



## An Extensive Framework towards the Design of Number-Plate Authentication (NPA) System

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**Abstract**— Lot of research took place in the field of automatic number plate recognition in last few years as security become an important aspect. The proposed model is also based on optical character recognition (OCR). The detection of Indian vehicles by their number plates is the most interesting and challenging research topic from past few years. It has been seen that the vehicle number plates are in diverse size and shape and also have diversity in color on the basis of country. This paper focuses on an approach based on straightforward but well-organized morphological operation and a well-known edge detection approach. Number plate authentication is widely used in areas such as vehicle parking, traffic management, access control for highly secured areas, and monitoring of theft vehicles. The proposed method will work on both white and yellow color plates. Here with recognition of number plate, authentication of number as well as vehicle color verification is done. Vehicle color verification is also done to make sure that in case of vehicle robbery victim may replace the theft vehicle number plate with different registered number plate. When system monitors the number it will found it registered and grant permission. Here vehicle color will increase system reliability. The work is divided in to two phases. In first phase, activities like license plate location detection, image acquisition, optical character recognition (OCR) and edge detection technique is applied on input image. The outcome of first phase is segmented characters. Second phase involves activities like template matching and vehicle color verification. The paper also intends vehicle authorization by verifying number and vehicle color from vehicle registration database.

**Keywords**— Number Plate Authentication (NPA), Optical Character Recognition (OCR), Edge Detection, Template Matching

### I. INTRODUCTION

Vehicle Number plates are prime thing of the basis of which identification is done. Identification of Vehicles is done either manually or automatically. Automatic identification is an application of image processing technique. Automatic vehicle identification and authentication systems are used for the purpose of parking, traffic management, access control and tracking of wanted vehicles.

Digital image is an input to the system and that captured image will do through with various image processing techniques like image acquisition, enhancement, morphological imaging, segmentation and pattern matching, recognition etc. All these work is categorized in two phases.

- a. In first phase, activities like license plate location detection, extraction and segmentation.
- b. Second phase involves activities like template matching.

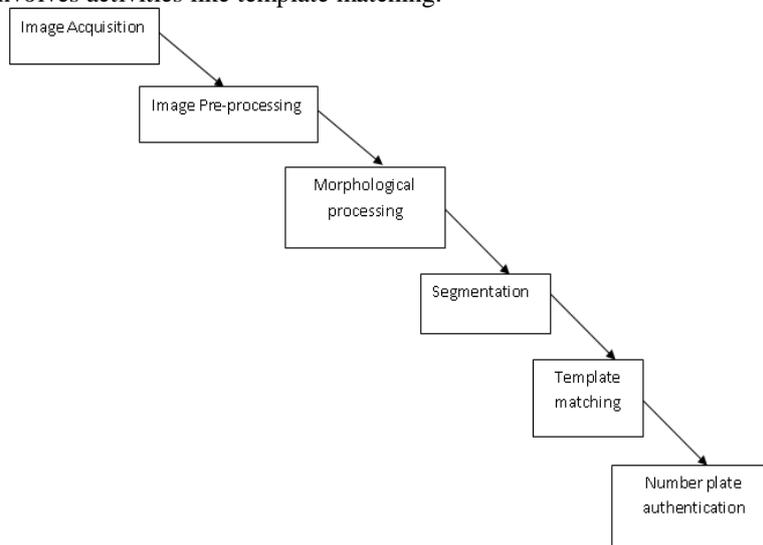


Fig 1: Fundamental steps of number plate recognition & Authentication

After recognition of vehicle plate number authentication check will be performed from database. If the recognized number is authentic the gate will be opened else if the vehicle number is not valid then the gate will remain closed and a report message will be generated to concerned security personnel. The fundamental step for the recognition and authentication process is shown in figure 1.

As it is known that all afford done in past year on the vehicle recognition process is based on optical character recognition.

## **II. RELATED WORK**

Lot of afford has been done in extraction techniques of vehicle number plate. As it is known that in India license plate is rectangular in shape. [1] [2] uses Edge Detection based method for detecting rectangle shape from input image. This is the simplest and efficient approach. [1] [3] uses Sobel edge detection to find the edges which is due to the color difference between number plate and vehicle body. [6] [7] [8] Image Morphology processing is used for extraction of the number plate from input image. It adds additional feature that helps in removal of unnecessary diminutive parts from number plate. [4] Has proposed a hybrid method which is combination of Edge Statistics and Morphology. The accuracy of locating vehicle number plate is 99.6%. [3] Has used Hough transformation to find the straight lines in an image which indicates the number plate. It is a boundary driven extraction approach which takes lot of computational time.

In [5] Optical Character Recognition is technique in image processing. It is used to classify/ scan alphanumeric text into computer – readable text to recognize the license plate. It requires pre-processing stage to remove the boundaries which helps in recognizing the characters. It process information more quickly, accurately and efficiently and also minimizes the errors.

In [10] Adaptive binarization is used to convert the intensity from evening to noon. In [13] fixed background color is used and it reduces the edge points and removes the fake regions.

[11] Uses Horizontal and Vertical Projection for segmentation propose. [12] Overcomes with its problem by combining Contour transform with Hough transform.

Template Matching [9] is used to test the characters with templates which are designed. It is useful for recognizing fixed size characters and non-broken. It finds small blocks of an image and match with template image. Template design is vital part of template matching. Template design must match templates to it corresponding image also have some amount of mismatch to other templates.

In [14] neural network approach is used then character is detected by matrix Mapping and Training. With this approach 96.53% average recognition rate is obtained by twice hidden layer.

In[15] Spectral analysis approach is used for pulling out license plate location from input image and connected-component analysis approach and SVM feature-extraction techniques are used for segmentation of character.

All the above related mentioned work as well as other work in this field only used optical character recognition and simple template matching but in these model there is a chance of forgery in case of theft if the victim is using a registered number plate in place of that theft vehicle number plate.

## **III. PROPOSED WORK**

The proposed method will work on both white and yellow color plates. Here with recognition of number plate, authentication of number as well as vehicle color verification is done. Vehicle color verification is also done to make sure that in case of vehicle robbery victim may replace the theft vehicle number plate with different registered number plate. When system monitors the number it will found it registered and grand permission. Here vehicle color will increase system reliability.

The work is divided in to two phases. In first phase, activities like license plate location detection, image acquisition, optical character recognition (OCR) and edge detection technique is applied on input image. The outcome of first phase is segmented characters. Here we use extensive edge detection approach with morphological processing like's dilation and erosion.

Second phase involves activities like template matching and vehicle color verification.

The fundamental steps of proposed model are shown below in figure 2. The steps are as follows:-

- I. Image Acquisition
- II. Pre-processing (e.g. like scaling, histogram equalization)
- III. Image Enhancement
- IV. Image Restoration and Degradation
- V. Color image processing
  - a. Vehicle color
  - b. Convert image in gray scale
  - c. Convert image in binary image
- VI. Identification of vehicle
  - a. Number plate area
  - b. Vehicle color
- VII. Morphological Processing & Segmentation
  - a. Noise filtering
  - b. Clip number plate
  - c. Number extraction

- d. Separate each number from plate and perform morphological operations
- VIII. Template Matching
- IX. Authentication of vehicle number (template generated number from database) and verification of vehicle color from database.

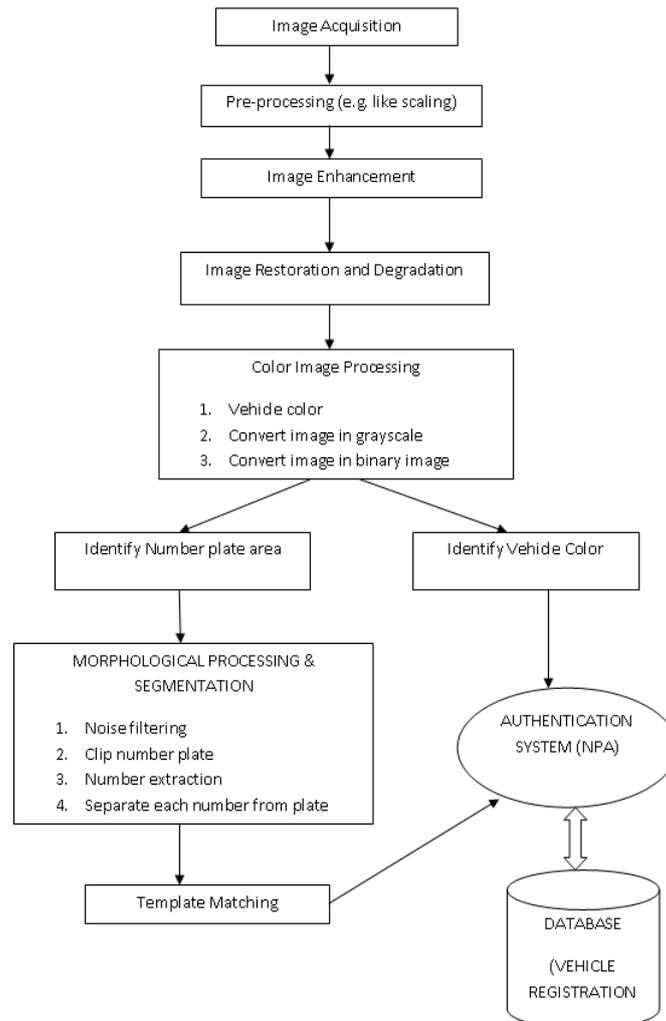


Fig 2: Number Plate Authentication (Npa) System

0	1	2	3	4	5	6	7	8	9	A	B	C	D	E
F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
U	V	W	X	Y	Z									

Fig 3: Templates used for matching

The template generated number and template based matching is done with the help of templates shown in above mentioned figure 3.

#### IV. CONCLUSION

The above proposed work uses a fast approach for recognizing number plate. This approach is a hybrid approach which is combination of pre-processing like histogram equalization, edge detection, morphological processing and segmentation. In first phase of number plate extraction, extraction is done on features such as the color, the boundary, or the presence of the characters. Here vehicle color is also recognized. In character segmentation stage, the extraction of characters is done by projecting characters color info, by characters labelling, or by matching characters position. In second phase, the recognition of characters is done by template matching technique. Just because of formatting of various license plate it becomes quite a tedious task to automatically recognize license plate also backgrounds and environment increase the challenge. In future MATLAB based implementation will be done with more security and accuracy parameters & email control will be developed to send notification.

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