

Certain Investigations on Vehicles Number Plate Identification using Top Hat Transform Algorithm and Optical Character Recognition

M. Mervin Paulraj
PG Student,
Department of Electronics and Instrumentation,
Bharathiar University- Coimbatore,
Tamil nadu, India.
E-mail: mervinpaulraj15@gmail.com

Dr. J. Vijayakumar
Associate Professor and Head,
Department of Electronics and Instrumentation,
Bharathiar University- Coimbatore,
Tamil nadu, India.
E-mail: vijayakumar@buc.edu.in

Abstract— Investigation on vehicles number plate with top hat transforms is the method to recognize the characters on number plate utilizing the process like Image processing and OCR. The conception of this project is, first the image of the vehicle is to be captured. Next, the number plate of the vehicles is extracted from captured images using Top Hat transform algorithms. Conclusively, Optical Character Recognition recognizes the character presented in number plate. Additionally, the extracted data is stored in our database. This project can be implemented on various security zones like Parking Systems, Traffic Control areas, Toll gates, tracking of vehicles, etc. In the current scenario, the usage of vehicles increases day by day. Hence it's impossible to maintain the record manually for entire Vehicles. By expanding this system it becomes easy to sustain such rather records. In the majority of the nations, the extent of the number plate relies upon the aspect ratio. It can be figured by Width over Height. This work proposes the strategy for following Indian Number Plates of the vehicle. While contrasting other number plate extraction strategy this technique varies in such a path, in several strategies, they utilized just an area of a number plate for recognizing the character. However, in this method the entire vehicle can be included which first finds the particular zone of number plate then it executes character Recognition. Template matching technique where used in previous methods of number plate identification which one and only needs an area of a number plate. The disadvantages of previous techniques are it can only recognize already stored character in the templates and if there is more than one number plate, it is impossible to identify the sector of the number plate. Therefore to overcome such errors, we developed this algorithm which relatively gives better results while comparing with other methods. The absolute time taken for one execution is below 5 seconds.

Keywords- Number plate Recognition, OCR, Top-Hat transform.

I. INTRODUCTION

In our life Number Plate Recognition, systems are the most primary method used in Intelligent Transportation Systems (ITS). It portrays a crucial role in transportation. The use of vehicles in the day to day life gets increased due to the population of human beings. Due to this monitoring of vehicles becomes harder. Hence Number Plate Recognition system is the technique used for monitoring of such vehicles. This system uses image processing to recognize the vehicles by tracing their number plates without human effort.

In most of the countries, features of the number plates were strictly maintained like Size of number plates, the Background colour of number plates, Colour of characters, Font size, Space between characters, Number of lines in the plate, etc. In most of the countries, the size of the number plate depends on the aspect ratio. It can be calculated by Width over Height. But while comparing to other countries the extraction of number plate from Indian vehicles is much difficult because in India there is no standard is followed like aspect ratio. Hence Number plate extraction of Indian vehicles gets difficult. Indian number plates can be categories into two types such as

1. Commercial Vehicles
2. Private Vehicles

In the Commercial Vehicles number plates, it has Yellow colour as its background and characters were in Black colour while on Private Vehicle's number plate it has White colour as its background and characters were in Black colour. According to the Indian Vehicle Registration scheme it consists of two

letter code which indicates the states followed by two numbers which denote the districts and it is followed by the series of alphanumeric code which uniquely identifies the Vehicles.

This work proposes the method for tracking Number Plates of the Indian vehicle. While comparing with other number plate extraction method this method differs in such a way, In other methods, they utilized only an area of a number plate for Character Recognition but in our method, the whole vehicle can be involved which first finds the specific area of number plate then it performs Character Recognition.

II. REVIEW AND PERFORMANCE ANALYSIS

The algorithms for image processing involves in various steps such as filtering, edge detection, OCR etc. The rapid and efficient system is designed for detection of far number plate [1] using Gabor filter and OCR. Neural based OCR system is manufactured [2] for ANPR applications. Any font of the texts or any positions of the numbers were identified by the system [3]. The ambiguous characters are recognized by the system [4, 5], which is based on the analysis of position and angles. Those outputs will be compared with the informations of the vehicle like vehicles owner name, registration place, owner's address, etc. The NPR preliminary stages are reviewed [6], which describes the localization and orientations of number plates.

The fast and uncomplicated method is presented [8, 12] for detecting vehicle number plates by using Vertical Edge Detection Algorithm. After this process, the output image is performed through the deviation () of the Gaussian filter and

the noise will be removed using filtering techniques [9]. Edge detection techniques [10] are also important step to recognize the number plates and its characteristics. In this research paper, the car number plates will be detected using morphological and top-hat operators. An efficient system is presented to detect double row plates [13].

This work can be implemented on automatic toll collection [14, 15], Parking areas [16, 17], High-security areas [18], Intelligent Transport System [19], Tracking of vehicles in real time [20].

III. METHODOLOGY

3.1. Flow Diagram

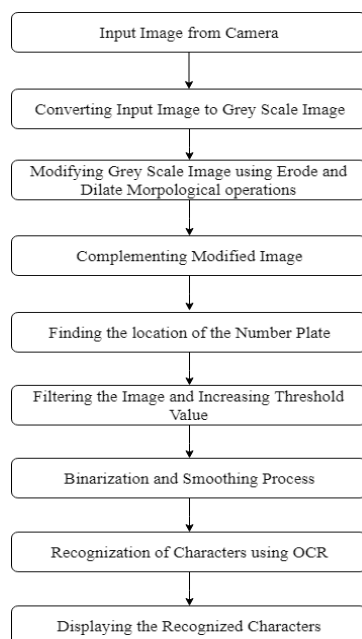


Figure 1 Flow Diagram of Proposed Method

Fig.1 explains the working process of the proposed algorithm. First, the input image is captured using 4 different types of cameras such as Canon EOS 60D, Nikon D5100, USB 2.0 VGA UVC Webcam and MI A1 android device. Then the image will be converted to the greyscale image. Then, the contrast of the image is enhanced using Top-hat colour enhancement method. After that, the background of the image is cleaned and number plate detected using a combination of two top hats. After detecting number plate characters in the number plate should be extracted. For this purpose, the image is a threshold and binarized. Finally, the output image is passed through OCR for extracting the characters.

3.2. Proposed Method

Step 1 - The input images are captured using different cameras like Canon EOS 60D, Nikon D5100, USB 2.0 VGA UVC Webcam and MI A1 android device. The input image format is jpeg.

Step 2 - RGB components can't be used throughout this algorithm. So the input 3-D coloured image is converted to 2-D grey image for further processing.

Step 3 - Now the grey scale image is modified by, erodes and dilates operations to increase the contrast of an image. These erode and dilated operation is followed by the guidelines of Top Hat contrast enhancement.

Step 4 - In this step, contrast enhanced image is complemented. The reason for complementing the image is, at the next step we are using Top and Bottom hat algorithm which detects the rugged region of the plate which is in rectangular form.

Step 5 - The both top-hat algorithm is implemented for analyzing the image to find the area of the plate. The essential requirements are to preserve shapes of letters.so that it can easily recognize the characters by further steps.

Step 6 - For finding area of the number plate, directional filtering is used. A directional filter constitutes some basic edge detection technique.

Step 7 - After passing the image through the directional filter the edge of the plate can be identified and now to consider the character in the number plate. Therefore, the character presented in the edge filtered area is separated for further operation.

Step 8 - For finding the character in the detected plate area, the image obtained in the previous step is subtracted with the grey scale image. Now in the complete image, only the area of character presented gets displayed.

Step 9 - Thresholding is the process that converts the grey scale image to binary image. Image Binarization converts an image of 256 grey levels to a b/w image. Binarization is a pre-processor for OCR. Most of the OCR packages work only on bi-level images.

Step 10 - The last step is to adjust the image which is applied for OCR. For this process, the Modified top hat image is complimented and their output image is added to the last binarize the image. Which removes the black background.

Step 11 - The printed texts in the number plates are converted into machine-encoded characters using Optical character recognition. By using this toolbox characters are extracted from the last output image.

IV. RESULTS AND DISCUSSIONS

In this research paper, four types of cameras are used for capturing the image. The first two images were captured by DSLR cameras such as Canon EOS 60D and Nikon D5100. The last two images were captured by ordinary cameras like USB 2.0 VGA UVC Webcam and 12MP dual Camera of MI A1 android device. MATLAB R2017a is used as the software platform. The original image and resultant character extracted images are shown in following figures.

In Figures 2, 3 and 4 the contrast of an image is enhanced. In Figures 5 and 6 backgrounds are cleaned. In Figures 7, 8 and 9 area of the number plate is detected. In figures 10 and 11 characters in number plate are highlighted for extraction. In Figure 12 the characters are extracted using OCR. The proposed method is rapidly executed within minimum 2 seconds and maximum 5 seconds. Hence, the proposed method has the low elapsed time which makes the quick response from possible outcomes.



Figure 2. Input image from the camera

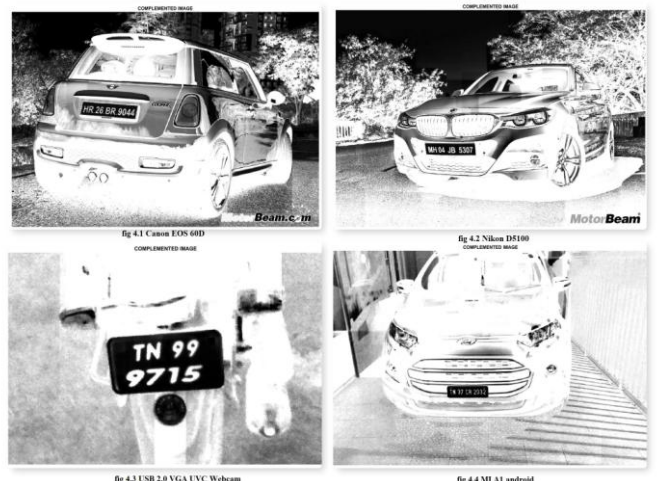


Figure 5. Complementing Modified Image



Figure 3. Converting input image to grey scale image



Figure 6. Applying Tophat and Bottom-Hat Algorithm



Figure 4. Modifying image using Top-hat contrast enhancement



Figure 7. Applying Filter to detect area of plate

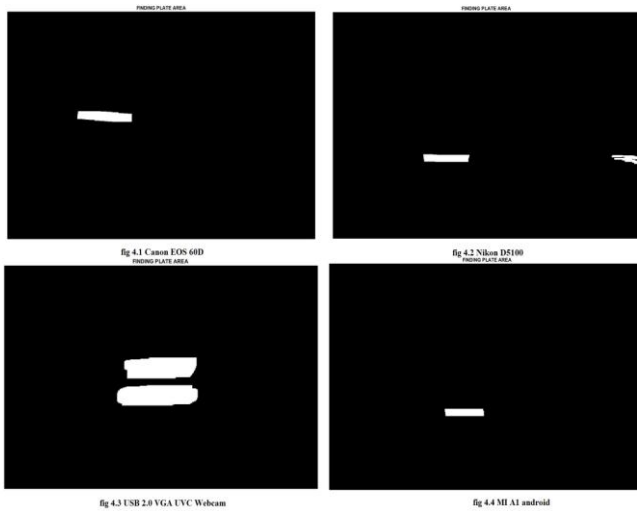


Figure 8. Finding plate area

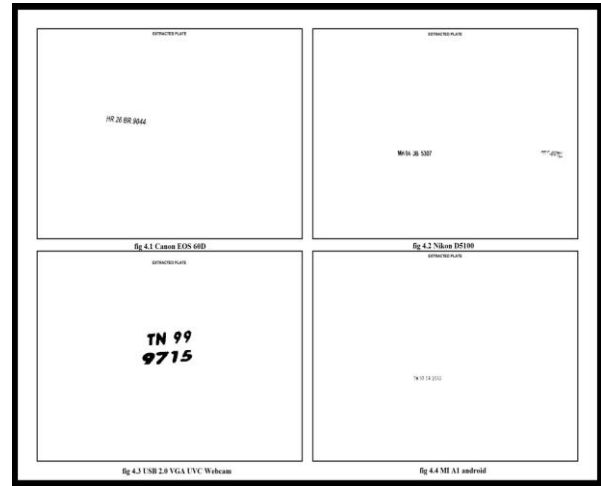


Figure 11. Extracting characters in plate



Figure 9. Finding Characters on Plate



Figure 12. Optical Character Recognition

V. CONCLUSION

We have checked and evaluated various number plates using Top Hat Transform algorithm and OCR technique and found some of the factors which affect OCR technique, i.e. type of font, noise, tilting, shape etc. In future the work can be done on these factors and efficiency may be increased more considerably for more valid results. This OCR technique recognizes most of the fonts, if there is a problem in recognizing the fancy fonts then the template matching technique is used for a better result, but the problem is if template matching technique is used only the font in the saved template gets recognized. Tilting can be reduced by calibrating the position of the camera. The efficiency in recognizing character is 90 %. Absolute time taken for an individual process is below 5 seconds.



Figure 10. Thresholding and Binarization

REFERENCES

- [1] Aarti Soni, Dr.Raman Chadha, Sukhmeet Kaur, 'Automated Car Number Plate Detection System to Detect Far Number Plates', International Journal of Computer Applications, July 2016, ISSN (online): 2349-784X, Volume 3, Issue 01
- [2] Aarti Soni and Sukhmeet Kaur, 'Vertical-Edge-Based Car-License-Plate Detection Method', 'IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE)', Jan. Feb. 2017, e-ISSN: 2278-1676,p-ISSN: 2320-3331, Volume 12, Issue 1 Ver. II, PP 01-06
- [3] Amina Khatra,, 'Vehicle's RC Plate Tracking based on Image Processing Applications', 'International Journal of Scientific Engineering and Research', Dec-2013, ISSN (Online): 2347-3878, Volume 1 Issue 4
- [4] Ankita Lad, Mr. Dhaval Patel, 'Review Of License Plate Recognition (Lpr) Using Edge Detection', 'IJARIE',Apr-14, ISSN(P): 2249-6831; ISSN(E): 2249-7943, Vol . 4, Issue 2 , 197-204
- [5] Ankita Lad, Mr. Dhaval Patel, 'Online Vehicles License Plate Detection and Recognition System using Image Processing Techniques' April 16-18, 2006, 'Proceedings of the 5th WSEAS International Conference on Applied Computer Science, Hangzhou, China' (pp793-800)
- [6] Cosmo H.Munuo, Dr. Michael Kisangiri, 'Number Plate Recognition Using Ocr Technique', 'International Journal Of Research In Engineering And Technology', Sep 2013, eISSN: 2319-1163, pISSN: 2321-7308, Volume: 02 Issue: 09
- [7] Deepti Sagar, Maitreyee Dutta, 'A Neural Network based Character Recognition System for Indian Standard High Security Number Plates' Aug-2012, 'International Journal of Image Processing And Visual Communication', Volume 1,Issue 1
- [8] Isra A.R, A.Gokulanathan, 'Automatic Indian Vehicle License Plate Recognition', Jul-2013,'International Journal of Emerging Trends in Electrical and Electronics', ISSN: 2320 95693, Volume 5, Issue 03
- [9] Lakshmi Priya .V , K. Perumal, 'Recognition Of Vehicle Number Plate Using MATLAB' 'International Journal Of Research In Engineering And Technology', May-16, e-ISSN: 2395 -0056 |p-ISSN: 2395-0072 |Volume: 03 Issue: 05 |
- [10] Mahalakshmi .S, Prabha.M.Karani, 'Number Plate Recognition Using an Improved Segmentation', May 2014, 'International Journal of Innovative Research in Science, Engineering and Technology', ISSN: 2319-8753, Vol. 3, Issue 5
- [11] Marcin IWANOWSKI 'Automatic License Plate Recognition Using Optical Character Recognition Based on Image Processing' IJARIE, Vol-1 Issue-2 2015 IJARIE-ISSN(O)-2395-4396
- [12] Neethu Navas, Hema S. Mahesh 'VEDA based Car License Plate Recognition' International Journal of Science Technology & Engineering , May-2016, ISSN (online): 2349-784X, Volume 2, Issue 11
- [13] Seetharam S, Suresh Kumar M, Sai Saravana Harish R, Manikandan T , 'An Efficient Method of Number Plate Extraction from Indian Vehicles Image', Proceedings published in International Journal of Computer Applications , Feb-2014, ISSN : (0975 8887), Volume 88 No.4
- [14] Namrata Shirodkar, Preksha Uchil, 'Number Plate Detection using Image Processing for Automated Toll Collection to prevent fraudulent behaviour' International Journal of Advanced Research in Computer Engineering & Technology, May-2015, ISSN: 2278 1323, Volume 4 Issue 5,
- [15] Shoaib Rehman Soomro, Mohammad Arslan Javed, Fahad Ahmed Memon 'Vehicle Number Recognition System For Automatic Toll Tax Collection' IEEE, 2012 , 978-1-4673-4886-7/12/\$31.00
- [16] Bhawna Tiwari, Archana Sharma, Malti Gautam Singh, Bhawana Rathi , 'Vehicle Plate Extraction and Recognition using Hopfield Neural Network and Comparison with DWT, Correlation and NN Algorithms' International Journal of Application or Innovation in Engineering and Management, May-15, Volume 4, Issue 5, ISSN 2319 – 4847
- [17] Nidhi, Sachin Tyagi, 'Automatic Number Plate Recognition by Using Matlab' International Journal of Innovative Research in Electronics and Communications, June 2015, Volume 2, Issue 4,PP 1-7, ISSN 2349-4042 (Print) & ISSN 2349-4050 (Online)
- [18] Ms. Shilpi Chauhan and Vishal Srivastava, 'Matlab Based Vehicle Number Plate Recognition' International Journal of Computational Intelligence Research, 2017, ISSN 0973-1873 Volume 13, Number 9, pp. 2283-2288
- [19] Kumhari Bhikshapathi ,Dama Haribabu, 'A Review-Recognition Of License Number Plate Using Character Segmentation And Ocr With Template Matching' International Journal of Advanced Research in Computer and Communication Engineering, Feb-2016, Vol. 5, Issue 2, ISSN (Online) 2278-1021, ISSN (Print) 2319 5940
- [20] Asad Ali Safi, Muhammad Azam, Shahbaz Kiani, Nadeem Daudpota, 'Block-Based Neural Network for Automatic Number Plate Recognition' International Journal of Scientific and Research Publications, ISSN 2250-3153, Volume 4, Issue 9