

Vehicle Number Plate Detection and Owner Identification

Ashwin Jaware(1), Shailesh Nirmal(2), Dnyaneshwar Borole(3)

*Department of IT
Student, (Pravara Rural Engineering College Loni,Ahamadnagar)*

Abstract

Identification of cars and their owners is a tedious and error prone job. The advent of automatic number plate detection can help tackle problems of parking and track control. The system is designed using image processing and machine learning. The image of vehicle is captured, which is preprocessed using techniques like grayscale, binarization. De-noising of number plate is done using various filters. The characters of the number plate are segmented by CCA and ratio analysis as well. After the Detection is completed then we will identify the vehicle, We check that number plate in our database is valid or not. If it is valid then the entry details of the vehicle will be stored in the other database. If it is not found in our database it will find on the web and store the details. When the vehicle is return it will check the previous database and store the exit time of vehicle.

Keyword:- Number plate detection, prepossessing, grayscale, binarization, OCR, median filter, image processing, cca, image recognition, number recognition, cloud storage, Database of vehicle register number plate.

I. Introduction

A vehicle registration plate is a metal or a plastic plate attached to a motor vehicle for social identification purposes. The license plates are placed on the front and back of the vehicle.

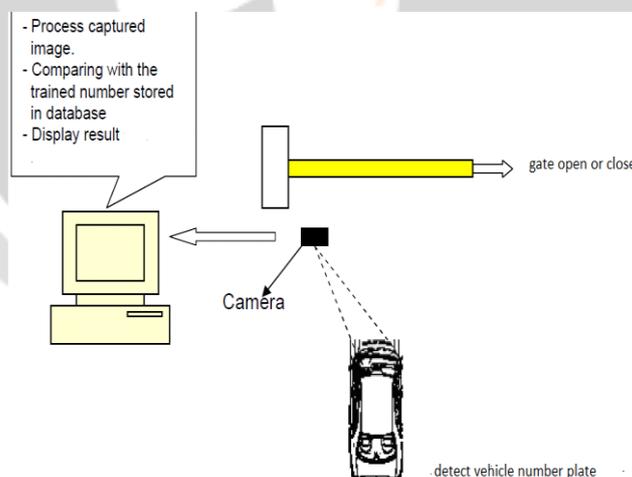


Fig 1 : Proposed System Working

Automatic number plate recognition (ANPR) is an image processing technology which uses number (license) plate to identify the vehicle.

The ANPR system consists of following steps:-

- i. Vehicle image capture.
- ii. Preprocessing.
- iii. Number plate extraction.
- iv. Character segmentation.
- v. Character recognition.

The system is only for the detection and recognition. We were develop the system for the identification of the vehicle owner and develop the system for register the vehicle entry and exit position and time on the main gate. We have used the various datasets for the identification purpose.

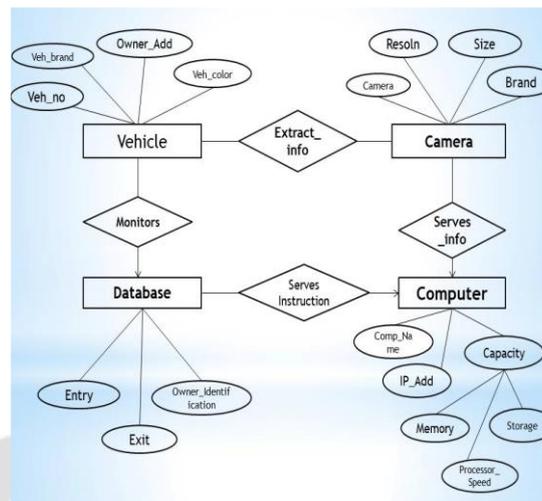


Fig 2. ER Diagram of system

II. Literature Survey

Literature Survey is an important phase in the system development life cycle as we collect and acquire the necessary information to handle or develop a project during this phase. A literature review is a description of the literature relevant to particular field or topic. It gives an overview of what has been said, who the key writers are, what are the prevailing theories and hypothesis and what methods and what methodologies are appropriate and useful.

In this project research is done prior to taking up the project and understanding the various methods that were used previously. A detailed analysis of the existing systems was performed. This study helped to identify the benefits and drawbacks of the existing systems.

Mr. Manish Pawar In this anticipate [2] for the recognition the OCR techniques is used which is susceptible to misalignment and to various sizes. The affine transformation can be used to advance the OCR recognition from various size and angles. The programmed vehicle identification system using vehicle license plate is exhibited. A series of image processing techniques of the system for identifying the vehicle from the database stored in the PC.

Mr. R. Islam, Mr. N. Suleman In this paper they [3] proposed that Automatic Number Plate Recognition (ANPR) is a method that catches the vehicle image and confirmed their license number. ANPR can be used in the presentation of stolen vehicles. ANPR can be used in various manners by using to identify it stolen vehicle on the highway.

Mr. K. Mohamad In this paper they explained [8] an automatic number plate in- spection of letter sets of plate using image processing and optical character recognition.

An imperative system has been created of training interface using LABVIEW software.

Mr. Kuldeepak et al. In this paper [1] they introduced that high level of precision has been required by the number plate recognition when streets are occupied and number of vehicles are passing through. In this paper, by optimizing different parameters, they have accomplished an exactness of 98. It is essential that for the tracking stolen vehicles and monitoring of vehicles of an exactness of 100 can't be bargained with. Therefore to accomplish better precision streamlining is required. Additionally, the issues like stains, blurred regions, smudges with various text style and sizes ought to be remembered. This work can be further boundless to minimize the errors because of them.

Mr. AmrBadr extenal. In this paper [6] Automatic recognition of car license plate number got to be in dispensible part in our day by day life. This paper mainly explains an Automatic Number Plate Recognition System (ANPR) using Morphological operations, Histogram manipulation and Edge discovery Techniques for plate localization and characters segmentation. Artificial Neural Networks are used for Character classification and recognition.

III. Objectives

- a) To identify the vehicle number plate.
- b) To determine or identification of the vehicle owner.
- c) To understanding the grayscale and binarizing techniques.
- d) To learn the various techniques of ML for detection and identification
- e) To use for the time management and reducing the traffic on particular area.
- f) To reduce the manual work through the system working.

IV. APPLICATIONS

1) Parking

The plate number is used to automatically enter pre-paid members and calculate parking fee for non-members (by comparing the exit and entry times).

2) Access-control

A gate automatically opens for authorized members in a secured area, thus replacing or assisting the security guard.

The events are logged on a database and could be used to search the history of events.

3) Tolling

The car number is used to calculate the travel fee in a tollroad, or used to double-check the ticket.

4) Border Control

This installation covers the borders of the entire Country. Each vehicle is registered into a central database and linked to additional information such as the passport data. This can be used to track all border crossings.

V. Methodology for Detection

The entire process of ANPR can be seen in (Fig. 1 to Fig. 6). All the stages in the following diagram are explained in detail as follows.

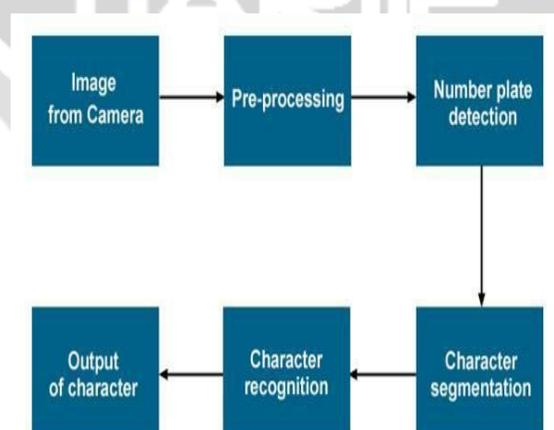


Fig. 3. Flowchart of Detection System

Image From Camera (Image Acquisition)

The initial step is the Capturing of an image i.e., getting an image using the digital camera associated with the PC. These acquired images are in RGB format & it can be further processed for the Number Plate Extraction. The database system contains the personal information of the vehicle owners.

A. Pre Processing

1) Gray Scale Conversion

Gray scale conversion is the first and the most important step in image pre-processing. The captured image is influenced by many elements like: Optical system distortion, image noise, motion blur, etc. The main reason why the gray scaled images are used instead of working on colorful images directly is that RGB (color) has a 3-dimensional property (24-bit size) which means a larger size being trained by the software each time. The color information is noise in image processing as it makes it difficult for the software to pre-process the image. On the other hand, gray scale has less size and is acceptable in most of the algorithms.



Fig. 4 RGB To Grayscale

2) Binarization

The Binarization Method converts the image into an image in which the pixel can only have 2 values – 0 or 1, i.e., a black and white image. The result of OCR (optical character recognition) is highly dependent on binarization. More accuracy is achieved in character recognition using a good quality binarized image as the original image consists of noise.

Otsu Binarization Method uses automatic binarization level decision and global threshold technique, based on the shape of the histogram has been a widely used technique used for image detection.

We have proposed a new method for low light/bright conditions where Otsu's method fails. We increase or decrease the Otsu's threshold up to 2.5 times the original threshold value by dividing/multiplying with numbers between 1.1 and 2.5 with increments of 0.1 each time, until suitable threshold is achieved. Our algorithm will test a range of predefined range of threshold values until it gets us the required number of characters in the final stage. The threshold that gives us the maximum number of characters in the end will be selected.



Fig 6. Localization with CCA



Fig 5. Binarized Image

B. Number Plate Localization

1) Connected Component Analysis(CCA)

To remove the unwanted image space, the algorithm of the component connected to the binary filter is applied first. The parsing of the connected component is done to determine the characters in the image. The basic proposal is to pass through the image and find a connected pixel. Each component (dots) is distinguished and extracted. Plate localization is concerned about segregating the number plate area from the rest of the image. The basic stride in recognition of vehicle Number Plate is to identify the plate size. CCA considers the image in the form of pixels. Since at this stage the image is binarized, image can be said to be composed of 2-pixel values, 0 and 1, to represent white and black regions in the image respectively. It will group regions having similar pixel intensity values (by default 0 valued pixel) together, hence revealing the connected regions. Using bounding box in python we were able to draw rectangles representing the “connected regions” classified by CCA. In the wake of labeling the associated components, the region will extricate from the input image. Number plate localization is appeared in figure. Our next task is to remove the unnecessary connected regions.



Fig 7. Rectangle Selection with CCA.

2) Ratio Analysis

To shortlist the falsely selected candidates for number plate we can introduce new parameters. If we assume that the position of the camera and the car will be roughly be same every time, we can say that the ratio of height and width of the number plate to the height and the width of the entire image, respectively, will lie in a defined range. Some more properties like the rectangular shape of the number plate and width being greater than the height were also incorporated in the shortlisting.



Fig. 8. Localization with ratio analysis

C. Noise Reduction

Doing noise reduction at only the number plate will reduce the processing time. The following techniques help in removing dust, water and other noise which can often appear on our number plates.

1) Unsharp Masking Filter

This technique is used to remove noise by creating a mask of the original image using the negative image (blurred). This mask is then merged with the original image, giving an image better than the original one. For creating the mask, we use the Gaussian blur. We have used the following formulae for unsharp masking:

$$x = i - s * b \dots\dots\dots (1)$$

$$r = i + x \dots\dots\dots (2)$$

where, i = image of the car, s = unsharp strength, b=negative image, x = mask, r = resultant image.



Fig.9 With unsharp masking(Right) without unsharp masking(left)

2) Median Filter

Median filter is an excellent and widely used noise reduction technique to get a clean image. This technique works on the principle of calculating the median intensity value of the pixels and using it as the output intensity value. The calculation is done using a window which slides along the image.



Fig.10 With(right) and without(left) median filter

D. Character Segmentation

Once the license plate has been extracted, each character must be fragmented. The essential thought after region growing is to remember one or more criteria that are quality for the wanted region. Subsequent to establishing the criteria, the image is looked for any pixels that satisfy the necessities. At whatever point such a pixel is experienced, its neighbors are checked, and if any of the neighbors likewise parallel the criteria, both the pixels are measured as have a place with the same region. We get individual character and number image by using, vertical and horizontal scanning technique. Example-



Fig. 11. Example of Plate Segmentation.



Fig. 12. Character Segmentation.

E. Character Recognition

This is the most essential and basic phase of the ANPR system. To identify characters, the segmented characters in the license panel must match the templates that are already created. The recognition process returns the license number in ASCII format and saves it in a excel document. In this recognition is a two-track process. In the first pass, an attempt was made to identify each word in turn. Each satisfactory word is passed to the adaptive workbook as training data. The adaptive workbook gets an opportunity to learn the text more accurately. It displays the techniques that were used to order and then perceive the individual characters. The classification is based on the extracted features. These features are then arranged using either the statistical, syntactic or neural methodologies.

Distinctive strategies were used for character recognition, letters and characters in the paper. Finish the identification by calculating the likeness of features. For the comparable characters, make the second identification with the technique for highlight point matching Another methodology is that Once the lines in an extracted vehicle number plate are separated, the line separation procedure is presently connected segment savvy so individual character can be separated. The separated individual characters are then stored in separate variables. The extracted characters taken from number plate and the characters on database which we have stored are presently coordinated.



Fig. 13. The Recognized Characters

The following phase is template matching. Template matching is a proficient algorithm for character recognition. The characters image is match up to our given database and the best resembling is considered. Another technique for character recognition is the optical character recognition (OCR) is used to look at the every individual character against the complete alphanumeric database. The OCR really uses relationship strategy to match individual character and finally the number is recognized and stored in string format in a variable. The character is then contrasted and the database for the vehicle authorization. The resultant signs are offered according to the consequence of comparison. Templates will exist for every one of the characters i.e. A-Z and 0-9 as appeared in figure.

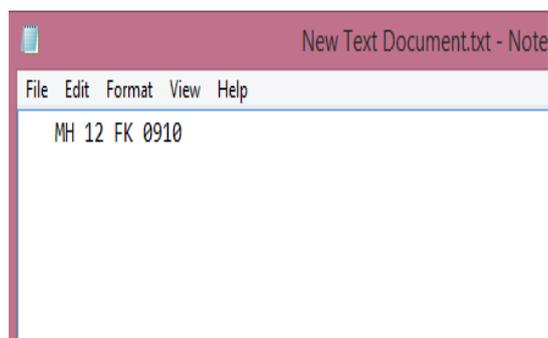


Fig. 14. The Recognized Characters

F. Fusion Of Above Techniques

Ensembles are one way to improve your accuracies on the dataset. Here voting method is being used which combines different types of techniques and their predictions to give an improved and better results. Here, a combination of SVM (linear class_er) with KNN and a combination of logistic regression with Random Forest are implemented using ensemble by combining two techniques that leads to overcome the shortcomings of individual technique.

G. Identification

After the successful detection of the vehicle number plate we can design the system for identification of the owner details. We can check the various databases. The identification of the vehicle owner is the part of identification model. The project is work in 3 models like recognition, identification and database registry.

1) Owner Details

The owner details can be found in the databases. We can take the various data which is used for training purpose. The owner details will be found in the database. If the details of owner is not found in the database then it will use web database or the RTO/cloud/local database for identification of the vehicle.

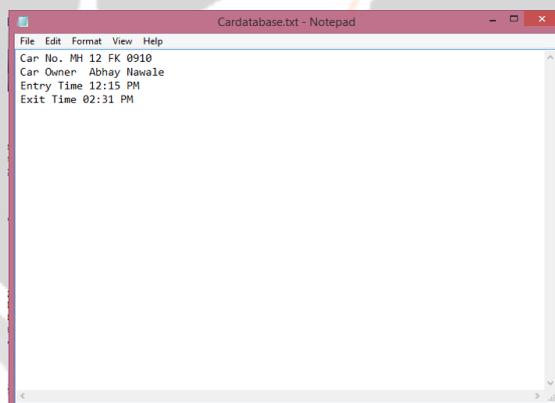


Fig 15. Owner Details

2) Working

The real working of the model is learn in this chapter. Firstly we take the image of the vehicle and pre-processing on it. After the pre-processing the detection of number plate is taking place. Then the character segmentation is will be processed for the further operations like character recognition will be proceed and we are getting the output as text characters.

We have the key element that is Vehicle number plate. The vehicle have their own unique Number plate. Therefore we can identify the vehicle details and the owner details of the vehicle.

3) Entry Registration

After getting the characters of the vehicle number plate we are giving the characters as input to database and checks the details about the registered vehicles. If the the details of the vehicles and owners are not found in the database the it will go to the RTO/Cloud Server Database and send it to the Registry system.

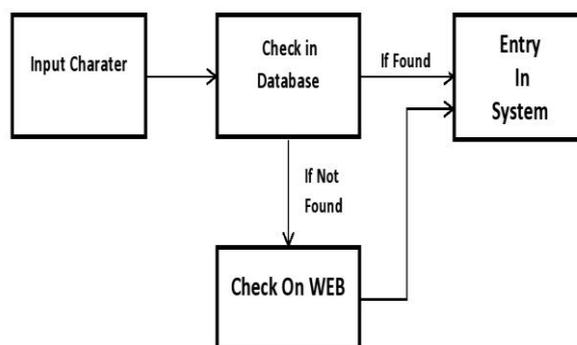


Fig. 16. The entry model

The registry System Stores the details about the vehicles and owner of that vehicle and note down the time when vehicle is enters into the gate. In the fig we mention the web services like RTO/Cloud/Local database.

4) Exit Registration

After the successful registry we can note the exit time. When the vehicle is exiting from the gate it will repeat the process upto recognition. After that it will directly go to the registry database and check the entrance time and note down the exit time and details. After the successful registry of the vehicle and note the time of entry and exit. We can add that data to the main database.

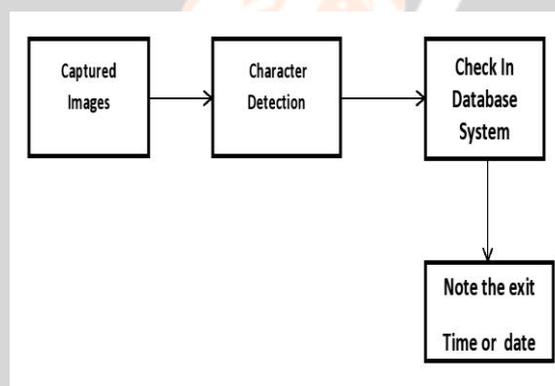


Fig 17. The exit model

Conclusion

In this paper, the automatic number plate recognition system using vehicle license plate is introduced. The system utilizes image processing techniques for recognizing the vehicle from the database stored in the computer by user. The system works agreeably for wide variation of conditions and distinctive sorts of number plates. The system is actualized and executed in python/java and performance is tried on genuine images. In the existing work, work has been done on contorted number plates. This method has an issue of commotion and image is taken from separation. In proposed work a novel system has been proposed for denoising and for the better character recognition using standard classifiers of neural networks and give better body detection.

The system work with the cloud database for the entry and exit registry system. We find and store the vehicle owner details. Simply our aim is to detecting the vehicle and the their number plate and identify the owner of that vehicle.

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