Open Road Tolling Using Pattern Recognition

Supreethkumar S Naik[1], Th Bidya Chandra Singha[1], Venkatesh N[1], Sumaiya Tasneem[1], A Rafega Beham[2],

Dr.Jitendranath Mungara[3]

B.E Student, Dept. of I.S.E, New Horizon College of Engineering, Bangalore, Karnataka, India [1]

Senior Assistant Professor, Dept. of I.S.E, New Horizon College of Engineering, Bangalore, Karnataka, India [2]

HOD, Dept. of I.S.E, New Horizon College of Engineering, Bangalore, Karnataka, India[3]

ABSTRACT: In India, most of the highway toll plaza is manually operated involving hard cash and paper reciept. Thus this system requires vehicles to stop or slow down for toll payment, which results in traffic congestion and reduce fuel efficiency. Open road tolling (ORT) system eliminates these problems by allowing the vehicles to pass without slowing or stopping. The system uses minimal hardware and software components reducing maintenance costs while most of the processing is done on software side. Vehicle number plate recognition is achieved by pre-processing input number plate followed by localization of number plate, extracting the characters and resizing them to match with templates.

KEYWORDS: Open Road Tolling, Number plate recognition, Region props, Template matching

I. INTRODUCTION

In metropolitan cities like Mumbai and Bangalore, where vehicle population is about 6.5 billion, it is difficult to keep track of each vehicle. Because of huge increase in population of vehicles day by day it is a serious task for traffic management to control traffic. Traffic Congestion will also occur at Toll plazas where driver has to wait in the queue. In Order to eliminate this problem we use the concept of Open Road Tolling. Earlier existing systems like Barcode scanner and Transponders. In Barcode Scanners the waiting time of the driver at toll booths will increase usually. Barcode scanner is similar to the traditional manual collection system and it is not ideal for new users. Transponders are usually costly and they are also not ideal for new users. Because of this reason we had to use the concept of ORT. [1] Open Road tolling uses Number Plate as an input. After pre-processing Number plate it is used for further Analysis like toll collection [2], security purpose, sending notifications to the owner. In Open Road tolling we have hardware and software requirements. In hardware requirements it consists of high end camera. In software requirements it uses image processing and pattern matching. In order to recognize Number plate, it generally has following steps 1) Image Acquisition 2) Pre-Processing 3) Localization 4) Segmentation 5) Recognition. Image Acquisition is to obtain image from source, Pre-Processing is done to enhance the quality of the image, [3] Localization is to obtain the image of Number plate. After obtaining the processed image the characters are segmented [4] and recognized with already stored templates. For character recognition template matching algorithm is used. In this paper we propose another method called image correlation method which is much simpler than template matching

II. RELATED WORK

There are many algorithms used for character recognition method but the most used traditional one is template matching. In the Open Road Tolling earlier template matching algorithm is used for number plate recognition and for localization of Number plate histogram method is used. In the first step we acquire an image from a high end camera. The image is converted to grey scale image because to enhance the image of the number plate. The grey scale image is subjected to morphological dilation and erosion operations. These operations are carried out to remove noise from the image. Horizontal and vertical histogram edge based method is used for localization of the number plate. In this method the difference of each connected pixel in row wise and column wise is calculated. As number plate contains plain background with letters and numbers in it the difference in connected pixels, edges of the letters and numbers is very high. Therefore number plate may have high horizontal and vertical histogram values. These areas can be removed out

by using dynamic threshold. After obtaining only the number plate region each character is segmented and it is resized to match with the already stored templates. But there are few drawbacks of using this method. The localized number plate will not segment the characters properly most of the times. So the number plate is not recognized properly which cannot be used for further purposes.

III. METHODS USED

The Open Road Tolling system needs to be fast as it allows vehicles to pass through the toll plaza at normal speed. Hence the method used in ORT system needs to be lightweight on the software side. Only the character recognition and validation with database needs to be done at the software side.

Motivation to use our method is as follows

1. A lightweight method needs to be used since system is expected to be fast. The number plate localization method is shortened and integrated into character recognition method, since focused image will be obtained from the camera.

2. System is easier to implement and results conform with real world scenarios. Billing notification will be sent immediately after passing through toll plaza.
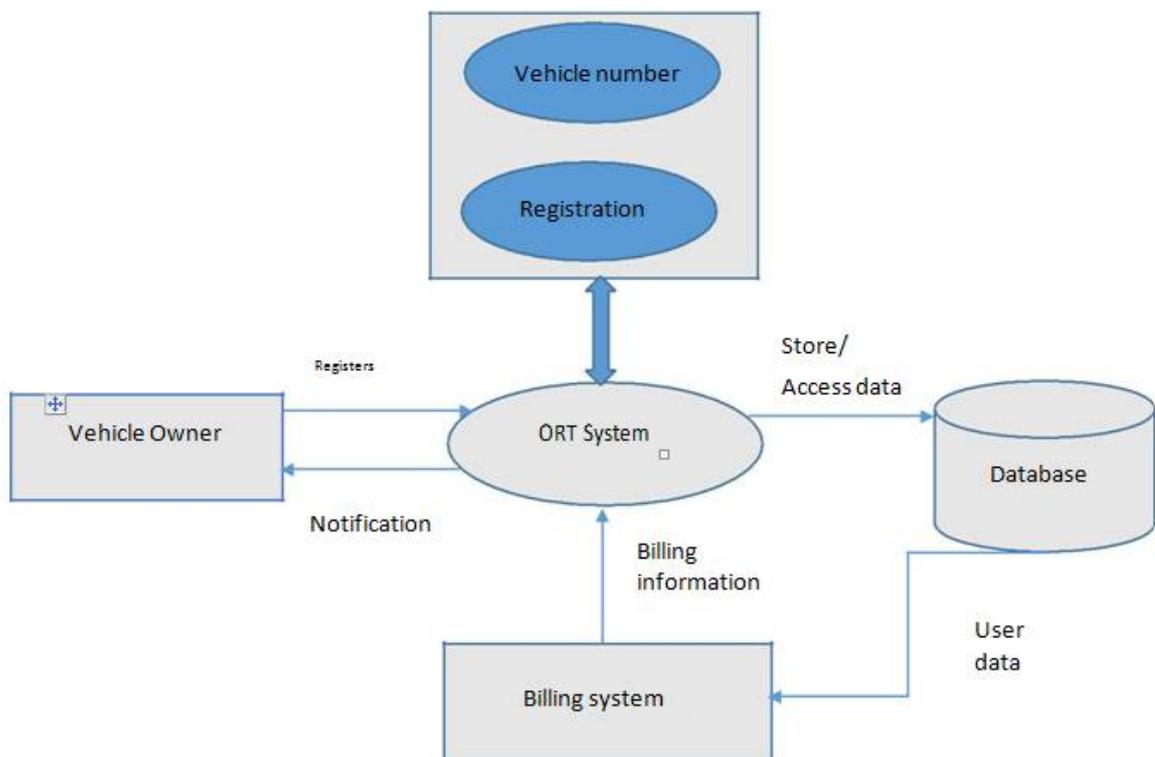
The image is first pre-processed and converted to grey scale. After converting to a grey scale the threshold value of image is calculated to reduce intra class variance of black and white pixels. After calculating the threshold value of grey scale image it is converted to binary image which has black and white as pixel values. The threshold value of the binary resets all black pixel value 1 to 0 and white pixel value 0 to 1 The binary image of a number plate contains not only alpha-numeric characters but can also contain other non-desirable portions considered as noises and need to be removed e.g. screws on the plate. To remove these relatively small image objects, the binary image is subjected open area operation by specifying an experimentally determined value v such that all objects containing number of pixels smaller than specified value is removed. To determine the total number of alpha-numeric characters in the number plate, a connected component labeling using an 8-level connectivity is performed. This returns the total number of characters n in the plate. Each character of the processed binary number plate image is segmented using Bounding box method. This method will segment each character and will crop the characters and resize it to match with templates. For number plate recognition technique image correlation method is used. This method has less processing steps, yet it is much faster, straight forward and reliable technique where segmentation and recognition steps will carry out properly.

Since localization is not done on the software side, it is expected to be adjusted on the hardware side. The camera is expected to have setup in such a way that the zoom or focus will be set on the number plate. Treadles can be used to time the focus. Adequate light can be provided at toll plaza or the camera can be setup with flash light to improve the recognition rate.

IV. EXPERIMENT AND ANALYSIS

FACTORS INVOLVED

1. **Adequate lighting**

Since greyscale and image binarization is involved, it is seen that any shadows with greater threshold value is also taken in consideration for character recognition. If a character has overlapped with the shadow with greater threshold, then there are chances that during binarization the character merges with shadow and deemed as invalid character. This can simply be solved by having adequate lighting condition. As shown in figures below.
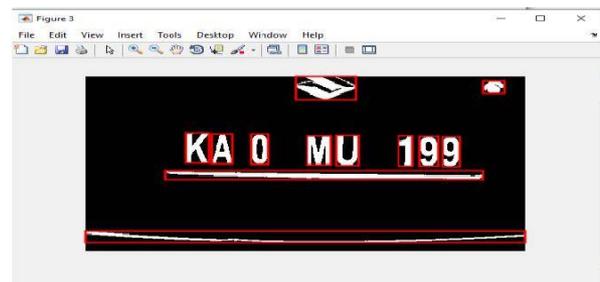

Fig.1 Vehicle with inadequate lighting

Fig.2 Missing character during recognition

Fig.3 Vehicle with adequate lighting


Fig.4 Fully recognized characters

In the above images, Fig. 1 Shows that with poor lighting condition, character '1' is merged with shadow and hence not recogized as seen in Fig.2. However, with adequate lighting in Fig. 3, all the characters are properly recognized as seen in Fig. 4.

Testing

SL. NO	NUMBER PLATE IMAGE	NUMBER PLATE	ERROR IN ALPHABET	ERROR IN NUMBER	ACCURACY
1		KA35N2089	NIL	NIL	100%
2		KA51MG5516	NIL	NIL	100%
3		KA03MS434	NIL	NIL	100%
4		KA01MN5281	NIL	NIL	100%
5		TN29BX1660	1	NIL	90%
6		KA0HT8502	NIL	1	90%
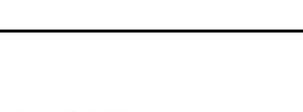
The characters from number plate in image 1 to 4 have been recognized correctly, and has an accuracy of 100% .In images 5 only one character ie, 'B' is incorrectly interpreted as '8'. This is due to diversity in template and can simply be solved using better template. In image 6 one number is not recognized properly. This is because the screw overlapping on the character, interferes with character recognition and noise elimination. Hence from our experimentation, classification rate comes to 96.67%.

V. CONCLUSION

In order to improve the recognition rate in open road tolling system various methods can be used. The existing method has low recognition rate and it has lot of processing steps to be implemented in horizontal and vertical histogram techniques. In image correlation method it is implemented in matlab software where it is easier to implement. Image correlation method is a straight forward approach, reliable technique and easy to implement. The character segmentation and recognition technique will occur in a systematic way in the proposed method but in the existing method character segmentation and recognition technique will not happen correctly. However it must be seen that the method used will be simpler, light and robust.

REFERENCES

[1]   D. Jadhav and M. Sabnis, *"Open road tolling in India by pattern recognition,"* 2015 International Conference on Technologies for Sustainable Development (ICTSD)*, Mumbai,2015,pp.1-5.doi: 10.1109/ICTSD.2015.70*95911.

[2]   Priyanka Chhoriyal, Govinda Paliwal, Poonam Badhan, "Image Processing Based Automatic Toll Booth in Indian Conditions", *UETAE*, vol. 3, no. 4, April 2013.

[3]   Satadal Saha, Subhadip Basu, Mita Nasipuri, Dipak Kumar Basu, "License Plate Localization from Vehicle Images: An Edge Based Multi-stage Approach", International Journal of Recent Trends in Engineering*, vol. 1, no. 1, May 2009.*

[4]   Chetan Sharma, Amandeep Kaur, "INDIAN VEHICLE LICENSE PLATE EXTRACTION AND SEGMENTATION", International Journal of Computer Science and