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DETECTION OF LICENSE PLATE NUMBER USING DYNAMIC IMAGE PROCESSING TECHNIQUE

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Abstract

It is believed that there are currently millions of vehicles on the roads worldwide. The over speed of vehicles ,theft of vehicles, disobeying traffic rules in public, an unauthorized person entering the restricted area are keep on increasing. Edge is a basic feature of image. The image edges include rich information that is very significant for obtaining the number plate detection based on morphological operations by object recognition. This paper reveals about the design and development of automatic number plate recognition. Dynamic image processing techniques are used for recognizing the license plate numbers from an image containing it. Recognition of license plate in a picture which is prone to illumination problems is done using this process. We need an automatic public security system. Each vehicle has their own Vehicle Identification Number („VIN") as their primary identifier. The VIN is actually a License Number which states a legal license to participate in the public traffic. The proposed paper is to identify the vehicle with the help of vehicles License Plate (LP).LPRS is one the most important part of the Intelligent Transportation System (ITS) to locate the LP. In this paper certain existing algorithm drawbacks are overcome by the proposed morphological operations for LPRS. Morphological operation is chosen due to its higher efficiency, noise filter capacity, accuracy, exact localization of LP and speed.

Keywords: Number plate detection, Image processing, Vehicles, Traffic rules

I. INTRODUCTION

The location phase of the LP is the most basic stride in a programmed vehicle recognizable proof framework. A various examination has been completed to overcome numerous issues confronted here yet there is no broad strategy that can be utilized for recognizing tags as a part of better places or nations, in view of the distinction in plate style or plan. All the created systems can be classified by chose elements whereupon the discovery calculation was based and the kind of the recognition calculation itself.

Outside shape based systems were created to distinguish the plate in light of its rectangular shape. Edge-based strategies were additionally executed to identify the plate in light of the high thickness of vertical edges inside it. Inquires about depended on the power dissemination in the plate's region concerning its neighborhood where the plate is considered as Maximally Stable External Region (MSER). Numerous analysts have consolidated diverse elements in their frameworks. The connected identification calculations extended from window-based factual coordinating routines to profoundly insightful based procedures that utilized neural systems or fluffy rationale.

It has been utilized infrequently in view of their high computational needs. Distinctive explores have been attempted at diverse levels under a few requirements to minimize the inquiry space.

Scientists construct their with respect to pixel shading elements to portion the picture contingent upon stable hues into plate and non plate areas, trailed by shape subordinate guidelines to recognize the plate's range. Achievement rate of 92.8% was recorded for 70 test tests. It was utilized to hunt down the best settled rectangular territory having the same surface components as that of the model format. The utilized method needs constancy to scaling on the grounds that altered parameters have been utilized for the extent of the plate's range. It was utilized to find the plate vertically in the wake of distinguishing the left and right points of confinement taking into account flat symmetry of the vertical surface histogram around the plate's range.

II. LITERATURE REVIEW

Edge finding method and window filtering is suggested by Kranthi et al. [2]. Edge finding method is not giving significant output when image is having complex background because it is very sensitive to unwanted edges. So windowing method where intensity summation in horizontal and vertical direction is calculated that will provide proper detection of license plate. For object enhancement they have used scale down, sorting of intensity pixel and then multiplication of top 20 % pixel by 2.55, which provide better result compared to histogram equalization technique.

Abbas et al. [5] suggested vertical edge based car license plate detection method. For low resolution image of size 352 * 288, in which they have used adaptive thresholding technique followed by vertical edge detection using 2 * 4 mask and proved that its performance is faster (47.7 ms) than the sobel and getting 91.4 % correct detection. Advantages are like able to process low resolution image and with complex background, tolerance to lighting, tilt, varied sizes and designs of LPs. But their algorithm is highly complex.

III. PROPOSED METHOD

In this section, an overview of the system is introduced. The proposed system is composed of phase: image processing phase.

In this phase, an input color image is exposed to a sequence of processes to extract the relevant two dimensional objects that may represent the symbols constituting the LP. These processes that are carried out in different stages, as depicted in Fig. 1, will be presented in the following subsections.

A. Color to grayscale conversion

The input image is captured as a color image taking into account further processing of the image to extract other information relevant to the concerned vehicle. Color (RGB) to grayscale ($\boldsymbol{gs}$) conversion is performed using the standard NTSC method by eliminating the hue and saturation information while retaining the luminance as follows:

$$\mathrm{gs} = 0.229 * \mathrm{R} + 0.587 * \mathrm{G} + 0.114 * \mathrm{B} \tag{1}$$

Each phase is composed of many stages. The flowchart in Fig. 1 depicts the various image processing stages that finally produce image objects.

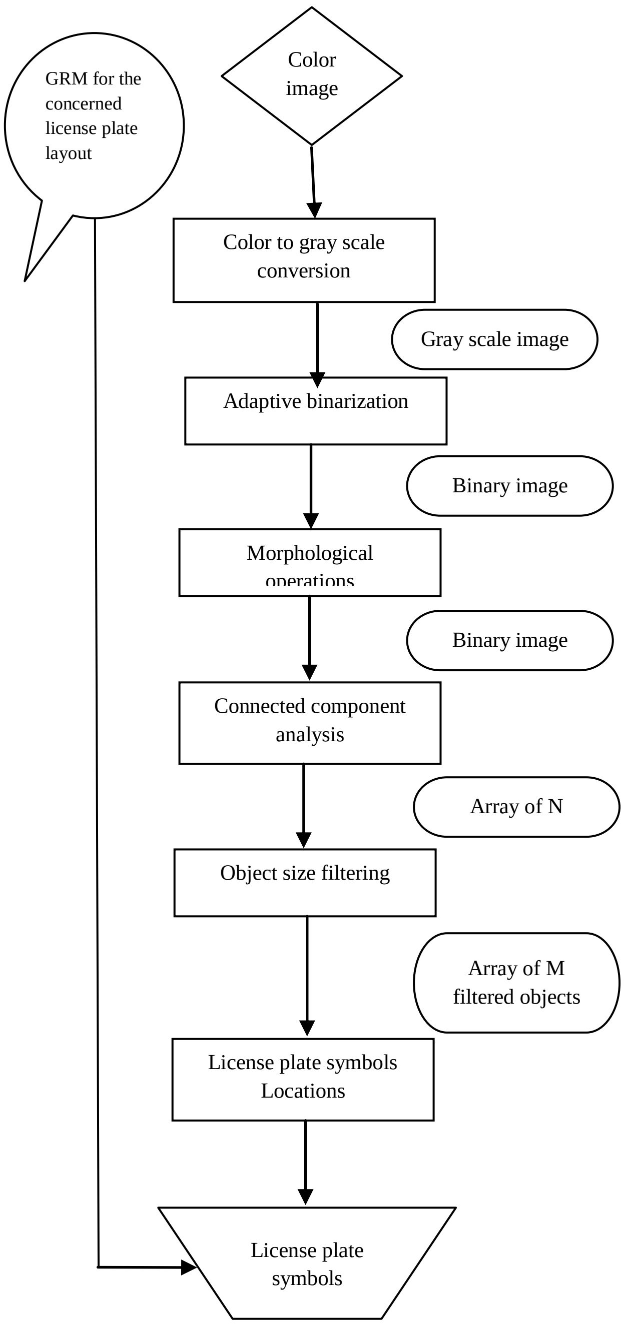

Figure 1: The system's overall flowchart for the localization of the LP symbols

B. Gray to binary using a dynamic adaptive threshold

Converting the input image into a binary image is one of the most sensitive stages in localizing LPs due to spatial and temporal variations encountered in the plate itself and the environment around it resulting in several illumination problems. Hence binarization of the image according to a fixed global threshold is not suitable to overcome these problems. In our system, a local adaptive method based on the techniques described has been implemented to determine the threshold at each pixel dynamically depending on the average gray level in the neighborhood of the pixel. Although some images can be binarized successfully using Otsu's global threshold method.

C. Morphological operations

Morphological operations such as dilation and erosion are important processes needed for most pattern recognition systems to eliminate noisy objects and retain only objects expected to represent the targeted patterns. In LP detection, closing operation (dilation followed by erosion) is performed to fill noisy holes inside candidate objects and to connect broken symbols. On the other hand, opening (erosion followed by dilation) is applied to remove objects that are thinner than the LP symbols. In our system, closing is applied to fill spaces that break the bodies of symbols using a 3-pixel-disk element in the first experiment. This process is very important especially for the recent Saudi LP layout where a light gray watermark is used for authentication purposes. This watermark becomes white after the binarization process and breaks down most of the bodies of the LP symbols.

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D. Connected Component Analysis (CCA) and objects extraction

CCA is a well known technique in image processing that scans an image and groups pixels in labeled components based on pixel connectivity. An 8-point CCA stage is performed to locate all the objects inside the binary image produced from the previous stage. The output of this stage is an array of N objects.

E. Size filtering

The objects extracted from the CCA stage are filtered on the basis of their widths W_{obj} and heights H_{obj} such that the dimensions of the LP symbols lie between their respective thresholds as follows:

$$W_{min} \leq W_{obj} \leq W_{max} \quad and \quad H_{min} \leq H_{obj} \leq H_{max} \qquad (2)$$

Where H_{min} and W_{min} are the values below which a symbol cannot be recognized (8 pixels for example) and W_{max} can be set to the image width divided by the number of symbols in the license number. H_{max} is calculated as W_{max} divided by the aspect ratio of the used font. The ranges of these values can be narrowed in the case of a mounted camera to speed up the process of detection but for a moving camera, the ranges depend on the required object to camera distance range.

In the above relationships, relativity is achieved by dividing on the height or width of the first object depending on which is more stable for practical reasons although it is logically to divide differences in heights on height and differences in widths on width to compensate for scale changes in the general case. For most LPs (see Appendix), the heights of symbols are almost equal for both digits and letters while some symbols have different widths than others. Hence, normalized relationships between any two objects can be based on the height of the first object

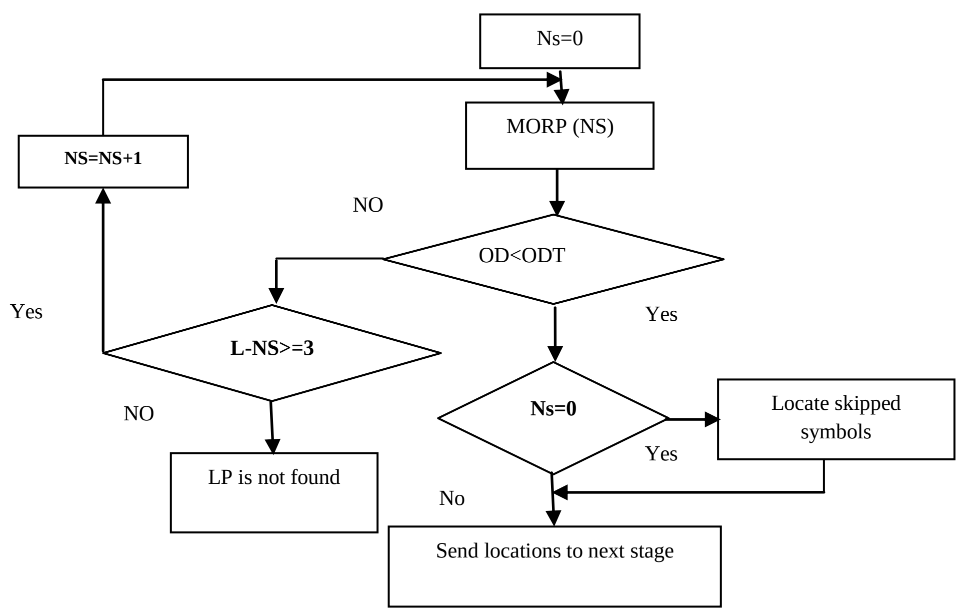

Figure 2: Flowchart for detecting LP's symbols incase of touching and broken symbols

Considering the two objects O1 and O2 shown in Fig. 8, the position relationship is defined in the two directions by the following formulas:

$$RX_{2,1} = (X_2 - X_1)/H_1 \qquad (3)$$

$$RY_{2,1} = (Y_2 - Y_1)/H_1 \qquad (4)$$

The size relationship is defined by the following

$$RH_{2,1} = (H_2 - H_1)/H_1 \qquad (5)$$

$$RW_{2,1} = (W - W_1)/H_1 \qquad (6)$$

The above equation does not represent the objects' shapes because they are unknown in case of an unknown plate. Only the aspect ratio for fixed width-fonts can be added for the first object as follows:

$$AS_l = W_l/H_l \qquad (7)$$

Objective Distance (OD) and Fitness Formulation

Considering the distance between the prototype chromosome p, corresponding to the input GRM, and any chromosome k, five distance values can be defined as follows :)

$$\Delta RX_{k,p} = \sum_{j=1}^{L-1} \left| \left(RX_{j+1,j}\right)_k - \left(RX_{j+1,j}\right)_p \right|$$
(8)

$$\Delta RY_{k,p} = \sum_{j=1}^{L-1} \left| \left(RY_{j+1,j}\right)_k - \left(RY_{j+1,j}\right)_p \right|$$
(9)

$$\Delta RW_{k,p} = \sum_{j=1}^{L-1} \left| \left(RW_{j+1,j}\right)_k - \left(RW_{j+1,j}\right)_p \right|$$
(10)

$$\Delta RH_{k,p} = \sum_{j=1}^{L-1} \left| \left(RH_{j+1,j}\right)_k - \left(RH_{j+1,j}\right)_p \right|$$
(11)

$$\Delta AS_{k,p} = \left| AS_k - AS_p \right| \qquad (12)$$

Combining the five objective distance functions into one global objective distance function that represents the distance between any chromosome k and the prototype chromosome p, is performed through the following formula:

$$OD_{k,p} = W_x \Delta RX_{k,p} + W_y \Delta RY_{k,p} + W_h \Delta RH_{k,p} + W_w \Delta RW_{k,p} + W_{as} \Delta AS_{k,p}$$
(13)

Since, as stated in the literature, the fitness is a function that should be maximized, hence the fitness of chromosome k (Fit_k) can be related to the global objective distance function as follows:

$$Fit_k = -OD_{k,p} \qquad (14)$$

Adaption for the LP detection problem

The previous formulation can be used for the representation of a compound object consisting of a group of smaller objects and can be used to locate the compound object in an image given that its GRM values are nearly fixed.

$$OD_{k,p} = \Delta RX_{k,p} + 4\Delta RY_{k,p} + 4\Delta RH_{k,p}$$
(15)

Finally, by substituting from 15 into 1 4, the formula for the fitness of a chromosome k(Fit_k)is given as follows:

$$Fit_k = -\Delta RX_{k,p} + 4\Delta RY_{k,p} + 4\Delta RH_{k,p}$$
(16)

F. The selection method

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In our system, the Stochastic Universal Sampling (SUS) method has been adopted for the selection of offspring in the new generation. In SUS method, each individual is mapped to a continuous segment of a line equal in size to its fitness as in roulette-wheel selection.

G. Mutation operators

Mutation is needed because successive removal of less fit members in genetic iterations may eliminate some aspects of genetic material forever. By performing mutation in the chromosomes, it ensures that new parts of the search space are reached to maintain the mating pool variety.

H. Crossover operator

There are many methods to implement the crossover operator. For instance, single point crossover, two point crossover, n-point crossover, uniform crossover, three parent crossover and, alternating crossover, etc. These operators are not suitable for our problem because the resultant children will not be valid because of repeated genes that may be produced in the generated chromosomes. Also, if we prevent repetition, the resultant children's fitness will be enhanced slowly because of the randomness of these mechanisms

IV. RESULTS

Figure 1: Original image

Figure 2: Gray image

Figure 3: Black and White image

Figure 4: Adaptive binarization

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Figure 5: Morphological operation

Figure 6:resultant image

V. CONCLUSION

This paper reveals about the design and development of automatic number plate recognition. Dynamic image processing techniques are used for recognizing the license plate numbers from an image containing it. Recognition of license plate in a picture which is prone to illumination problems is done using this process. We need an automatic public security system. Each vehicle has their own Vehicle Identification Number („VIN") as their primary identifier. The VIN is actually a License Number which states a legal license to participate in the public traffic. The proposed paper is to identify the vehicle with the help of vehicles License Plate (LP).LPRS is one the most important part of the Intelligent Transportation System (ITS) to locate the LP. In this paper certain existing algorithm drawbacks are overcome by the proposed morphological operations for LPRS. Finally the simulation results shows that the proposed method shows better performance over conventional approaches and result is performed in the MATLAB software.

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