Automatic Number Plate Recognition Using OpenCV And Machine Learning

Teena Rose Mathew
PG Scholar of
Department of Computer Applications
Amal Jyothi College of Engineering
Kanjirappally, Kerala
teenarosemathew2022b@mca.ajce.in

Paulin Paul
Asst. Professor of
Department of Computer Applications
Amal Jyothi College of Engineering
Kanjirappally, Kerala
paulinepaul@amaljyothi.ac.in

Abstract **- A well-known application for detecting cars in complex security systems, parking lots, and traffic controls is the Automatic Number Plate Recognition System (ANPRS). ANPR is a relatively new field in image processing that employs a wide range of algorithms, methodologies, and methods. This study describes the creation of an ANPR system using Python, a free and dynamic programming language that works in conjunction with Open Computer Vision Libraries. The main goal is to combine and employ many morphological procedures in order to properly recognize and translate the license plate of a certain car. This is based on picture improvement, grayscale transformation, Bilateral Filtering edge detection, and getting the vehicle's license plate from a photograph, among other procedures. After the previous processes have been completed, the segmentation approach is utilized to detect the text on the number plate utilizing template matching and OCR. From an image of a vehicle, our technology can precisely and quickly recognize the license number. This system achieved 91.5 % accuracy, 91.1 % precision, and 91.8 % recall.**

Keywords – ANPR, OpenCV, Python Programming, Image Processing, Machine Learning, Artificial Intelligence.

I. INTRODUCTION

Vehicles are constantly rising in number nowadays, making it difficult to keep track of them all. Vehicle identification is required in a variety of situations, such as traffic, gate admission, and so on, to provide security. The number plates on each vehicle serve as a unique identifier. Manually entering car license numbers will be a time-consuming task. This study provides a viable method for automating and decreasing the complexity of human data entering.

Number plates are used to assess the length of time that a vehicle will be parked. A vehicle's number plate is immediately identified and entered in the database as it enters an input gate. The number plate of a car leaving a parking lot via an output gate is read and compared to the first one in the database. The time difference is used to determine the parking fee.

ANPR can record the images captured by the cameras, as well as the text from the number plate. These systems often use infrared (IR) lighting to allow the camera to take photos at any time of day.

Around the world, number plate recognition technology is used for surveillance. This technology can recognize and record license plate numbers, and it can be used in law enforcement, security, and automobile access. License plate technology is used in secure and gated entrances, traffic enforcement, police enforcement, and toll gates.

II. LITERATURE SURVEY

We only found a few studies that were connected to ANPR after doing a literature research.

However, all of the contributions made in this field are becoming more advanced by the day. In ANPR computations, the acquisition of a vehicle image and the recognition of a vehicle's license plate are commonly split into four steps. Character recognition and division are two important aspects of character development. The first step, for example, is to take a picture of the vehicle.

The system consists of three steps: first, detect and capture a vehicle image; second, detect and extract a number plate from an image; third, segment the individual character using image segmentation techniques; and finally, recognize the individual character using OCR using a database for each and every alphanumeric character.

The task of recognizing number plates for Indian conditions, where number plate standards are rarely followed, is proposed by Kulkarni et al[1]. The system is made up of a set of algorithms created specifically for Indian license plates. Number plate locating algorithms include "Feature-based number plate localization," "Image Scissoring," and "statistical feature extraction," respectively. The device can recognize single and double line number plates in a variety of lighting conditions. The success rate of the system is roughly 82 percent.

For segmenting characters on license plates, Khare et al. [2] suggest a novel method called partial character reconstruction. As a result, license plate recognition system performance improves. In a novel method, partial character reconstruction is proposed in the Laplacian and gradient domains based on stroke width. As a result, several character elements are loosing their contours. After normal spacing between characters and aspect ratios of character components are investigated, angular information of character components defined by PCA and the major axis is analyzed in a new approach for segmenting characters. The same stroke width parameters are then used to reproduce the whole shape of each

DOI: 10.5281/zenodo.6782787
ISBN: *978-93-5607-317-3@2022 MCA, Amal Jyothi College of Engineering Kanjirappally, Kottayam*

character in the grey domain rather than the gradient domain, which improves recognition rates.

Miyata et al. [3] present a method for detecting only the edge vertical components, and the sample license plates are narrowed down using contours generated from dilation and erosion processing and region fill processing. To determine if a sample region is a license plate or not, a Support Vector Machine (SVM) based on negative and positive instances is utilized, and then the position of the license plate is computed. Using varied aspect ratios, brightness differences between the automobile body and the license plate, and the number of positive and negative examples used in learning, the performance of the license plate detection algorithm in license plate and non-license plate images is explored. The method's efficacy was demonstrated using a license plate recognition rate.

Wei-chen Liu et al. [4] developed "A Hierarchical Plate Identification System employing Supervised K-means and Support Vector Machine," a unique hierarchical character recognition technique based on supervised K-means and SVM, to distinguish blurred and tilt license plates.

III. PROPOSED SYSTEM

The Automatic Number Plate Recognition (ANPR) system is a tool for identifying automobile license plates. This system's foundation is image processing. It helps with methods like recognizing vehicle number plates, processing them, and then using the processed data for other purposes like recording vehicle and accident data. We may see specifics about the collision and the vehicle, as well as download the information in pdf format. Here we had a success rate of 91.4 %. This system achieved 91.5 % accuracy, 91.1 % precision, and 91.8 % recall.

IV. AUTOMATIC NUMBER PLATE RECOGNITION (ANPR-Technology)

In recent years, automatic number plate recognition (ANPR) or license plate recognition (LPR) has proven to be one of the most effective methods for vehicle surveillance. ANPR is used by police agencies all around the world to determine whether or not a vehicle is registered or licensed, among other things. It's also utilized for electronic toll collection on pay-per-use roads and as a mechanism for highway agencies to track traffic flows, among other things.

The first step is to take a picture of the vehicle. The ability of the second and third steps to detect the car number plate and separate each character determines the effectiveness of the fourth step. These systems employ a variety of techniques to locate the vehicle's license plate and then extract the vehicle number from the image.

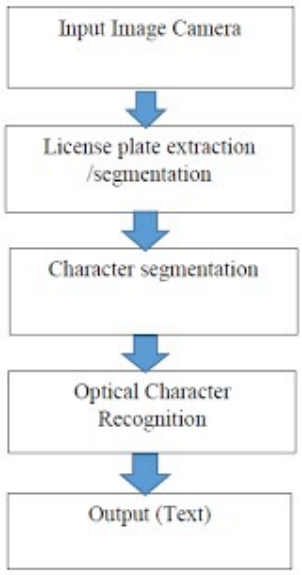

Fig 1: Flowchart of ANPR Technology

V. METHODOLOGY

There are several steps involved in determining the location of a number plate and extracting characters from those plates.

A. Capturing of Image.

The image of the car is captured by a high-resolution camera. The characters in the acquired image must be readable in order to complete the reaming operations.

B. Preprocess

A gray-scale image captured with an infrared (IR) camera serves as the input image for pre-processing. During preprocessing, take into account the background lighting circumstances as well as the number plate localization methods that will be used in the following steps. To improve the localization technique and save processing time, it's critical to remove as much background noise as feasible during the pre-processing step.

```
img = cv2.imread('image.jpg')
gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
```

The code above turns a color image to grayscale.

A. Localization

Binarizing the image is crucial for localization. The image is then converted to black and white. Characters are highlighted using Localization.

DOI: 10.5281/zenodo.6782787
ISBN: *978-93-5607-317-3@2022 MCA, Amal Jyothi College of Engineering Kanjirappally, Kottayam*

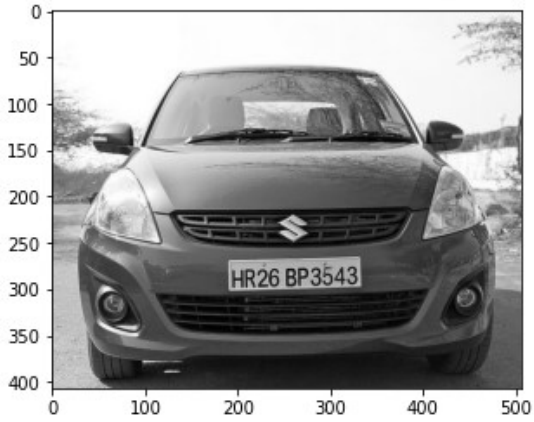

Fig 2: Converting a colour image to grayscale

```
bfilter = cv2.bilateralFilter(gray, 11, 17, 17)
edged = cv2.Canny(bfilter, 30, 200)
plt.imshow(cv2.cvtColor(edged, cv2.COLOR_BGR2RGB))
```

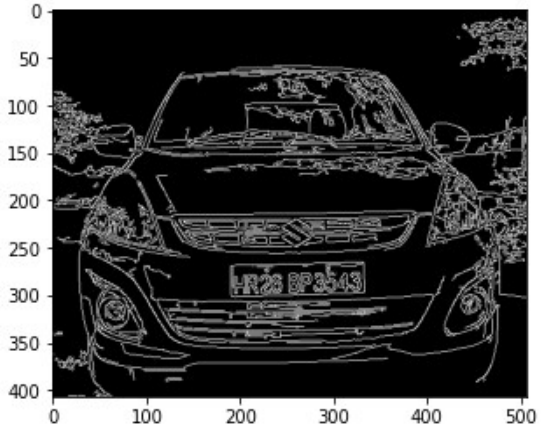

Fig 3: Localize the grayscale image

B. Apply Contours

To determine the number plate position from the image, we utilize discover Contours to find the rectangular region.

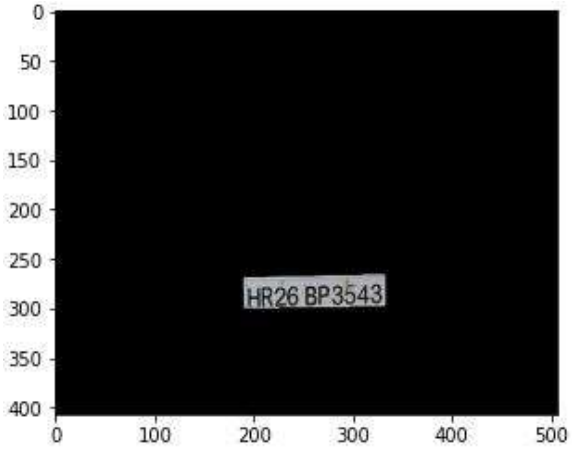

Fig 4: Apply Contours

C. Character Segmentation

At this stage, we map out all characters from the recognized number plates using linked component analysis.

Fig 5: Character Segmentation

D. Character Recognition

The final step is to recognize the character by comparing the picture character using the Optical Character Recognition (OCR) technique.

Fig 6: Character Recognition

The text displaying the vehicle number is the stage's final output.

DOI: 10.5281/zenodo.6782787
ISBN: *978-93-5607-317-3@2022 MCA, Amal Jyothi College of Engineering Kanjirappally, Kottayam*

E. Store Result in a text File

We may now save the result to a text file. We can get the plate number in our project from this text file. We can recognize the vehicle details as well as the accident details of that car using the number plate. We can also get the information by downloading it.

VI. RESULTS AND DISCUSSIONS

At first, the image will be captured using the camera. After acquiring the image, the application converts it to grayscale before deleting any possible number plates. After that, save the license plate to a text file. Finally, the vehicle's details are recognized. The car and accident facts will be pulled from the database and presented on the screen. We used a dataset of ten to train, as shown in Table 1(D-Dataset).Finally, we obtained an overall performance analysis success ratio for ten datasets, as shown in Table 2.

Table 1: Performance analysis for 10 dataset

	D 1	D 2	D 3	D 4	D 5	D 6	D 7	D 8	D 9	D 10
Accuracy	0.85	0.95	0.85	0.95	0.95	0.85	0.9	0.95	0.95	0.95
Precision	1.0	1.0	1.0	0.9	0.85	0.7	0.87	0.88	1.0	0.91
Recall	0.72	0.91	0.76	1.0	1.0	1.0	0.87	1.0	0.92	1.0

Table 2: Success Ratio for 10 datasets

Parameters	Accuracy	Precision	Recall
Reference 1	92%	95.7%	94.3%
Reference 2	90%	92%	90%
Reference 3	91.5%	91.1%	91.8%

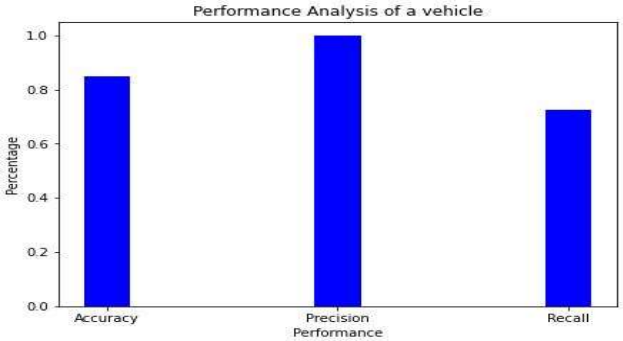

Fig 7: Performance Analysis of D1

VII. COMPARISON

Table 3: Comparison of base paper, reference paper and own paper

Parameters	Sample	Success Ratio
Accuracy	10	91.5%
Precision	10	91.1%
Recall	10	91.8%

When we analyzed the success rates of the two articles, we discovered that the base paper had a 94 percent success rate and our article had a 91.4 percent success rate. The difference in success ratios is 2.6 percent. Image quality, image saturation, pixel count, image focusing, and the cameras used to collect the photographs all contribute to this. To improve accuracy, we may use high-resolution cameras.

VIII. CONCLUSION

The methods for identifying and recognizing a vehicle's number plate using free open source software are discussed in this paper. Python and OpenCV are used to accomplish various image processing techniques. OCR - Tesseract and EasyOCR are two of the ways for extracting numbers from a number plate. This research proposes Machine Learning methods for increasing accuracy rates. However, this does not imply that the results will be 100 percent accurate. The proposed system attained 91.5 percent accuracy, 91.1 percent precision, and 91.8 percent recall.

IX. REFERENCES

[1] International Journal of Engineering Research & Technology (IJERT) IJERT ISSN: 2278- 0181 www.ijert.org Vol. 3 Issue 7, July - 2014 Automatic Number Plate Recognition System (ANPR System)

[2] Prathamesh Kulkarni, Ashish Khatri, Prateek Banga, Kushal Shah, "Automatic Number Plate Recognition (ANPR) System for Indian Conditions", IEEE, 2009

[3] Tella Pavani, DVR Mohan, "Number Plate Recognition by using open CV- Python", International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 06 Issue: 03.

[4] https://kccemsr.edu.in/public/files/technovision/1/Number%20Plate%20Recognition%20using%20Machine.pdf

[5] https://www.mdpi.com/1424-8220/21/9/3028

[6] https://www.researchgate.net/publication/349629053_Automatic_Vehicle_Number_Plate_Recognition_System_Using_Machine_Learning

DOI: 10.5281/zenodo.6782787
ISBN: *978-93-5607-317-3@2022 MCA, Amal Jyothi College of Engineering Kanjirappally, Kottayam*