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Performance Analysis on Automatic Number Plate Recognition System and Methods

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ABSTRACT

Now a days, vehicles are entering the educational institutes or other organizations without taking a proper record. It is necessary to implement a system which is used to detect the vehicle number plate and recognize it, is this vehicle registered in this institute or not. Automatic Number Plate Recognition (ANPR) System used to resolve this issue. This system is useful to Parking fee collection, Barrier crossing, Finding the stolen cars and so on. Some condition may be affect this due to low light or weather condition, size of the number plate also matter. This paper shows the multiple techniques to implement this system and also show the results of Automatic Number Plate Recognition system.

Key words: vehicle license plate detection, number plate recognition, character segmentation, ANPR technique, VLP recognition.

I. INTRODUCTION

Vehicle License Recognition VLP system used to security problems of traffic police or any other organization. VLP recognize the vehicles from road traffic, interchange tool plazas and many other locations in city chowks. This system detects the speed of vehicle motor car, bike and trucks etc. Everyone knows about over speeding accidents and violation of rules on motorway and GT roads. Stolen cars are also can located with this system. Computer vision is the way to control these accidents and rules violations on road. ANPR work on base of computer vision show in figure 1. Camera work like aeye, it detect the moving vehicle from the road and recognize its speed and identify the vehicle with its number plate or license plate.

VLP Vehicle License Plate detection is a difficult task to locate the license plate on vehicle. Where the license plate placed on vehicle. So Neural Network use to recognize the numbers and alphabets on number plate or license plate. This program recognizes the characters one by one. Artificial Neural Network (ANN) work on these techniques like a 2D coloration and inductive learning methods[1].License Plate Recognition (LPR) is a method to recognize the number plates of moving vehicles on road or parking areas. It is work with Intelligent Transport System (ITS). This LPR system reduce the human's efforts to locate the license plate on vehicle with high speed moving on road. And also it can doing good job on parking management system[2].

Camera is fixed on static position and its take images of vehicles and recognized their license plates. Image processing technique are used in LPR system. LPR obtained the grayscale images as input image and find color value from RGB. After this step it convert into binary, and image will convert into black and white for next step. So, the next step is identifying the license plate or recognize the location of license plate. License plate always occur in rectangular shape. This is located due to edge detection method. Characters are detected one by one nu segmentation of characters. These characters are using Connected Component Analysis (CCA)[3].

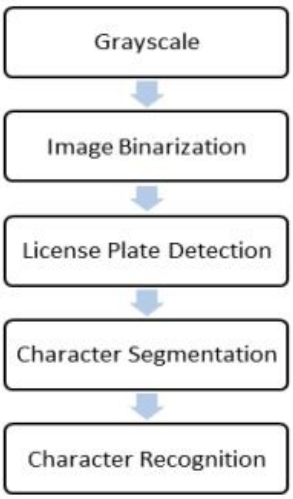

Figure 1: Process Model of ANPR

Automatic License Plate Recognition (ALPR)technology implement on this paper for vehicle detection and also recognize the vehicle license plate. As usual if other techniques for detecting vehicle and its speed or other tasks so many hardware will instruments used like a inductive loops, EM microwave detectors, sensors etc. These things are difficult to implement and modification. It may be doing well on slow or suddenly stops car. So all above matter solved by to make an algorithm which is used to detect vehicle and recognize its license plate through only videos which are captured by digital cameras. If we need any changes then only change the algorithm and modify its working[4]. That is why this technique is more reliable than the other hardware methods show in figure 2.

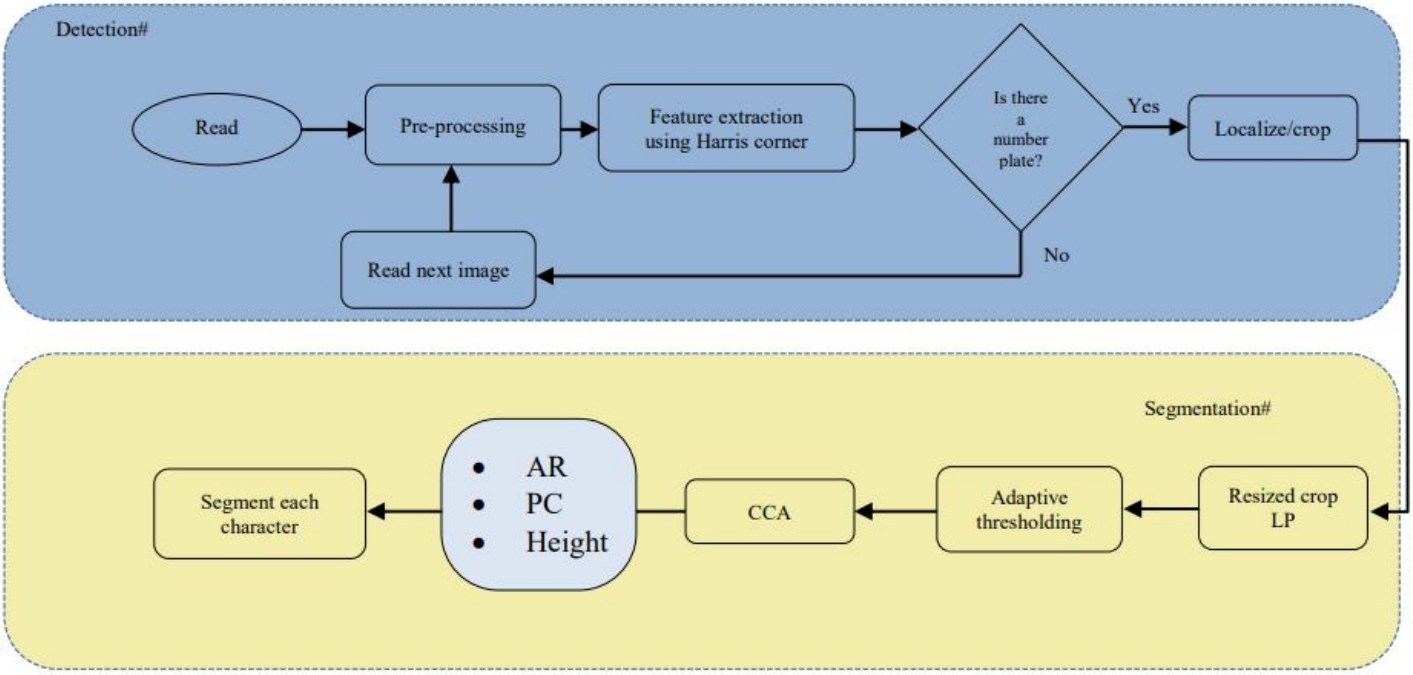

Figure 2: character segmentation and Recognition Proposed Algorithm

ALPR system facing some challenges like as:

- Brightness issues (Morning, evening, shadows)
- Camera angle, Occlusion of an image.
- Character are not complete on Plate.
- Blur images due to car's movement.

The main focus of this paper is perfectly recognize the license plate and then segmentation is done with ALPR[5].

In this paper author use the ALPR technique to extract the vehicle license plate information from images or collection of images taken by fixed or mobile cameras which are uniquely identify the vehicle license plates. These cameras are fixed on parking entrances or restricted areas where only registered vehicles are allowed. These cameras used to identify the traffic on roadside whose are violating the traffic rules and road patrolling. Handheld cameras are also work with this system. Author define this method Access Control System (ACS) based on ALPR[6], this system design provide the mush possible accuracy to detect vehicle license place. No need of special hardware. Only need to fixed camera on specific angle where camera can read the vehicle license plate and also use high resolution standard camera on the spot[7].

II. NUMBER PLATE DETECTION AND RECOGNITION TECHNIQUES

Several techniques for number plate or license plate detection and recognition are discussed in the subsections that follow.

A. Detection for License Plate by Shallow & Deep Learning CNNs in Complex Environments

In this article author cover the many problems during the license plate detection. For example: Large visual variations in complex environment, blur image due to unfocused image, light issues like a high reflecting light or dim light day time or nighttime and occlusion etc. As a result, the background issue during license plate detection must be resolved. Advance discriminative model is fulfilling the properly segmentation process of license plate from all type of backgrounds. That is why he is facing the computationally problems while detecting the plate. This technique propose to models 1st is Shallow CNN and 2nd is Deep learning[8] CNN[9]. To save computing time, Shallow CNN was used to delete the majority of the background area, and Deep CNN was used to identify the number plate in the remaining area. These two models work properly and make efficient result of license plate detection and recognitions[10] in figure 3.

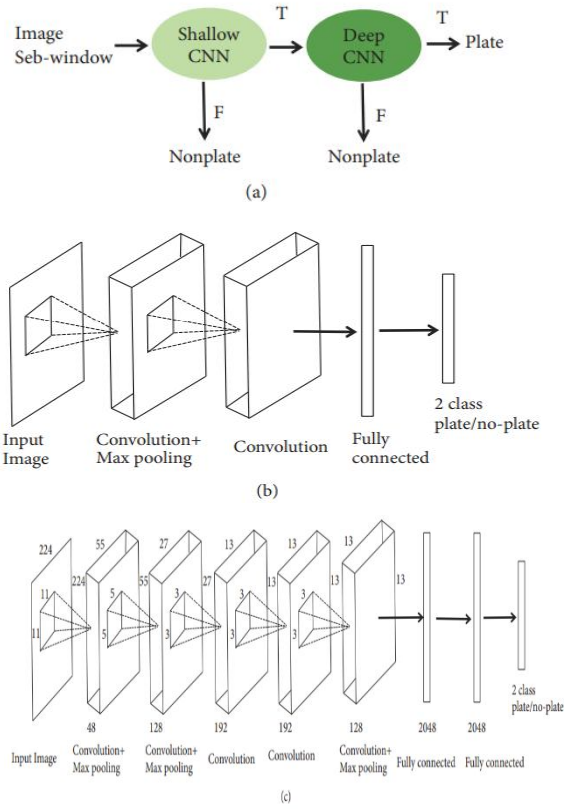

Figure 3: License plate detector framework

Figure 4 exist the license plate detector's overall part.

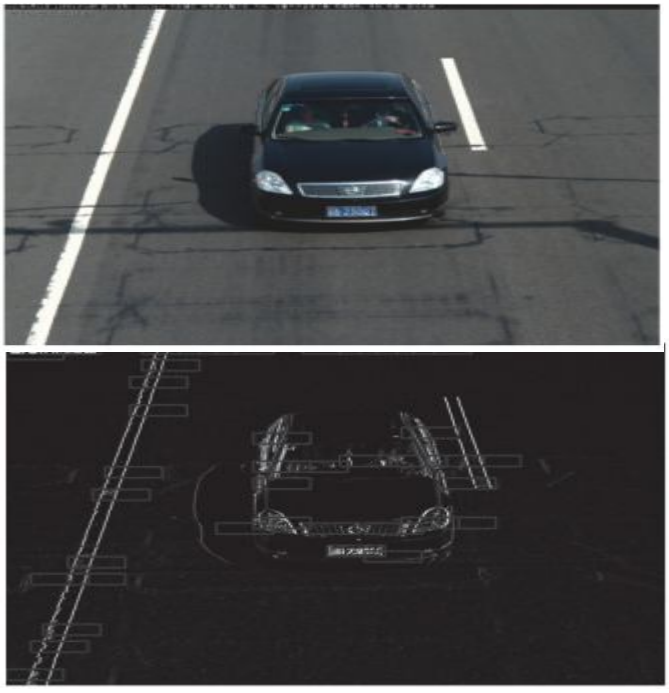

Figure 4: Shallow CNN obtained the Candidate Region.

a) Shallow CNN Configuration
b) Deep CNN Structure[11]

B. A Robust License Plate Detection and Character Recognition Algorithm Using a BPNN and a Feature Extraction Model

The quick advancement of license plate recognition technology is used by the author is used in wide area in Intelligent Transportation System [12]. The attribute extraction model and the BPNN Backpropagation Neural Network are used in this methodology for license plate identification and character algorithm. There are three stages of recognizing license plates: Localization of license plates, character segmentation, designation, and identification For machine learning classification, the Support Vector Machine approach (SVM)[13]and neural network techniques such as BPNN are used.

There are the some advantages and features: a robust license plate detection[14] and character recognition system work on a collective properties of BPNN and extraction model, which is use to advance recognition effective VPLR[15] algorithm. Extraction feature has three of features: two set of traverse density feature and edge detection feature. It is useful to train the neural network. So that is why this modal is very efficient to recognize characters on license plates in both conditions weaker brilliance and multifaceted backgrounds. Taking a photo or screenshot of the original registered motor vehicle is the first step in the license plate recognition and character segmentation process. There are many variations during image capturing such as image brightness, size of captured image and also image quality matter for batter detection and segmentations. Original image is necessary its resolution is 1250x750, this size is useful for large and small size of license plate. The original picture show in following figure 5:

Figure 5: Original image of Car

To begin, convert the original image to a grayscale version. Its beneficial for detection the license plate due to whole body of car having gray effect and license plate has different gray shade. So, it is easy to detect the plate area on car. This gray scale effect makes a contrast on car's body and plate. Edge

detection of car's license plate was highlighted background. After these steps next results are shown in figure 6.

a) First, the initial image is converted to a grey scale image, which decreases computing costs.

b) Then, to increase the contrast between the license plate region and the rest of the image, grey level stretch processing is applied.

c) The Roberts operator is used to illustrate the contrast between the license plate's border and the background.

d) With the exception of minor areas that are not part of the license plate field, image degradation and morphological closed operations are carried out.[16].

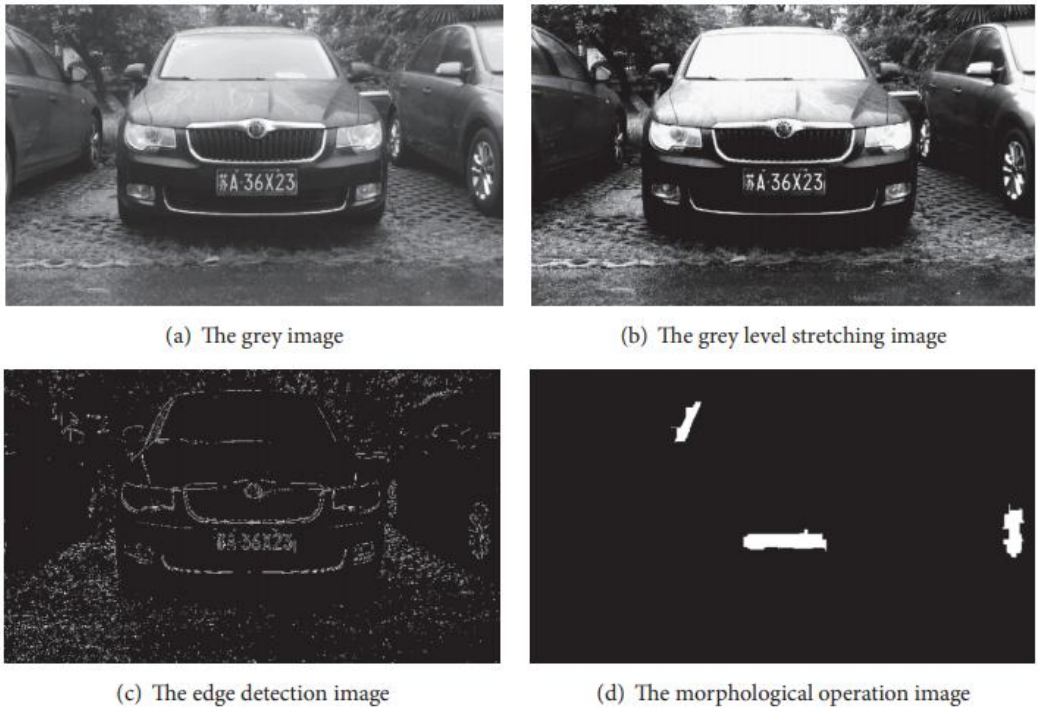

Figure 6: Results of each step in original Image preprocessing.

C. Web-based development of a smart plate number recognition system for fast cars.

Furthermost of the cases many road accidents occur due to the violation of rules. People are not following the roles. They were need to strictly obey the traffic rules. Developing countries are facing a lot of cases here violation of rules and its cause danger accidents. The reason of violation of rules is the authorities' do not enforce the public to follow the roles. That is why here need of which system which is enforce the public to follow the traffic rules. VPNR (Vehicle Plate Number Recognition) is a real-time embedded device that automatically recognizes vehicle plates. This system is useful to detect the vehicle through number plate which is violate the traffic rules. IR sensors use to detect the vehicle. Microprocessors use to detect the object within minimum time interval. In this time interval camera captured the plate number image and sent to Raspberry Pi. Image capturing task done with Raspberry Pi and image processing done with microprocessor. Numbers are recognized and viewed on web page via an IP address in figure 7 & 8.

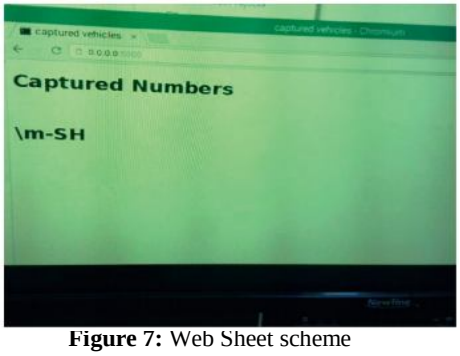

Figure 7: Web Sheet scheme

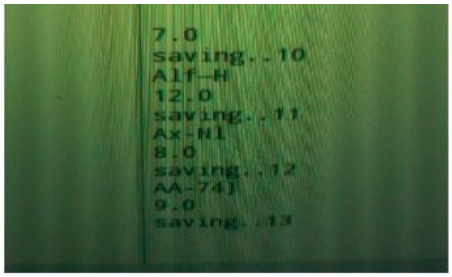

Figure 8: Captured Plate Numbers are show

In figure 9Open CV code in python an integrate with web page. Vehicle license plate numbers check from database with the query. We already have vehicle plate numbers which are defaulters in this city. If any plate number match, then its reveal this is defaulter's vehicle.

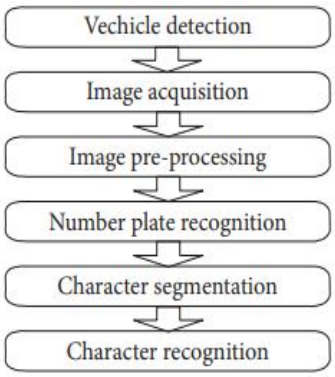

Figure 9: Proposed Design Process Flow

This system is developed for fast moving cars number plate detection. This is very efficient and methodological approach to dothese techniques and getting desired results in figure 10.

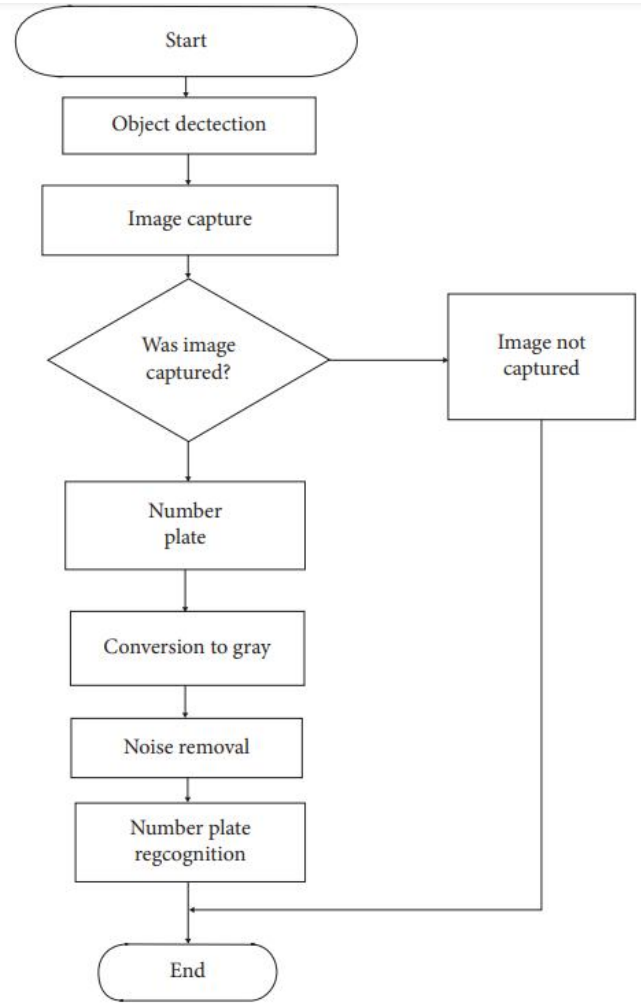

Figure 10: The System Design Flow Chart

In figure 11 vehicle detection process in which moving vehicle detect by the sensor which is known as Passive Infrared Sensor (PIR). This sensor send signal to microprocessor Raspberry Pi. This controller controls the camera which is use to capture the image of car's number plate. Raspberry Pi send signal to camera to capture the image.

After this process, image acquisition process will be start. This is difficult task to entails the captured image of moving vehicle into a useful information in a real time view. Image is captured in RGB. Which is consist of noise distortion and blur effects.

Image preprocessing phase convert the RGB image into gray scale image. Image converting done by an algorithm which is convert the image into 3D and 2D in gray scale image. Open CV library provide real time image recognition and vision to the computer.

Character Segmentation remove the unusable area of vehicle plate number. It partitions the numbers individual characters and identify each character. The image frames are detected and converted into ASCII meaningful text using Character Recognition and Open CV [17].

System Requirements and Design Methods:

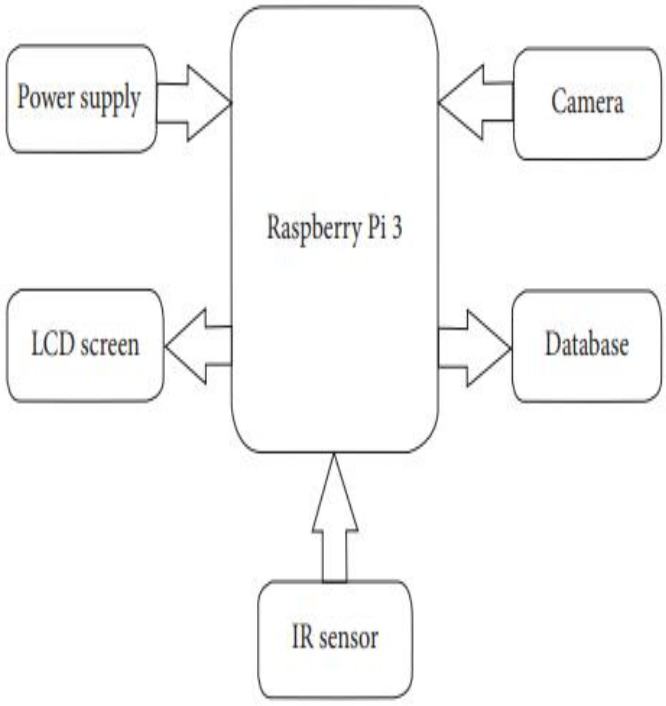

Figure 11: The suggested scheme is shown as a block diagram.

III. COMPARATIVE ANALYSIS

Table 1: Detail analysis of various techniques and performance measures

ANPR Techniques	Main Methods	Performance	Detects several license plates in a single picture.	Oblique License Plates are a good fit.	Adaptiveness on a larger scale	Noise Effective
K-Means Algorithm Character Segmentation for License Plate Recognition[18]	K-Mean Algorithm modifying by filtering SIFT key Points, OCR,LPR	94.03%	Yes	Yes	Low	Low
Intelligent System for Vehicles Number Plate Detection and Recognition Using Convolutional Neural Networks[13]	CNN is a deep learning technique that uses convolutional neural networks.	Acquired 98.2% accuracy Attained 98.1% accuracy	Yes	Yes	Low	Low
For ITS, a Real-Time Automatic Plate Recognition System Using Optical Character Recognition and Wireless Sensor Networks [19]	Smart Parking Service is an adaptive parking facility that uses optical character recognition (OCR) (SPANS)	Proposed Algorithm 80% Accuracy Gausian Blur 80% Accuracy Filter 2D 72% Accuracy	Yes	Modera te	High	Low
Using Multi-Level Deep Features and a Foreground Polarity Detection Model, an Adaptive Approach for Multi-National Vehicle License Plate Recognition [6]	two important LPR stages: 1. (LPCS) 2. (LPCR)	96.04% recognition accuracy is achieved	Yes	Modera te	Low	Low
Automatic Vehicle License Plate Extraction Using Morphological Operations and Region-Based Convolutional Neural Networks [20]	Detect vehicle in real time mode. R-CNN Model used.	Detection of vehicle Rate in real time environment is 92% and detection of License plate rate is 83%	Yes	Yes	High	Low

IV. CONCLUSION

I reviewed several works on the Automatic Number Plate Recognition (ANPR) system as explain in above table 1. Deep neural networks are used in the majority of recent ANPR systems. Their architectures are distinct as well. In terms of function selection techniques, preprocessing techniques, and techniques for integrating various elements, they vary as well. Because of its efficacy and ability to adapt to various circumstances, deep learning has become the preferred method of many researchers in the field of machine learning. In some ANPR methods, deep neural networks are used exclusively. The majority of neural networks are used during the recognition and detection processes. It is often reliable, but it almost always lengthens the run time. This problem can be overcome by combining identification and recognition into a single neural network. Some methods work well in situations The license plates are not parallel to the horizontal line in this case. On the basis of the techniques used, accuracy, and detection suitability, we compared different techniques. As a result, we've seen a slew of new strategies and advancements in this field. Despite the fact that a lot of work has been done, Because of the increased amount of automation and security standards, the need for a more sophisticated ANPR system isn't going anywhere.

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