Number Plate Detection Using Template Matching Technique

Jugal Kishor Mishra [1], Sonu Agrawal [2]
[1]*Shri Shankarcharya Group of Institutions, Bhilai, Chattisgarh, India*

***Abstract* -** One of the major research topics of intelligent transportation system and traffic monitoring system is the License Plate Recognition (LPR) method. LPR systems have much scientific usage such as the payment of parking fee, highway toll fee, and traffic data collection, traffic monitoring systems, and so on. However, LPR was established to extract the information of vehicles by the image of their license plates. This paper presents a detail analysis of LCR system and also a proposed method of applying the template matching approach for character image recognition process. The new approach can be applied equally to Indian cases. It is based on keeping the image of these number plates along with a list of characters as entries in a table and then matching these entries one by one with the car plate. The new approach is tested on various samples of extracted license plate images captured in outdoor environment. The result yield 80% recognition accuracy, the method takes 0.306 seconds to perform the car plate recognition.

***Keywords* -** *License plate recognition, template matching, Segmentation. Introduction*

I. INTRODUCTION

License Plate Recognition (LPR) is one kind of artificial intelligent systems which is being used for many potential applications in Transportation areas [5]. It can be considered as a replacement for automatic radar and light running systems. Such systems are established to recognize vehicles by the contents of their license plates. The fundamental logic in number plate recognition is high efficiency and recognition speed [1].

Due to the massive increase in number of vehicles, license plate recognition technique became the major research area for researchers. Most previous researches and systems have faced some kind of poor performance due to the diversity of plate formats, the non uniform outdoor illumination conditions during image acquisition, noisy patterns connecting characters and poor edge enhancement.

OCR techniques have always been a challenge to researchers because of some issues like working conditions, such as limited views, backgrounds, different illumination, and different type of license plate, vehicle's speeds and ranges of the distance between camera and vehicle. Several techniques have been developed to achieve this job.

This paper proposes a template matching method for number plate recognition technique. Second section will describe the related work with number plate recognition and automatic number plate detection techniques. Third will introduce the problem related with number plate recognition and also the proposed work.

Fourth section will be the details of result of experiment and last section is the conclusion and the future work.

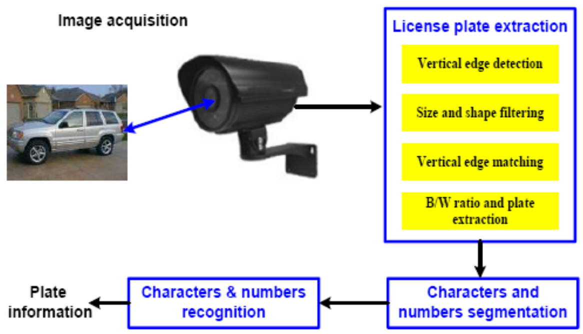


Fig: License Plate Recognition System

II. RELATED WORKS

The methods discussed in preceding sections are common methods for license plate recognition. Apart from these methods, various literatures are also discussed method for plate recognition. As most of the methods discussed in these literatures use more than one approach, it is not possible to do category wise discussion. Different number plate segmentation algorithms are discussed below.

There is a case study of enforcing the template matching mechanism for character image recognition [1]. The new approach can be applied equally to Egyptian and Saudi Arabian cases and can be extended more countries. It is based on keeping the names of these countries along with a list of Arabic characters as initial entries in a data table and then matching these entries one by one with input plate. The new approach is tested many samples of extracted license plate images captured. The result shows 90% recognition efficiency.

There are numerous ANPR systems available in market. Traffic control and vehicle owner identification has become the major issue for these systems. There is another paper; different approaches of ANPR are discussed by considering image size, success rate and processing time as parameters. Towards the end of this paper, an extension to ANPR is also suggested by the author.

To locate Chinese number plate Hui Wu and Bing Li [10] has implemented a method to obtain horizontal and vertical difference to find exact rectangle with vehicle number. The researchers converted vehicle plate image into gray scale and then applied automatic binarization using MATLAB. The authors claim to have average recognition rate of 0.8s.

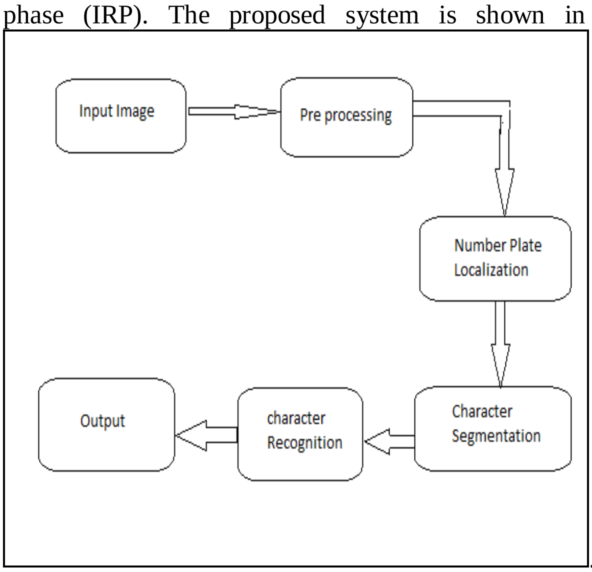
This paper represents review on automatic number plate recognition system. In this paper the basic details of the recognition system is presented. The objective of the author is to design an efficient automatic vehicle identification system by using the vehicle number plate, and to implement it for various applications. The system take input as color image of the vehicle and the output has the registration number of that vehicle. The system contains the four main steps to obtain the required output. They are image acquisition, plate localization, character segmentation and character recognition. The system is implemented in MATLAB 2010.

The artificial neural network method has shown good accuracy but long processing time and a need for periodical training for better accuracy. Template matching theorem has been used widely for recognizing the segmented characters and numbers.

Template matching method has shown high accuracy but requires efficient searching method and needs a large storage to save all the numbers and character templates. Fuzzy logic technique has been used to recognize the plate's segmented elements showing high performance, accuracy and short processing time. However, it is sensitive to the noise and Distortion.

III. THE SUGGESTED APPROACH

Unlike the traditional methods for number plate recognition, the proposed work does not need the segmentation process of the input image of number plate. The new approach begins directly after the license plate extraction phase; and will be called herby as information recognition phase (IRP). The proposed system is shown in figure.



A. PLATE REGION EXTRACTION

Plate region extraction is the first stage in this system. Image captured from the camera is first converted to the binary image consisting of only 1's and 0's (only black and white). by thresholding the pixel values of 0 (black) for all pixels in the input image with luminance less than threshold value and 1 (white) for all other *pixels.* After obtaining plate location, region involving only plate is cut giving the plate as shown here.

Fig: Plate Image

TABLE I. TABLE STYLES

Table Head	Table Column Head		
	Table column subhead	***Subhead***	***Subhead***
Copy	More table copy[a]		

[a] Sample of a Table footnote. *(Table footnote)*

In the segmentation of plate characters, license plate is segmented into its constituent parts obtaining the characters individually. Firstly, image is filtered for enhancing the image and removing the noises and unwanted spots. Then dilation operation is applied to the image for separating the characters from each other if the characters are close to each other. The result of this segmentation is in Figure

Fig: Locations of plate characters

Final approach is necessary for template matching. For matching the characters with the database, input images must be equal-sized with the database characters. Here the characters are fit to dimension. The extracted characters cut from plate and the characters on database are now equal-sized. The next step is template matching. Template matching is an effective algorithm for recognition of characters. The character image is compared with the ones in the database and the best similarity is measured.

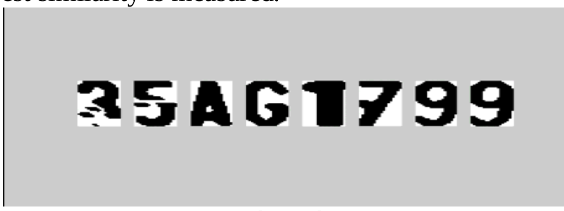


Fig: Equal size characters

This system used the database as the license plates characters all 33 alphanumeric characters (23 alphabets and 10 numerals). The flowchart for the proposed system is shown below.

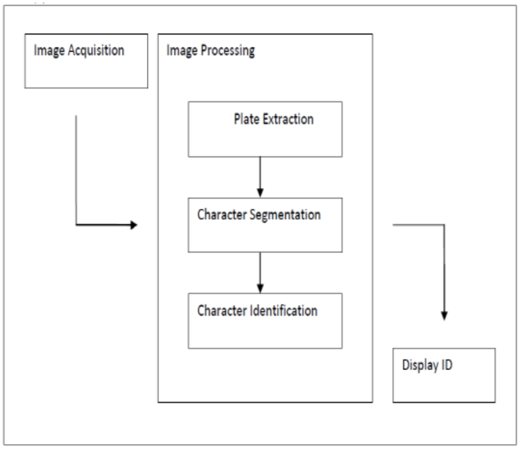


Fig: Flowchart for Proposed license plate localization method.

The LCR systems work efficiently under certain conditions. And some of the commercial products available in the market are also introduced with their details features.

IV. EXPERIMENT RESULT

In the proposed model, various samples of number plates have been taken and GUI is implemented using MATLAB. The result of the experiment shows 80% accuracy. The following table shows the result.

The average recognition rate is 0.306 sec. The GUI program takes number plate image as their input and process it. If the number is identified then the output will be displayed. The time graph and the HUI output is shown.

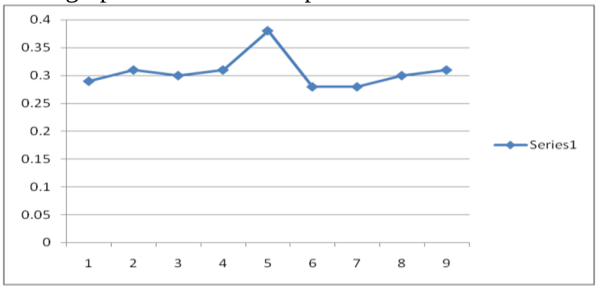
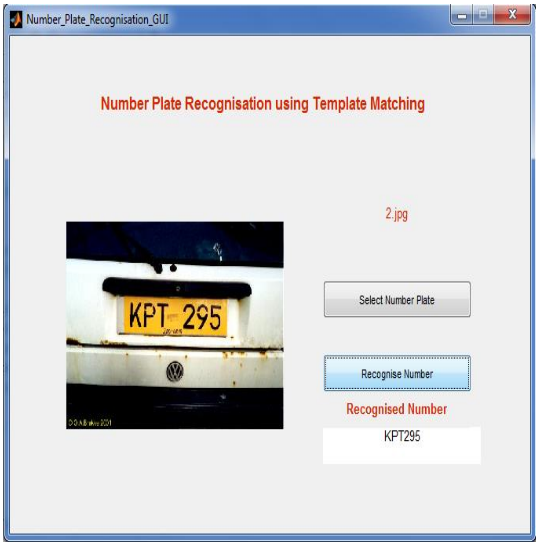


Fig: Average Recognition Time Graph



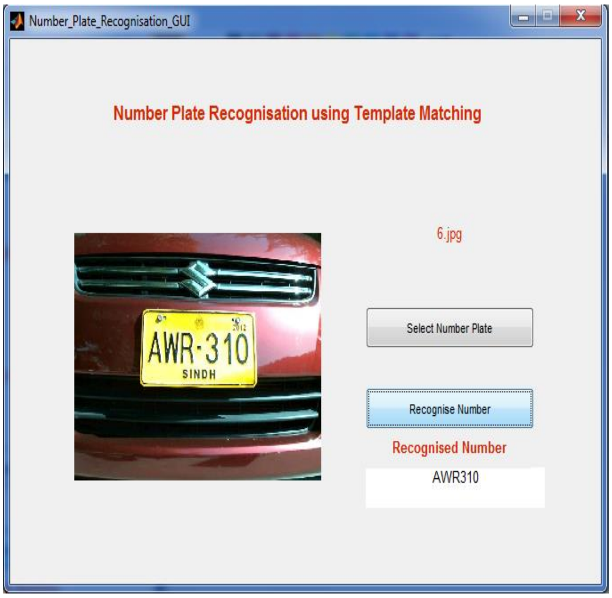


Fig: GUI output

V. CONCLUSION

The process of vehicle number plate recognition requires a very high degree of accuracy when we are working on a very busy road or parking which may not be possible manually as a human being tends to get fatigued due to monotonous nature of the job and they cannot keep track of the vehicles when there are multiple vehicles are passing in a very short time .To overcome this problem, many efforts have been made by the researchers across the globe for last many years.

A similar effort has been made in this work to develop an accurate and automatic number plate recognition system. We have used moving window method to obtain the desired results. The setup has been tested for various vehicle number plate images containing different number plates from different states. In the process of final evaluation after optimizing the parameters like brightness, contrast and gamma, adjustments, optimum values for lightening and the angle from which the image is to be taken. We get an overall efficiency of 80 % for this system. Though this accuracy is not acceptable in general, but still the system can be used for vehicle identification. It may be concluded that the project has been by and far successful. It can give us a relative advantage of data acquisition and online warning in case of stolen vehicles which is not possible by traditional man handled check posts.

Though we have achieved an accuracy of 80% by optimizing various parameters, it is required that for the task as sensitive as tracking stolen vehicles and monitoring vehicles for homeland security an accuracy of 100% cannot be compromised with. Therefore to achieve this, further optimization is required. Also, the issues like stains, smudges, blurred regions & different font style and sizes are need to be taken care of. This work can be further extended to minimize the errors due to them.

b. S.NO	c. Image	d. Time (in Sec)	e. Recognition
f. 1	g. 1.jpg	h. 0.29	i. Yes
j. 2	k. 2.jpg	l. 0.31	m. Yes
n. 3	o. 3.jpg	p. 0.3	q. No
r. 4	s. 4.jpg	t. 0.31	u. yes
v. 5	w. 5.jpg	x. 0.38	y. Yes
z. 6	aa. 6.jpg	bb. 0.28	cc. Yes
dd. 8	ee. 8.jpg	ff. 0.28	gg. No
hh. 9	ii. 9.jpg	jj. 0.3	kk. Yes
ll. 10	mm. 10.jpg	nn. 0.31	oo. Yes

VI. REFERENCES

[1] L. Zheng, X. He, Q. Wu, T. Hintz, 'Number Plate Recognition without Segmentation', Proceedings of Image and Vision Computing New Zealand 2007, pp. 164–168, Hamilton, New Zealand, December 2007.

[2] A.S. Johnson, B.M. Bird, 1990, "Number-plate Matching for Automatic Vehicle Identification," IEEE Colloquium on Electronic Image and Image Processing in Security and Forensic, April, 1990.

[3] D.G. Bailey, D. Irecki, B.K. Lim and L. Yang "Test bed for number plate recognition applications", Proceedings of First IEEE International Workshop on Electronic Design, Test and Applications (DELTA'02), IEEE Computer Society, 2002.

[4] Cheng, Y., Lu, J., Yahagi, T.: "Car license plate recognition based on the combination of principal components analysis and radial basis function networks." Signal Processing, Proceedings, ICSP '04, 7th International Conference, vol.2, pp. 1455-1458(2004).

[5] Sangeeta Agrawal, Rohit Raja, Sonu Agrawal, "Support Vector Machine for age classification", in the proceedings of International Journal of Emerging Trends and Advanced Engineering, Volume 2, Issue 5, May 2012.

[6] M.I.Khalil," Car Plate Recognition Using the Template Matching Method", International Journal of Computer Theory and Engineering, Vol. 2, No. 5, October, 2010, 1793-8201.

[7] Francesca O.:Experiments " License Plate Recognition System." DISI, Università degli Studi di Genova, Technical Report number: DISI-TR-06-17(2007).

[8] Yoh-Han Pao, "Adaptive Pattern Recognition and Neural Network." Pearson Education Asia, 2009. Joon Kim, "Automatic recognition of a car license plate using colour image processing," Image Processing, 1994. Proceedings. ICIP-94., IEEE International Conference, vol.2, no., pp.301, 305 vol.2, 13-16 Nov 1994.

[9] Eun Ryung Lee; Pyeoung Kee Kim; Hang

[10] Tavsanoglu V, Saatci E. "Feature extraction for character recognition using Gabor-type filters implemented by cellular neural networks," Proceedings of the 2000 6th IEEE International Workshop on Cellular Neural Networks and their Applications, IEEE. 2000, pp.63-8. Piscataway, NJ, USA.

[11] Hui Wu and Bing Li, "License Plate Recognition System," in International Conference on Multimedia Technology (ICMT), 2011, pp. 5425-5427.

[12] sonu agrawal, sushil kumar, Sanjay Kumar, "A Novel Idea for Age Invariant Face Recognition" , in the proceedings of International Journal of Advanced Research in Computer Science and Software Engineering (IJARCSSE-2014) Volume 3, Issue84, July 2014.

[13] H.J.Kim, D.W.Kim, S.K. Kim, J.V. Lee, J.K. Lee, 1997, "Automatic Recognition of Car License Plates Using Color Image Processing,"

[14] Er. Kavneet Kaur1 , Vijay Kumar Banga2 ,Number Plate Recognition Using OCR Technique, International Journal of Research in Engineering and Technology Vol-2, September – 2013, ISSN: 2319-1163.

[15] Pooja Kamavisdar, Sonam Saluja, Sonu Agrawal "A Survey on Image Classification Approaches and Techniques" International journal of advanced research in Computer and Communication Engineering, Volume 2, Issue 1, January 2013.

[16] Sonam Saluja, Aradhana Kumari Singh, Sonu Agrawal, "A Study of Edge-Detection Methods" International journal of advanced research in Computer and Communication Engineering, Volume 2, Issue 1, January 2013

[17] Sonu Agrawal, Sushil Kumar, Sangeeta Agrawal, "A Survey on Face Recognition Techniques", in the proceedings of International Journal of Engineering Research and Applications (IJERA – 2012), Volume 2, Issue 4, July 2012.

[18] Yoshimura H, Etoh M, Kondo K, Yokoya N."Gray-scale character recognition by Gabor jets projection," Proceedings 15th International Conference on Pattern Recognition, ICPR-2000. IEEE Comput. Soc. Part vol.2, 2000, pp.335-8 vol.2, Los Alamitos, CA,USA.

Mr. Jugal Kishore Mishra is a ME (CTA) Scholor in Shri Shankarcharya Technical Campus, Junwani, Bhilai.

Prof. Sonu Agrawal received his M.Tech (Gold Medalist) degree in Computer Technology from National Institute of Technology (NIT) Raipur, India in 2008. He is pursuing Ph.D. from CSVTU, Bhilai. He has seven years long experience in the field of teaching. His research areas are Wireless Computer Network, MANET, Bluetooth Network and its Enhansement, His research work has been published in many national and international journals.