# Automatic Number Plate Recognition

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*Abstract:* With increasing traffic problems every day, it is becoming difficult to control traffic and identify the owner of a vehicle that violates traffic rules. Therefore, such violators go unpunished as the traffic personnel fails to retrieve the number of their speeding vehicles. As a result, one of the answers to this challenge is to design an Automatic Number Plate Recognition (ANPR) system. ANPR systems are now available in a variety of configurations. However, they all come with limitations for recognizing the number plate, due to factors like over-speeding of the vehicle, non-uniform letters and different languages of the number plate, and so on. As a result, alternative methods to ANPR are addressed in this study, with the goal of suggesting an extension to ANPR that takes image size, success rate, and processing time into account.

*IndexTerms* - ANPR, Automatic Number Plate Recognition, License plate

## I. INTRODUCTION

ANPR has been one of the helpful approaches for vehicle surveillance in the last few years. It can be implemented in a number of public places to fulfil some purposes like Automatic vehicle parking systems, car park systems, and traffic safety enforcement.
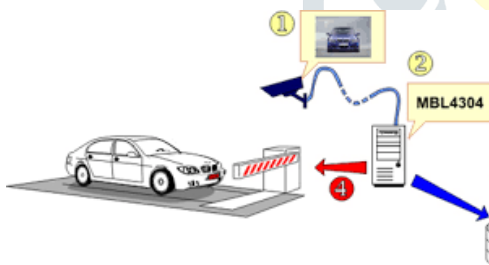


Fig.1: System Architecture

The four steps of an ANPR algorithm are as follows:

1. Image capture of a vehicle
2. Identification of licence plates
3. Segmentation of characters and
4. Identifying characters

The first stage is to capture a picture of a fast-moving car while ensuring that none of the vehicle's components, particularly the vehicle number plate, are missed, which is a challenging challenge [8]. The fourth step's success is determined on how well the second and third phases find the car number plate and distinguish each character. The majority of ANPR systems use techniques such as artificial neural networks (ANN), probabilistic neural networks (PNN) [9], and optical character recognition (OCR). Most ANPR systems use common approaches such as artificial neural networks (ANN), Optical Character Recognition (OCR), Probabilistic neural networks, Configurable method, salient, concentrating window (SCW), Sliding, MATLAB, BP neural networks, support vector machines (SVM), Least Square Method (LSM), inductive learning, scale-invariant feature transform (SIFT), trichromatic imaging, online licence plate matching based on weighted edit distance, and color-discretization [4][5].

## II. LITERATURE SURVEY

Algorithm research and development in intelligent transportation have gained a lot of interest recently. Controlling traffic and enforcing traffic laws necessitates the use of an automated, accurate, quick, and resilient car plate recognition system [1][2]. This is where ANPR comes in. The number plate recognition technology assists in capturing, extracting, and verifying the vehicle owner's information. A camera is incorporated to capture the images of the number plate.

S. Roy, Choudhury J. Mukherjee developed a method for number plate localization, primarily for automobiles in West Bengal. The Sobel edge detection method and a simple and efficient morphological procedure are presented in this study. It focuses on two steps: the first is to identify the number plate, and the second is to segment all of the letters and digits so that each number may be identified independently [3]. Based on our analysis of many studies, we have concluded that several strategies are available to recognize the number plate such as Automatic license plate recognition, Sobel edge detection, and Novel methods used to detect edges and fill up the gaps that are fewer than 8 pixels, classify the features in each step, and identify the license plate.

## III. IMPLEMENTATION

Number plate identification algorithms are divided into many categories based on the methodologies used. The following factors should be considered to detect vehicle number.

Screws on the plate: A plate may have screws that could be Considered as a character.

Background of the plate: Based on vehicle type a plate can have different background Colors. For example, a rented Vehicle number plate can have different background than other private and government vehicle.

- Location of the plate: A licence plate can be found on any part of the vehicle.
- Size of the plate: Vehicle plates can be of different sizes.

Image segmentation is a method used to extract number plate method [6]. Out of numerous image segmentation methods available, Image binarization is the most commonly used technique. Pre-Processing steps involve the following methods [7]:

- Gaussian Blur- Which is highly effective in removing high frequency content like noise, edge.
- Grayscale conversion- It's made up of several tones of grey. By retaining the brightness, a true colour picture may be turned to grey. It gives the brightness of the number plate [10].
- Sobel Operator- It calculates the first derivatives, particularly within edge detection algorithms.
- Thresholding- Converts grey scale into binary image.

**Use case diagram**

The use case diagram is a sort of UML diagram that allows you to depict system functionalities as well as the actors that interact with them.



Fig. 2: Use case diagram

**ER Diagram**

Entity Relationship Diagram (ERD) or ER diagram (ERD)  is a diagram that depicts the connection between entity sets in a database. ER diagrams, in other words, help to explain the logical structure of a database. The three fundamental concepts that ER diagrams are constructed around are entities, characteristics, and relationships. The ER diagram represents the entity framework architecture. The below diagram (Fig.3) shows the Entity-Relationship diagram of our ANPR. We have used the gliffy tool to create this Entity-Relationship diagram.
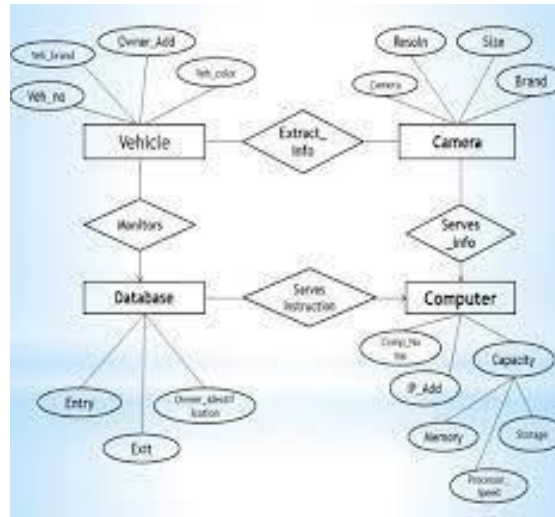
Fig.3: ER Diagram

## Mind Mapping

Mind mapping is a useful and powerful technique that helps to visualize thoughts and communicate them to others and improves learning, promotes information-recording, demonstrates how various facts and concepts are connected, and boosts problem-solving creativity. Mind Mapping may also be used to break down difficult activities or topics into manageable chunks allowing you to plan successfully without being overwhelmed or forgetting crucial details. We used MindMeister for our project to create a mind map to organize the product list.

## IV. RESULT

The outcomes of the ANPR are depicted in the two figures below. Fig.4 shows the number plate of the car. Fig. 5 shows the characters of the number plate recognized.



Fig.4: Number plate of the car



Fig.5: The number plate's output

| Actual Plate | Predicted Plate | Mismatched characters | Accuracy |
|---|---|---|---|
| DL 4C AF 4943 | DL 4C AF 4943 | 0 | 100% |
| KA 19 P 8488 | KA 19 P U4UU | 3 | 67% |
| MH 12 DE 1433 | 88 12 DE 1433 | 2 | 80% |
| WB 02 W 6886 | X8 02 X 6886 | 2 | 80% |

Fig.6: Results of the Template Matching

## V. CONCLUSION

Car owner identification, car model identification, traffic monitoring, vehicle position monitoring, and vehicle speed control may all be done with ANPR. It has the potential to be cost-effective for any country. Some image enhancement methods, such as super-resolution, should be focused on low- resolution photos. The majority of ANPR is focused on analyzing a single-vehicle number plate in real-time while photos are being taken. It is obvious that ANPR is a challenging system due to the various stages, and it is now impossible to attain 100 percent overall accuracy because each step is dependent on the preceding one. The performance of ANPR is affected by factors such as vehicle shadow, non-uniform size of license plate characters, varied lighting circumstances, and varying font and backdrop color. Several systems are designed to perform just in these limited circumstances, and they may not be as accurate in other situations. Some of the systems have been created and are being utilized in certain countries. It is clear that relatively few ANPR systems have been built for India. As a result, developing such a system for a country like India has a lot of potentials. As a result, in the suggested system, an attempt has been made to overcome the aforementioned problems and produce superior results.

## VI. FUTURE ENHANCEMET

The current ANPR technology has a number of flaws, including erroneous results if the image is not of proper quality, such as if the input image is blurry or the license plates are not captioned. As a result, the current algorithm can be tweaked to give better results. Template matching was performed on number plates from the provided image, with an average accuracy of 80%. This accuracy can be enhanced by using two layers of neural networks and positioning the camera appropriately to get the best frame. Furthermore, character recognition has constraints, such as the quantity of characters, which varies by location, necessitating the development of a global algorithm. A more advanced version of this system may be created by taking inputs from a live video stream and picking the optimal vehicle frame for categorization of vehicle kinds, as well as detecting the plate using neural networks and the car owner's data.

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