of the last S pixels seen is calculated while traversing the image. If the value of the current pixel is T percent lower than the average then it is set to black; otherwise, it is set to white. This technique is useful because comparing a pixel to the average of neighboring pixels will keep hard contrast lines and ignore soft gradient changes. The advantage of this technique is that only a single pass through the image is required. Wellner uses 1/8th of the image width for the value of S and 0.15 for the value of T in order to yield the best results for a variety of images. The value of T might be a little bit modified from the proposed value by Wellner depending on the used images whereas it should be in the range $0.1 < T < 0.2$ in this method. However, Wellner's algorithm depends on the scanning order of pixels. Since the neighborhood samples are not evenly distributed in all directions, the moving average process is not suitable to give a good representation for the neighboring pixels. Therefore, using the integral image in has solved this problem

B. Unwanted Lines Elimination Algorithm

Thresholding process in general produces many thin lines which do not belong to LP region. Can see that there are many long foreground lines and short random noise edges besides the LP region. These background and noise edges are unwanted lines. These lines may interfere in the LP location. Therefore, we have proposed an algorithm to eliminate them from the image. This step can be considered as a morphological operation and enhancement process. There are four cases in which unwanted-lines can be formed. First case: the line is horizontal with angle equal to 0 degree as (─); second case: the line is vertical with angle equal to 90 degree as (│); third case: the line is inclined with angle equal to 45 degree as (/); and fourth case: the line is inclined with angle equal to 135 degree as (\). Therefore, ULEA has been proposed in order to eliminate these lines. In this step, while processing a binary image, the black pixel values are background, and the white pixel values are foreground. A 3×3 mask is used throughout all image pixels. Only black pixel values in the thresholded image are tested. Indicated in below blocks named figure 3.1 In order to retain small details of license plate, only the lines whose widths equal to 1-pixel are checked. Supposed that b(x,y) are the values for thresholded image. Once, the current pixel value located at the mask center is black, the 8-neighbor pixel values are tested. If two corresponding values are white together, then the current pixel is converted to white value as foreground pixel value (i.e., white pixel).

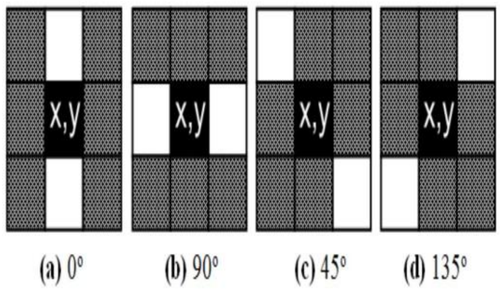

Fig 2 Converting center pixel to background

C. Vertical Edge Detection Algorithm

The advantage of VEDA is to distinguish the plate details region, especially, the beginning and the end of each character. Therefore, the plate details will be easily detected and character recognition process will be done faster. After thresholding and ULEA processes, the image will only have black and white regions, and VEDA is processing these regions. The idea of VEDA concentrates on intersections of black-white and white-black A mask 2×4 is proposed for this process , where x and y represent rows and columns of the image.. Below picture illustrates that the conversation melt down happens at the two different kind of regions

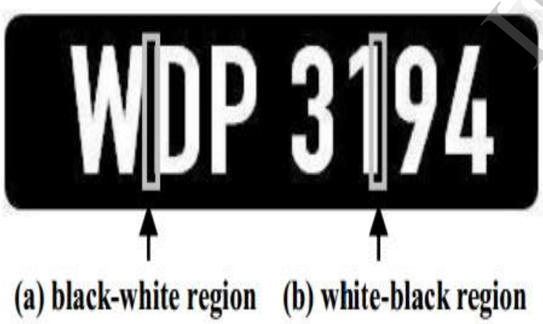

Fig 3 Intersection of Black-White and White-Black region

The center pixel of the mask is located at point (0, 1) and (1, 1). By moving the mask from left-to-right, the black-white regions will be found. Therefore, the last two black pixels will only be kept. Similarly, the first black pixel in case of white-black regions will be kept. The proposed mast system had shown below

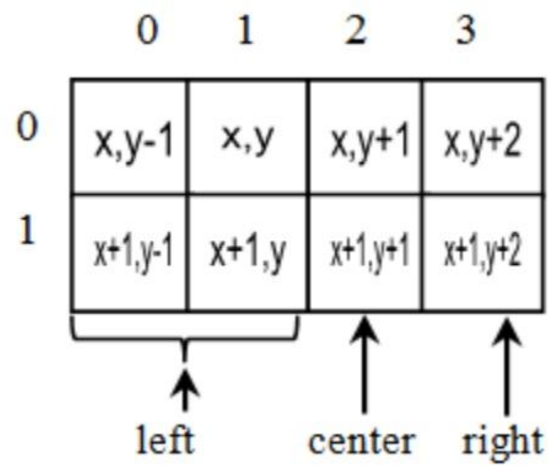

Fig 4 The design of the proposed mask

D. Highlight Desired Details Based On Veda

After applying VEDA, the next step is to highlight the desired details such as plate details and vertical edges in the image. HDD performs NAND-AND operation for each two corresponding pixel values taken from both ULEA and VEDA output images. The NAND-AND procedure for this process. This process depends on VEDA output in highlighting the plate region. All the pixels in vertical edge image will be scanned. When there are two neighbor black pixels and followed by one black pixel as in VEDA output form, the two edges will be checked in order to highlight the desired details by drawing black horizontal lines connecting each two vertical edges. First, these two vertical edges should be surrounded by a black background as in the ULEA image. Second, the value of horizontal distance (HD) represents the length between the two vertical edges of a single object. The HD has 6 been computed using the test images. The HD value is selected to be suitable for removing long foreground and random noise edges that have not been eliminated earlier. This scanning process will start moving from left to right and from top to bottom. After all pixels are scanned, the regions in which the correct LP exists are highlighted

E. Candidate Regions Extraction

This process is divided into four steps as follows: Count the Drawn Lines per Each Row: The number of lines that have been drawn per each row will be counted and stored in a matrix variable, HwMnyLines[a], where a=0, 1, … height-1. Divide the Image into Multi-groups: The huge number of rows will delay the processing time in next steps. Thus, in order to reduce the consumed time, gathering many rows as a group is used here

F. Plate Region Selection

This process aims to select and extract one correct LP. It contains five sub-sections. The first one explains the selection process of the LP region from mathematical perspective only. The second one applies the proposed equation on the image. The third one gives the proof of the proposed equation using statistical calculations and graphs. The fourth one explains the voting step. The final one introduces the procedure of detecting LP using the proposed equation. The flowchart of PRS and PD is also provided. The Selection Process of the LP Region,

G. Canny's Algorithms

Because the Canny edge detector is susceptible to noise present in raw unprocessed image data, it uses a filter based on a Gaussian (bell curve), where the raw image is convolved with a Gaussian filter. The result is a slightly blurred version of the original which is not affected by a single noisy pixel to any significant degree.An edge in an image may point in a variety of directions, so the Canny algorithm uses four filters to detect horizontal, vertical and diagonal edges in the blurred image. The edge detection operator (Roberts, Prewitt, Sobel for example) returns a value for the first derivative in the horizontal direction (G_x) and the vertical direction (G_y). From this the edge gradient and direction can be determined:

$$\mathbf{G} = \sqrt{\mathbf{G}_x^{\,2} + \mathbf{G}_y^{\,2}},$$
$$\mathbf{\Theta} = \operatorname{atan2}(\mathbf{G}_y, \mathbf{G}_x)$$

- if the rounded gradient angle is zero degrees (i.e. the gradient is in the north-south direction) the point will be considered to be on the edge if its gradient magnitude is greater than the magnitudes at pixels in the east and west directions,
- if the rounded gradient angle is 90 degrees (i.e. the gradient is in the east-west direction) the point will be considered to be on the edge if its gradient magnitude is greater than the magnitudes at pixels in the north and south directions,
- if the rounded gradient angle is 135 degrees (i.e. the gradient is in the north east-south west direction) the point will be considered to be on the edge if its gradient magnitude is greater than the magnitudes at pixels in the north west and south east directions,
- If the rounded gradient angle is 45 degrees (i.e. the gradient is in the north west-south east direction) the point will be considered to be on the edge if its gradient magnitude is greater than the magnitudes at pixels in the north east and south west directions.

Note that the sign of the direction is irrelevant, i.e. north-south is the same as south-north and so on. Tracing edges through the image and hysteresis thresholding - Large intensity gradients are more likely to correspond to edges than small intensity gradients. It is in most cases impossible to specify a threshold at which a given intensity gradient switches from corresponding to an edge into not doing so. Therefore Canny uses thresholding with hysteresis. Thresholding with hysteresis requires two thresholds – high and low. Making the assumption that important edges should be along continuous curves in the image allows us to follow a faint section of a given line and to discard a few noisy pixels that do not constitute a line but have produced large gradients. Once this process is complete we have a binary image where each pixel is marked as either an edge pixel or a non-edge pixel. From complementary output from the edge tracing step, the binary edge map obtained in this way can also be treated as a set of edge curves, which after further processing can be represented as polygons in the image domain.

III. EXPERIMENTAL RESULTS

A mathematical formulation is proposed for this purpose and once this formulation is applied on each pixel, the probability of being that pixel an element of the LP can be decided. As previously mentioned, for the candidate regions, each column will be checked one by one. If the column blackness ratio exceeds 50%, then the current column belongs to LP region and thus, this column will be replaced by a vertical black line in the result image. Hence, each column is checked by the condition: If colmnHght blckPix then the current column is an element of the LP region. Here, the blckPix represents the total number of black pixels per each column in the current candidate region and the colmnHght represents the column height of the of the candidate region. This condition with a fixed value (0.5) is used with non-blurry images. However, some pixels of the candidate regions will not be detected in case the ratio of blackness to the total length (height) of the candidate region is greater than 50%. Therefore, the condition is changed to be less than 50% according to the ratio of the blurry level or the deformation of the LP.

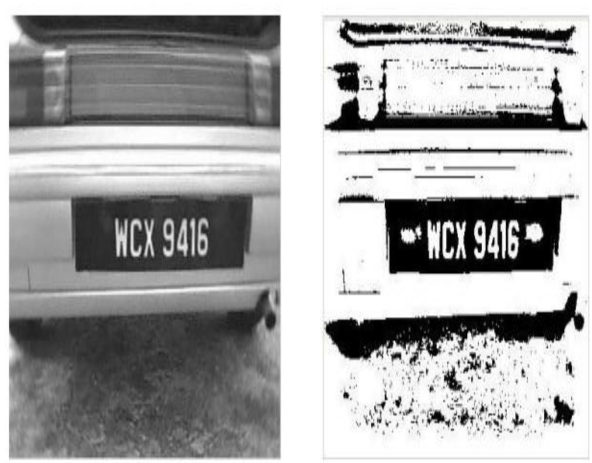

Fig 5 Original and thresholded converted image

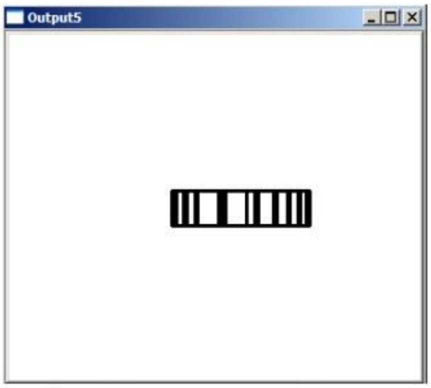

Fig 6.Plate area detection

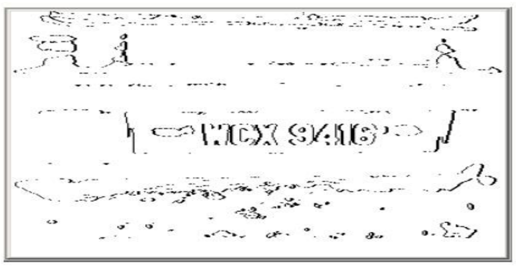

Fig 7 VEDA output

Fig 8 HDD output

IV. CONCLUSION

We have proposed a new and fast algorithm for vertical edge detection (VEDA) in which its performance is faster than Sobel's by 5-9 times depending on image resolution. VEDA contributes to make the whole proposed CLPD method faster. We have proposed a CLPD method in which dataset was captured by using a web-camera. 664 images taken from various scenes and under different conditions were employed. Only one LP is considered in each sample for the whole experiments. In the experiment, the rate of correctly detected license plates is 91.4%. Also, the computation time of the CLPD method is 47.7 ms which meets the real time requirements. Lastly, the VEDA based and Sobel based CLPD are compared and the findings show VEDA based is better in terms of the computation time and the detection rate.

V. FUTURE ENHANCEMENTS

Canny's algorithm. Other some algorithm like VEDA, Winer's adaptive thresholding values, and latest segmentation and region extraction, so on. Using these latest technologies and algorithm enhances detecting car license plate in greater manner. Using smallest cameras will help to reduce the implementation cost in hugely. Having database will lead to identify the complete details about the car and owner of it. To achieve low cost and least processing time is the motto of this project. This project could be used in various environments like police petrol, automatic car parking and ticket collecting machines. The proposed CLPD method can work to detect the region of car license plates. By applying new algorithm in this method is quite easy compare when it is having this much compatibility, direct apply or removing existing algorithm like canny's will be changeable, to achieve 100 percent success rate on detecting car license plate at any kind of environment and circumstances at the future.

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