Adopting Template Matching Method for Detection of International Vehicle Registration Number Plate

Mehar Muhammad V
4th Semester Student Of Mtech (Dcn),
Tjit, Bangalore

Ms Lekshmy V
Assistant Professor, Dept.Of E&Ce,
Tjit, Bangalore

***Abstract*-A localization methodology newly for Identifying an International vehicle license plate system, which is modified to reproduce the local context, is proposed, along with hybrid classifier that identifies license plate letters. The system presented here is based on a customized template-matching method by the study of target colour pixels to notice the location of a vehicle's license plate. A customized strip search enables localization of the paradigm colour-geometric pattern used in Iran and several European countries. This approach uses sporadic strip hunt to find the tint of every pixel on demand. In addition, when a group of target pixels is noticed, it is studied to validate that its figure and feature ratio match those of the standard number plate. This system keep away from time-consuming image algorithms and alteration for the entire pixels of image, such as resizing and Hough, Fourier, and wavelet transforms, by this means wounding down the finding response time. Number plate characters are recognized by a hybrid classifier that covers a decision tree and a support vector machine with a uniform fifth-degree polynomial kernel.**

I. INTRODUCTION

The reason behind Automatic license plate recognition system's high-priority in researches is vehicle'slicense plate is a unique identity andmany uses are there for this ALPR system.

As we said earlier many uses are there for this system and some of them are discussed in this section. This system can be used in parking areas and toll stations to allow access to the vehicles having authorized number plates, and we can also calculate the speed of a vehicle just by taking the vehicles speed at the starting and stopping stations. The other main use is if a vehicle is not allowed to travel in a specific area we can easily recognize their movement by monitoring the camera installed in the license plate recognition system.

One of the main advantages of this system is that it converts the captured images into a number of bits, and this number of bits representing the vehicles registration number. Inpresent systems the cameras taking the pictures of the vehicle and directly stores in the specific control station, because of this direct storage of pictures there will be a need of high memory spaces otherwise there won't be space for storing the upcoming pictures took by cameras. This problem can be easily solve our system by converting this big pictures into number of bits representing the vehicles registration number.

In speed control highways by installing the ALPR system we can recognize the vehicles going above or below the specified speed, this captured pictures are then compressed as to reduce the size and resolution and sends it using a MMS or SMS service. So it will be very better than sending the offence letter after some days to the vehicles owner. Thus this system using the color images from normal/high-resolution surveillance cameras is highly useful. This is the reason why manyresearches and studies using the color feature technique for the localization of licenseplates. Many ways are there for localization of the license plate such as HSV and HSI. Where HSV means the hue, saturation, and value, and HIS refers to hue, saturation, and intensity .In this above algorithms, which uses color features for license plate localization are specific of thecountry. Most of the implemented LicensePlate Recognitionare using the infrared photos andfor that the system have to be equipped with the infrared cameras and its other photographic parts.

II. DETECTION OFLICENSE PLATE

A. Detecting the Number Plate

For detection or the localization of the licence plate it normallyemploys the method of optimized template matching method. It is an algorithm that basically checksthe entire image surface to detect the object contained by usinga template.Normally this template-matching is not that flexible and can't be expanded as to accommodate images of varioussizes. In our proposed method, it helps to do an optimized template matching that is invariant of orientation and scale. So this proposed system will be able to detect the licence plate invariant of rotation and scale. The important thing that have to be taken into account is that the construction of a standard and unique country specific template of the licence plate. By detectingthe blue rectangle that appears on the licence plates of Iran and some another European countries it finds the aspect ratio of license plates. The below figure shows the blue rectangle on license plates of several countries.

Fig.1. license plate samples of Iran and some European countries.

B. *Cropping of Licence Plate:*

As shown in thebelow figure, the aspect ratio oflicense platesis standardandconstant, and it is usually determining by applying a vertical or a slope search. The direction and the length of a license plate can get from the slope sweep orthe vertical, the width of the license plate can be calculated by a simple multiple using the below formulas

LicensePlate*x* =5 × reclength

LicensePlate*y* =reclength

Wherethe width of the license plate is LicensePlate*x*, and lengthisLicensePlate*y*.

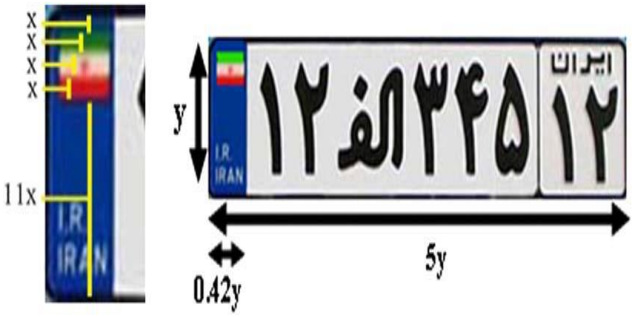

Fig.2The usual ratios in an International license plate and its blue rectangle.

The resizing is avoided in the proposed system because of the use of the ratio instead of the constant size. So all the licence plates can be processed regardless of the size of the image or the license plate. The proposed system can detect more than one licence plate from one image (if the image having many license plates).

III. CHARACTER RECOGNITION FROM LICENSE PLATE

Thecropping and localizationof the license platefrom the captured image is done in the previous stages. Now it has to go through the process ofrecognizing and classifying its letters and numbers named as recognition process. It occurs in mainly three steps. The first step is deals with improvement of the image quality and noise removal by applying image processing filters, here we use filters such as Laplacian filtersand histogram equalization, by this step it will be having sharp edges and applying morphological functions to present the license plate inoptimal position for character recognition. The binary image conversion takes place in the second step, and all the characters are separated through a segmentation function, by doing one more round of the image quality improvement. Inthe last step itrecognizes separated characters through fast and accurate classifiers, after this step it shows the result.

A. *Improvement of Image Quality*

By this step it tries to make the clearest and the most readable position of the captured image. the performance of the recognition system can be increased With more details of each character,. Converting smooth edges, or edge sharpening to no smoothen ones, is the most important part of this step. By forming sharpened edges, all the important details remain in the license plate's characters and their edges. The filter here used isLaplacian filter for edge sharpening.

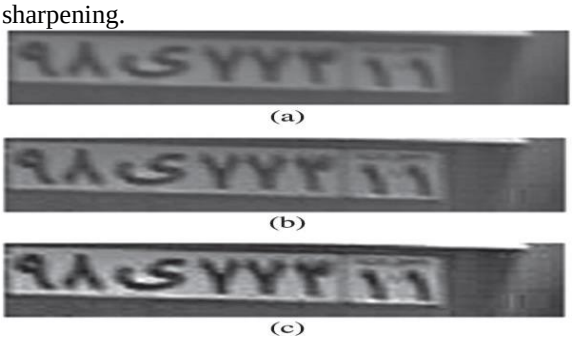

Fig.3. Different samples of cropped car plates after detection. (a) Original license plate after cropping. (b) After giving the histogram equalization and gamma adjustment. (c) After applying the Laplacian filter.

B. *Conversion process to Binary Images:*

a threshold value is requiredFor converting the license plate into a binary image. Because an incorrect high or low threshold causes connectivity or discontinuity between license plate characters; therefore, finding a correct trade-off threshold value is very important. For this purpose it uses a histogram, by that it can find entropies and the probability of distribution between foregrounds and background objects in the image. That also means that the threshold is a value that separates two independent peaks in intensity or colour histogram.

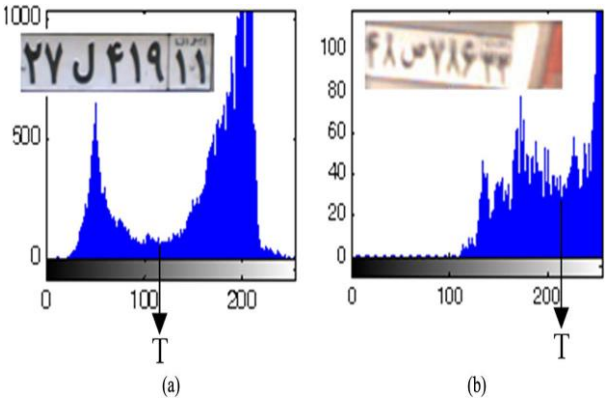

Fig.13. Selecting the threshold value using histogram. (a) Two independent peaks of the object and the background in histogram. (b) Setting a point as the threshold value will be difficult inhistogram with two relatedPeaks.

C. *Extraction ofCharacters*

The main step in recognition of the license plate is the system has to extract its characters. For extraction purpose there are several ways used. In here, as the location of each character is fixed, the simplest way for extraction can be used is a moving window in the constant area.In the proposed system,the extraction of eight objects will be the first step by applying connected component labelling.

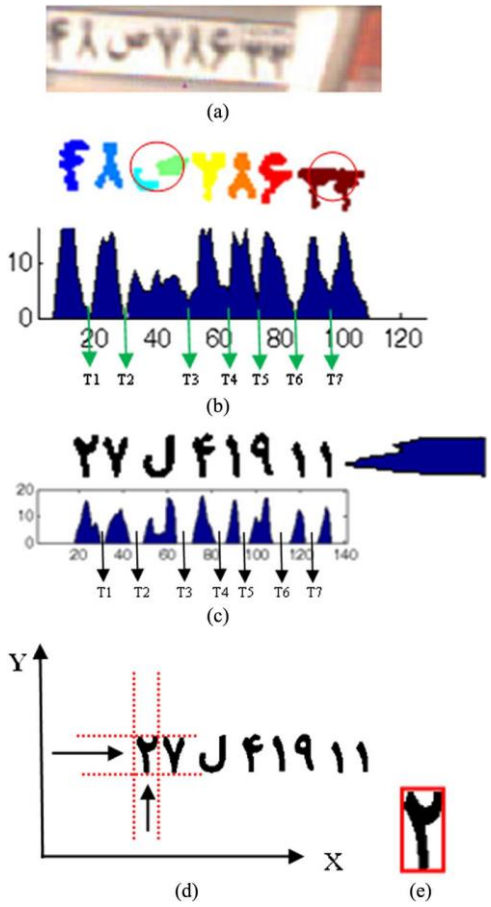

Fig.15. Steps ofcharacter extraction. (a) Original license plate after cropping.(b) License plate characters with discontinuity and connectivity; by separating eight peaks using a projectionplot to get the eight license plate characters. (c) Simplelicense plate projection of eight independent peaks. (d)In constant areas using theMoving window and trimming edges of each character. (e) Characters afterTrimming.

D. *Recognition of theCharacters:*

For the separate recognition of each character extracted from the license plate we are using template matching algorithm.

IV. EXPECTED OUTPUT

SYSTEM PERFORMANCE IN IMAGES FROM SPEED CONTROL CAMERAS ON HIGHWAYS

Conditions (Gatso speed control camera	Data set	Correct detection	Correct recognition	Detection performance	System performance
On the speed lane	500	483	463	96.6%	92.6%
On the middle lane	350	326	305	93.14%	87.14%
On the side lane	250	197	162	78.8%	64.8%
More than one vehicle	50	48	47	96%	94%

Table.1

As both the proposed system and the other LPR systems uses different license plate images and data sets,the performance comparison between this methods will be quite difficult.

We can evaluate the performance of the proposed method under four different conditions:1) the vehicle using the speed lane. 2) The vehicle using the middle lane. 3) The vehicle using the side lane, and 4) License plates of several vehicles in one captured image.

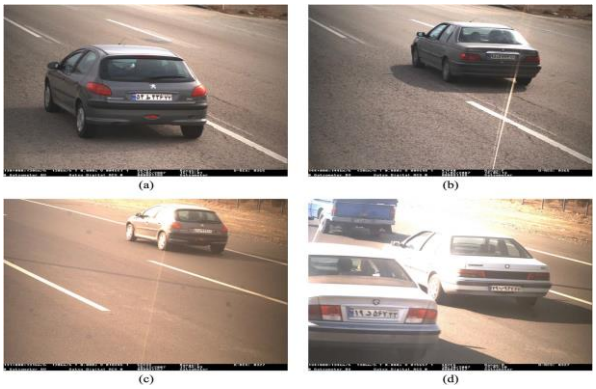

Fig.4.Pictures tookfrom highway speed control cameras. (a) Vehicle using the speed lane. (b) Vehicle using the middle lane. (c) Vehicle using the side lane. (d)License plates of several vehicles in one captured image.

From Table.1 it shows the evaluation results obtained from Gatso control speed cameras on highways under each of four above specifiedconditions. The proposed detection method is capable of detecting several license plates in an image. The proposed system can be considered successful because it can at least detects and recognizes a license plate correctly. A standard speed control station should focus and cover a lane, and the speed lane is the target lane for speed control cameras. Therefore, photos of vehicles in other lanes, taken by this type of speed control camera, are not standard. Our evaluation, based on the speed lane, ensures a better performance in detection and recognition

rate. By using this proposed system it ensures a good accuracy in the overall system performance.

COMPARISON OF DIFFERENT SYSTEM PERFORMANCES

Detection method	Recognition method	Detection rate	System performance
Fuzzy logic [27]	Neural networks	85%	82.62%
Morphological/Adaboost [40]	SAMME	96.93%	90.45%
Morphological [39]	SVM	97.5%	94%
Moving window/projection [28]	Neural networks	—	95%
Morphological [20]	Template matching	97.3%	84.14%
Edge detection and moving window [29]	Neural networks	99.67%	95.77%
Edge statistic and morphological [41]	—	96.5%	—
Edge detection/edge density [6]	—	96.67%	—
Geometric model matching by connected component analysis [26]	Neural networks	91%	86.9%
The proposed method	Decision tree and SVM	96.8%	94.4%

Table.2

Table.2 presents the comparison between the performance of theproposed ALPR system and that of the other methods currently employed for recognizing license plates. The system performance is the measure of an LPR system to giveaccurate results, including detection rate, segmentation rate, and recognition rate. The System performance can be calculated by using the given formula:
System Performance = Detection rate× Segmentation rate × Recognition rate.

V. CONCLUSION

The proposed work detects the location of license plates by recognizing its hue and shape. The main advantage of this proposed work is that the localization isinvariant ofscale and rotation. The proposed localization system detects all the license plate candidates available in the captured image by the camera. After detecting the license plate candidates, it follows by extraction and recognitionprocess for recognizing the eight characters in each license plate.This proposed work is still under progress and with some more modification and changes, we aspect to get better more results.

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