

MAJOR PROJECT

on

PYTHON Based Vehicle Number Plate Recognition

Submitted to

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

In partial fulfilment of the requirement for the award of the degree of

BACHELOR OF TECHNOLOGY

in

ELECTRONICS AND COMMUNICATION ENGINEERING

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING



**MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY & MANAGEMENT**

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Date: xx-Month-xxxx

CERTIFICATE

This is to certify that the project work entitled “**PYTHON Based Vehicle Number Plate Recognition**” work done by RAMU MOGILI (187Y1A0495), KARTHIK REDDY J (187Y1A0482) and KIRAN SAI CHANDANA (177Y1A0415) students of Department of Electronics and Communication Engineering, is a record of bonafide work carried out by the members during a period from January, 2022 to June, 2022 under the supervision of Mr E. SRINIVASULU. This project is done as a fulfilment of obtaining Bachelor of Technology Degree to be awarded by Jawaharlal Nehru Technological University Hyderabad, Hyderabad.

The matter embodied in this project report has not been submitted by us to any other university for the award of any other degree.

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The Viva-Voce Examination of above students, has been held on.....

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External Examiner

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LIST OF ABBREVIATIONS

Symbol	Description
NPR	Number Plate Recognition
RGB	Red Green Blue
VNP	Vehicle Number Plate
OCR	Optical Character Recognition
RLNP	Recognition Of License Number Plate
ROI	Region Of Interest
ANPR	Automatic Number Plate Recognition
ALPR	Automatic License Plate Recognition
CS	Character Segmentation

ABSTRACT

The ANPR (Automatic Number plate Recognition) system is based on image processing technology. It is one of the necessary systems designed to detect the vehicle number plate. In today's world with the increasing number of vehicle day by day it's not possible to manually keep a record of the entire vehicle. With the development of this system it becomes easy to keep a record and use it whenever required. The main objective here is to design an efficient automatic vehicle identification system by using vehicle number plate. The system first would capture the vehicles image as soon as the vehicle reaches the security checking area. The captured images are then extracted by using the segmentation process. Optical character recognition is used to identify the characters. The obtained data is then compared with the data stored in their database. The system is implemented and simulated on PYTHON and performance is tested on real images. This type of system is widely used in Traffic control areas, tolling, parking area.etc. This system is mainly designed for the purpose of security system.

CHAPTER-1

INTRODUCTION

1.1 Introduction

With the increasing number of vehicle in today's world it's not possible to manually keep a record of the entire vehicle. There need to be a man standing 24*7 to note down the number. It's a time consuming process and require manpower. Furthermore the data stored manually is not readable after a long time. So to overcome all these limitations here we tried to develop a system which would automatically detect the number plate and store it in its database. Later on when the information is required one can get it and use it. This process also helps to get the correct result compared to manually one. The process of working involves that as soon as the vehicle enters the secured area the system automatically captures the images and stores it. The processing of the image is done through the software stored in the system. If the vehicle matches the already stored information then it's allowed to pass the gate. And if the vehicle is not recognized or if its marked in the blocked list then it's not allowed to cross the gate and further checking process are followed.

Automatic vehicle identification is an image processing technique of identify vehicles by their number plates. Automatic vehicle identification systems are used for the purpose of effective traffic control and security applications such as access control to restricted areas and tracking of wanted vehicles. Number plate recognition (NPR) is easier method for Vehicle identification. NPR system for Indian license plate is difficult compared to the foreign license plate s there is no standard followed for the aspect ratio of licence plate. The identification task is challenging because of the nature of the light.

In NPR system spectral analysis approach is used were acquiring the image, extract the region of interest, recognized and stored in database. character segmentation using SVM feature extraction techniques. The advantage of this approach is success full recognition of a moving vehicle. It is difficult to detect the boundary of the Number plate from the input car images in outdoors scene due to colour of characters of the number plate and Background of the Number plate the gradients of the original image is adopted to detect candidate number plate regions. There are also algorithms which are based on a combination of morphological operation, segmentation and Canny edge detector. License plate location algorithm consist of

steps like as Edge Detection, Morphological operation like dilation and erosion, Smoothing, segmentation of characters and recognition of plate characters.

1.2 Related Work

The problem of automatic VNP recognition is being studied since the 90's. The early approaches were based on characteristics of boundary lines. The input image being first processed to enrich and enhance boundary line-information by using algorithms such as the gradient filter, and resulting in an image formed of edges. The image thus processed was converted to its binary counterpart and then processed by certain algorithms, such as Hough transform, to detect lines. Eventually, couples of 2-parallel lines were considered as a plate-designate. Another approach was based on the morphology of objects in an image. This approach focuses on some salient properties of vehicle plate images such as their brightness, contrast, symmetry, angles, etc. Due to these features, this method could be used to detect the similar properties in a certain image and locate the position of number plate regions. The third approach was based on statistical properties of text. In this approach, text regions were discovered using statistical properties of text like the variance of gray level, number of edges, edge densities in the region, etc. This approach was commonly used in finding text in images, and could well be used for discovering and designating candidate number plate areas as they include alphabets and numerals. In addition, there have been a number of other methods relating to this problem focusing on detecting VNP using artificial intelligence and genetic algorithms. These systems used edge detection and edge statistics and then AI techniques to detect the location of the number plate-designate area. All of the systems discussed above have some kind of limitations for example they are plate size dependent, colour dependent, Work only in certain conditions or environment like indoor images etc. The method that we are proposing is independent of colour, size, location and angle of the number plate of the vehicle.



Figure 1.1 Original image for recognition

1.3 Work Flow Process

Capture of Image: The first step is the capture of image. The image is captured by electronic device. Digital Camera or Webcam. The image captured is stored in JPG format. Later on it is converted in to gray scale image in .

Pre-processing: The next step after capturing the image is the pre processing of the image. When the image is captured there is lot of disturbances and noises present in the image for which the image can't be used properly. So in this step the noises from the image are required to be cleared to obtain an accurate result.

a. **Gray Processing:** this step involves the conversion of image in to Gray levels. Color images are converted in to Gray image. According to the R, G, B value in the image, it calculates the value of gray value, and obtains the gray image at the same time.

b. **Median Filtering:** media filtering is the step to remove the noises from the image. Gray level cannot remove the noises. So to make image free from noise media filtering is used.

Plate region extraction: The most important stage is the extraction of number plate from eroded image significantly. The extraction can be done by using image segmentation method. There are numerous image segmentation methods available in various literatures. In most of the methods image Binarization is used.

Character segmentation: In this step get the o/p of extracted number plate using labeling components, and then separate each character and split the each and every character in the number plate image by using split and also find the length of the number plate, then find the correlation and database if both the value is same means it will generate the value 0-9 and A - Z, and finally convert the value to string and display it in edit box, and also store the character in some text file in this code. Following figure shows the segmented characters



Figure1.2:- IMPLEMENTATIONS

The character recognition is now used to compare the each individual character with the character stored in the database. OCR uses the correlation method to match the characters. And if both the character matches then it displays the authorized otherwise it will display the unauthorized.

(A) Hardware Model: The hardware model consists microcontroller for controlling the complete hardware of the ANPR system. The ANPR algorithm on a PC receives the image and performs the processing, which Yields the vehicle number. This Number is then compared to standard database and finally provides signal to microcontroller to control the system Hardware. If the inputted plate contains the authorized number then the green indication light will be switched on w, and if the inputted plate contains an unauthorized number then red indication will be switched-on. The complete hardware model is shown in figure below.

CHAPTER-2

METHODOLOGY

In this technology we will be working on CCTV footage or input image given. The CCTV footage must be clear to extract the Vehicle number from the image taken as Input. The brightness and contrast must be clear and the number plate must be in format according to given by Indian government. The following methods is used in this technology: -

- a) Image capturing from camera
- b) RGB to Gray scale
- c) Detect license plate from image
- d) Character segmentation from number plate
- e) Character recognition
- f) Display vehicle number

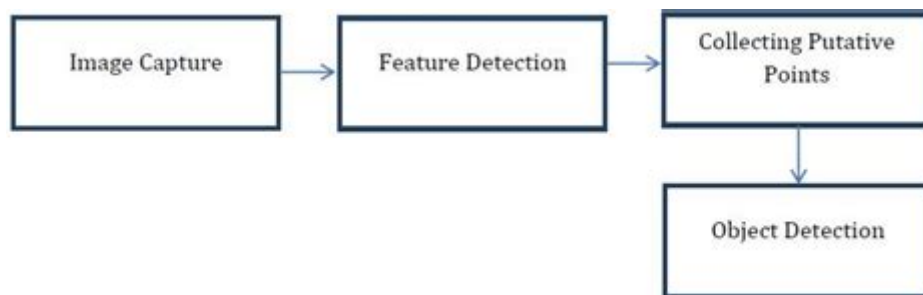


Figure2.1:- Block diagram for basic image/object detection

2.1 Image Capturing from Camera

In this method we will be capturing the image from CCTV footage. The image which is captured is in RGB format. We will be performing further methods on this RGB image only using Technology Vehicle Number Plate Detection.

The initial phase of image processing for Vehicle License Plate Recognition is to obtain images of vehicles. Electronic devices such as optical (digital/video) camera, webcam etc can be used to capture the acquired images. For this project, vehicle images will be taken with a Panasonic FX 30 digital camera. The images will be stored as colour JPG format on the camera. Next, we might proceed in using the Python function to convert the vehicle JPG image into gray scale format Input of this system is the image captured by a camera placed at a distance of 4-5metres away from the vehicle



Figure 2.2:-Number plate detected

2.2 RGB TO GRAY Scale

In this method we will work on the image taken as the input from the CCTV footage which is in RGB format. We will be converting that image into gray scale using python cv2.

RGB to gray-scale conversion is adopted, in order to facilitate the plate extraction, and increase the processing speed. This conversion is used.

Then we take the binary image, binary image is closed using square structuring elements to facilitate the plate extraction.

Mathematical morphology is used to detect the region of interest and Sobel operator are used to calculate the threshold value, that detect high light regions with high edge magnitude and high edge variance.

The binary gradient mask shows lines of high contrast in the image. These lines do not quite delineate the outline of the object of interest. Compared to the original image, gaps in the lines are observed that surrounds the object in the gradient mask. These linear gap disappears if the Sobel image is dilated using square structuring elements



Figure 2.3:- Sobel edge detection with dilation

Python with open cv provide a function `imfill` (BW, “holes”) that fills holes in the binary image. The dilated gradient mask shows the outline of the cell quite nicely, but there are still holes in the interior of the cell.



Figure 2.4:- RGB TO GRAY Format

2.3 Detect License plate from image

In this method we will be working on the image which was converted to gray scale from RGB format. We will detect the number plate from the gray scale image using the python.

The region of interest has been successfully segmented, but it is not the only object that has been found..

Finally, in order to make the segmented object look natural, the image is eroded twice with diamond and line structuring element. This helps in extraction of number plate area of the vehicle.

To get the only number plate area in a vehicle image with characters and numbers present on it the segmented image is multiplied with binary image.



Figure 2.5: - Number Plate Detected

2.4 Character segmentation from number plate

In this method we will be working on the image which is extracted from the gray scale image i.e. the number plate which is detected. We will divide each character of the number plate which is being detected to find the number from number plate. We will be performing further more methods on the segmented image.

Segmentation is one of the most important processes in the automatic number plate recognition, because all further steps rely on it. in

the function `regionprops` (for "region properties") provides a shortcut for determining many properties of a black and white or labelled

image. Measure properties of image regions (blob analysis) the `regionprops` syntax is `STATS = regionprops(L, properties)`, it measures a set of properties for each labelled region in the label matrix `L`. Positive integer elements of `L` correspond to different regions. For example, the set of

elements of `L` equal to 1 corresponds to region 1; the set of elements of `L` equal to 2 corresponds to region 2; and so on. The return value `STATS` is a structure array of length `max(L(:))`. The fields of the structure array denote different measurements for each region, as specified by `properties`.

Properties can be a comma-separated list of strings, a cell array containing strings, the single string 'all', or the string 'basic'. This table lists the set of valid property strings. Property strings are case insensitive and can be abbreviated

If properties are the string 'all', `regionprops` computes all the preceding measurements. If properties are not specified or if it is the string 'basic', `regionprops` computes only the 'Area', 'Centroid', and 'Bounding Box' measurements shows the segmented section of the cropped image by using `regionprops`.



Figure 2.6:- Segmented section of the cropped image

2.5 Character Recognition

In this method we will be working on the segmented image of each character. We will detect each character using OCR technique i.e. optical character recognition. Here each character is recognized individually. Then those character are combined to form a whole number that is present on the number plate which is taken in the form of image.

It is employed for the purpose of conversion of images of text into characters. The goal of Optical Character Recognition (OCR) is to classify optical patterns (often contained in a

digital image) corresponding to alphanumeric or other characters. The process of OC involves several steps including segmentation, feature extraction, and classification. Each of these steps is a field onto itself, and is described briefly here in the context of a python implementation of OCR. examples of OCR applications are listed here. The most common for use OCR is the first item; people often wish to convert text documents to some sort of digital representation.

1. People wish to scan in a document and have the

text of that document available in a word processor.

2. Recognizing license plate numbers.

3. Post Office needs to recognize zip-codes.

Before recognition algorithm, the characters are normalized. Normalization is to refine the characters into a block containing no extra white spaces (pixels) in all the four sides of the characters. Then each character is fit to equal size. Fitting approach is necessary for template matching. For matching the characters with the database, input images must be equal-sized with the database characters. The extracted characters cut from plate and the characters on database are now equal-sized.

The next step is template matching. Template matching is an effective algorithm for recognition of characters. The character image is compared with the ones in the database and the best similarity is measured. To measure the similarity and find the best match, a statistical method correlation is used. Correlation is an effective technique for image

recognition which was developed by Horowitz. This method measures the correlation coefficient between a number of known images with the same size unknown images or parts of an image with the highest correlation coefficient between the images producing the best match.

2.6 Display Vehicle Number

After performing all the methods of vehicle number plate detection using Python. We will be displaying that number on the screen.

It is employed for the purpose of conversion of images of text into characters. Number plate recognition is now used to compare the each individual character against the complete alphanumeric database using template matching. The matching process moves the template image to all possible positions in a larger source image and computes a numerical index that indicates how well the template matches the image in that position. Matching is done on a pixel by pixel basis. The template is of size 42×24 . Since the template size is fixed, it leads to accurate recognition.

2.7 Overview of Recognition of License Number Plate (RLNP)

A proposed system which is utilized to detect and identify the number plate of a particular vehicle and store the data into text form. Along with detection technique, the morphological operation is used to detect the number plate characters followed by segmentation approach, in which bounding box procedure is utilized to segment and extract each character from the number plate. After the segmentation, template matching approach is made use of to match the numbers and characters of the number plate. The number plate decoded will be used further for identification, matching and documentation purpose of vehicle details

Recognition of License Number Plate (RLNP) plays a significant role in many real-life applications, such as automatic toll collection, traffic law enforcement, parking lot access control, and road traffic monitoring [1]–[4].

RLNP is also known as automatic vehicle identification, car plate recognition, automatic number plate recognition, and optical character recognition (OCR) for cars. The variations of the plate types or environments cause challenges in the detection and recognition of license plates. They are summarized as follows[5].

1) Plate variations:

- a) Size
- b) Font
- c) Color

- d) Location
- e) Quantity
- f) Occlusion
- g) Inclination
- h) Standard versus vanity

2) Environment variations

- a) Illumination
- b) Background

The RLNP system that extracts a license plate number from a given image can be composed of four stages [5]. The first stage is to acquire the car image using a camera. Various camera parameters such as the type of camera, optical resolution, shutter speed, orientation, and illumination, have to be considered. The second stage is to extract the license plate from the image, which may take in account features like the plate boundary, the plate color, or presence of alphanumeric. The third stage is to segment the license plate from the image and extract the alphanumeric by projecting their color information, labeling them, or matching their positions with templates. The final stage is to recognize the extracted characters by template matching or using some classifiers, such as neural networks and fuzzy classifiers. The performance of an ALPR system relies on the robustness of each individual stage. The license plate extraction stage influences the overall accuracy of an ALPR system. The input to this stage is a car image, and the output is a portion of the image containing the potential license plate area which is the captured Region of Interest (ROI). Since, the license plate can exist anywhere in the image, hence the feature of license plate (e.g. license plate color, shape, boundary etc.) is sought and only pixels regions which match with the feature criteria are labeled as ROI. This approach is efficient and has low processing time which is fit for real time application.

RNLP System

The Recognition of License Number Plate (RLNP) system consists of four processing stages. In the image acquisition stage, some points have to be considered when choosing the RLNP system camera, such as the camera resolution and the shutter speed. In the license plate

extraction stage, the license plate is extracted based on the color, boundary and existence of the characters. In the license plate segmentation stage, the characters are extracted by color information, labeling or matching their positions with template. Finally, the characters are recognized in the character recognition stage by template matching. It is used by various security and traffic applications such as entrance of highly restricted areas for security and access control. These systems are also used for the traffic prospective gathering, traffic flow statistics, finding stolen car, controlling access to car parks, like in parking area, vehicle number plates are used to calculate duration of the parking. Automatic license plate recognition is quite challenging due to the different license plate formats and the varying environmental conditions.

The RLNP system that extracts a license plate number from a given image can be composed of four stages. The first stage is to acquire the car image using a camera. The second stage is to extract the license plate from the image based on some features, such as the boundary, the color, or the existence of the characters. The third stage is to segment the license plate and extract the characters by projecting their color information, labeling them, or matching their positions with templates . The final stage is to recognize the extracted characters by template matching, if characters are matched then it will display the output in text. The output text will be exported via Python as well as Notepad.

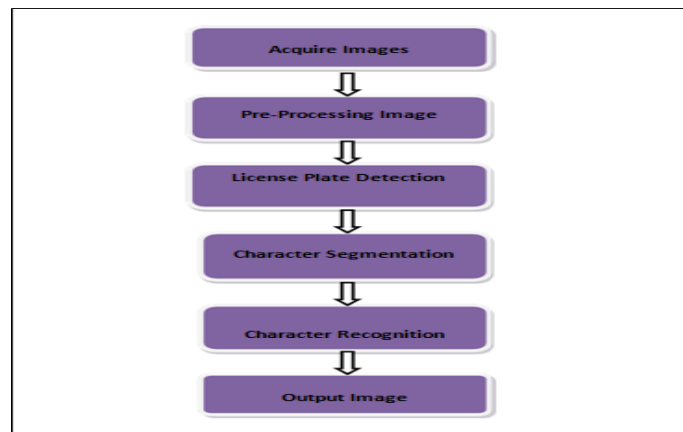


Figure 2.7:- Flowchart of RLNP System

CHAPTER-3

PROPOSED DESIGN

3.1 Introduction of Recognition of License Number Plate

The Recognition of License Number Plate (RLNP) is used by various security and traffic applications such as entrance of highly restricted areas for security and access control. These systems are also used for the traffic gathering, traffic flow statistics, finding stolen car, controlling access to car parks, like in parking area, vehicle number plates are used to calculate duration of the parking. In RLNP system, firstly, image of car is captured such that license plate is present in the image. In next stage, eliminate the non-useful parts of the image so that the characters on the license plates are easily identified and segmented. In the last stage, the segmented characters will be transformed from usage into text and it is known as Optical Character Recognition (OCR).

In India, basically two types of vehicle registration number plates are used:

- 1) White background with black letters on plate.
- 2) Yellow background with black letters on plate.

In comparison to foreign vehicle registration number plate, the Indian License number plate recognition is tedious because Indian license plate does not follow any standard aspect ratio. The goal of this dissertation work is to study and evaluate some most important License Plate Detection algorithms and compare them in terms of accuracy, performance, complexity, and their usefulness in different environmental conditions and adopts classification template matching of font characteristics, largely reduces the time of template matching and effectively eliminates the misidentification of similar characters. License Plate Recognition is an important function in intelligent traffic management systems such as parking management systems, access control, border control and monitoring, and tracking vehicles.

The most common solutions to license plate localization in digital images are through the implementation of edge extraction, histogram analysis, morphological operators and Hough Transform. An edge detection approach is normally simple and fast. This technique reduces memory space and computation requirements. Hough transform for line detection gives

positive effects on image assuming that the plate is made up of straight lines. However, it requires the outline of the plate to be obvious for satisfactory license plate localization.

After the localization of the license plate comes the character segmentation process. Common character segmentation processes are based on histogram analysis and thresholding. The final stage of this system is the character recognition process.

Recognition of license number plate (RLNP) system is made up of four modules:- Pre-processing of captured image, Extracting license number plate region, Character Segmentation and Character Recognition of license number plate and every step has its own importance in order to recognize the vehicle number plate.

Vehicles in each country have a unique license number, which is written on its license plate. This number distinguishes one vehicle from the other, which is useful especially when both are of same make and model. An automated system can be implemented to identify the license plate of a vehicle and extract the characters from the region containing a license plate. The license plate number can be used to retrieve more information about the vehicle and its owner, which can be used for further processing. Such an automated system should be small in size and portable.

3.2 ANPR Based on Yellow Algorithm

Different countries have different number plates so their techniques also differ for detecting the vehicles. In this way, the one country namely Sind have a different ANPR's algorithm¹. This algorithm is called yellow algorithm because number plate is in yellow color. The proposed system detects the vehicle and then captures the vehicle image. Then extraction part plays by the image segmentation. Character recognition done with the help of OCR. Then the output of OCR is compared with the database stored in the computer. The working of OCR is combination of software and hardware models. The software model is carried out with the Python 3.10.

Software model is categorised as1

1. Capture the image
2. Extract the plate
3. Recognition

The first step is carried out with the help of USB camera attached to the port attached to the PC. This image is in red green blue format (RGB) so that further processing is made easier. The second step of the proposed ANPR is the extraction of region of interest i.e. number plate. For this purpose we are using yellow search algorithm. This is the highlight feature of this proposed technique. This algorithm extracts the number plate efficiently. In SINDH number plate has yellow background with alphanumeric characters are in black color so it is easy for such algorithm to extract the characters.

The procedure for such algorithm is as follows:-

1. The algorithm is search for yellow pixel or that pixel which is closer to yellow value.
2. If pixel value is of yellow color then set that pixel equal to 1, otherwise set that pixel equal to 0.
3. The image obtained after search algorithm is black and white in color.

After search algorithm, filtering action is employed. There are two different filtering action is employed. The first technique is removing all white patches that are connected to border and set that pixel value equal to 0. The second method is based on the pixel count method. In this method number of white pixels counted and regions that contain less white pixel than the threshold value set that region equal to 01. At this moment, vehicle image is obtained. Smearing algorithm is used need to extract this image is obtained. This algorithm is looking for last and white pixels from the top left corner of the image. Smearing algorithm is used to crop that image.

Then the role of optical character recognition comes, it recognize or identify the number. The resultant output of smearing algorithm or it can be called cropped image gets inverted i.e. white pixel changes to black or black to white pixels. This leads to text is in white colour and plate background. The separation process separates the individual line. This separation process adds the each pixel value in a row. If the resultant sum of row is zero it means no text is present or if the resultant sum of row is greater than zero that means text is present in that row1. The first additive sum which is greater than zero states that starting of line and last additive sum states that end of line. This start and end values are behaving as limits which is used to crop the image. Line wise extraction finishes. Then column wise recognition starts and same procedure is applied.

The OCR is used to compare the output with database stored in PC.

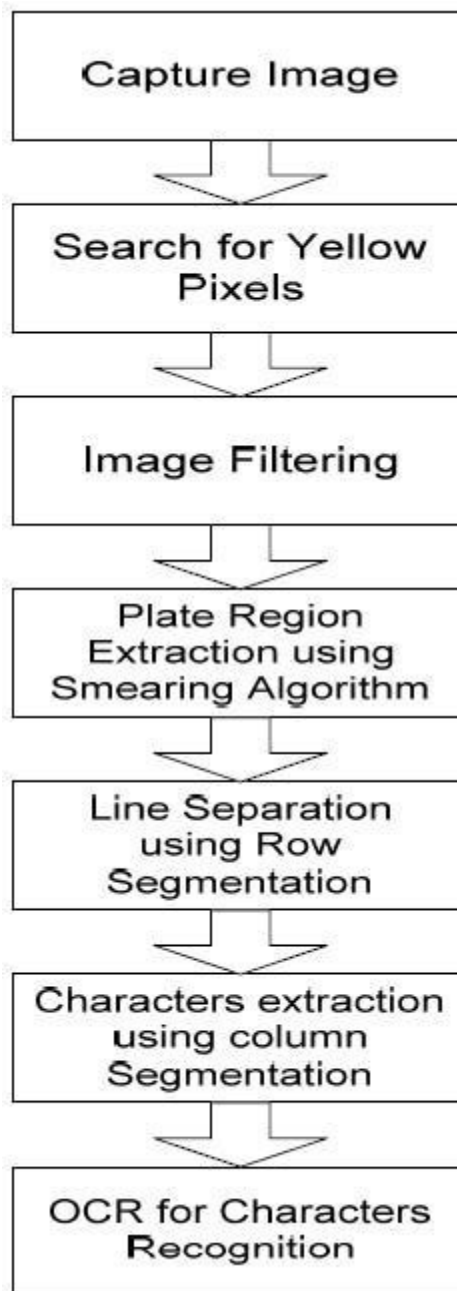


Figure 3.1:- Flowchart for Proposed Technique

3.3 ANPR for Indian Plate Recognition

Our Indian government uses feature based algorithm for detection of stolen vehicles. It is a real time embedded platform for detection of vehicles. These are called feature based because these algorithm execute on the basis of the feature of number plate. India consist of many states and each state has a different way of writing the numbers therefore such techniques

plays a very important role in such country. Such a technology consists of localization, image scissoring and statistical feature. Each step has a different function like localization for extracting the ROI from the image that is captured. The captured image consists of unwanted images also so therefore there is a need to extract the region of interest with the help of localization technique. After obtaining the region of interest, the characters have to be cut for getting the numeric or alphanumeric characters. These cutting of characters have to be cut with the special type of real time scissor called image scissoring technique. After image scissoring, characters has to be recognized, this recognition task has to be done with the statistical feature technique

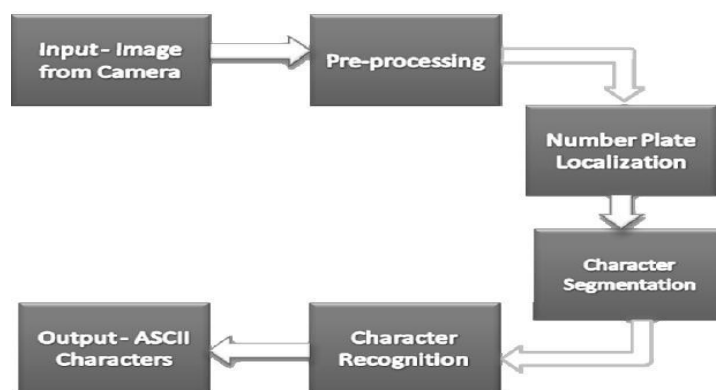


Figure 3.2:- Feature Based Technique Flowchart

3.4 ANPR based on Image Processing Techniques

ANPR implementation is based on image processing techniques is divided into four phases7-

1. License plate area location module
2. Pre-processing module
3. Text recognition module
4. Authentication module

In this phase the issue is to when camera will be started for taking the video. This issue is resolving by placing the sensors on the road side7. This sensors send some signals to the system so that system will switch on the camera and sensors are placed 8 feet above the ground which is a good position.

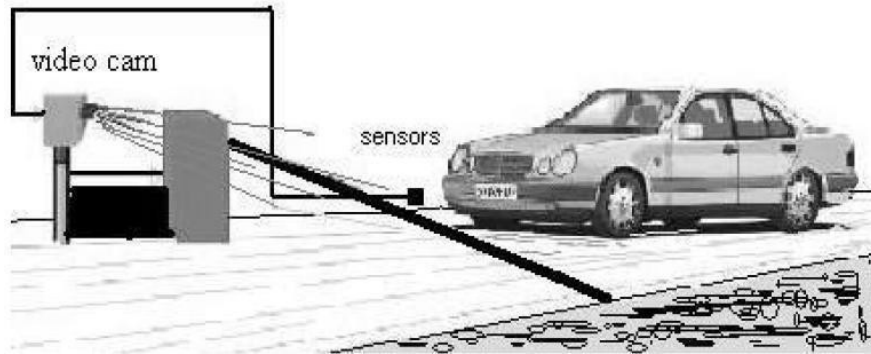


Figure 3.3:- LPA Location Module

The procedure is as follows

1. Placing the video camera, so that input is perfectly clicked. Perfectly clicked means no unwanted environment is there in the image⁷.
2. Convert the image into gray scale. Then extract the frame from the gray scale image.
3. Identify the edges in the frame with the help of sobel edge detection method. Sobel edge detection identifies the corner detection, rectangular detection and range of rectangle. Start from step 1 again if edges not detected.
4. The third step is pre-processing, apply histogram equalization technique that smooth the rectangle of license number plate and sharpens the characters of the license number plate. This gives a threshold value.
5. The fourth step is recognition. Divide horizontal segment into three horizontal segments. It recognizes the character from the number plate or from the segments of number plate. Authentication is the fifth step in which segmented data is compared with the data stored in database.

3.5 ANPR Based on FPGA

ANPR is also called intelligent transportation system. In this proposed paper, ANPR implementation based on FPGA is discussed which consist of

1. Number plate localization (NPL) - Number plate is detected [6]
2. Character Segmentation (CS) - It is a pre-processing step, where each character can be segmented.

3. Optical Character Recognition (OCR) -OCR compares the characters that are segmented with those characters which are stored in the database.

3.6 ANPR Based on Neural Networks

The ANPR system composed of, extracting ROI, segmentation of characters & recognition of characters⁵. This number plate is a key of interest so that it would be extracted from the whole i/p image. This number plate is processed in the next steps of character segmentation. In this part each and every character gets segmented or isolated or separated. Based on the individual feature of characters, each character is identified. Firstly, it is necessary to know what neural network is. A neural network is a device with one or more inputs and one output. The neural network has two modes of operation:-

1. Training mode
2. Using mode

The supervised learning technique has been applied where the neuron is trained and can fire random input pattern. As per training given to the neuron if the input pattern similar to the taught one is detected then the output will be created as the present input. After training if the neuron will not recognize the taught input pattern then the decision will be taken as per the firing rule taught to the neuron.

CHAPTER-4

EXPERIMENTAL RESULTS

This section presents the simulation results of the developed ANPR system. Different images of cars having different colours and structure types are taken and stored in PC. The screenshot of the simulation and are displays below. Two original images of vehicle are shown.



Figure 4.1&4.2: Input images

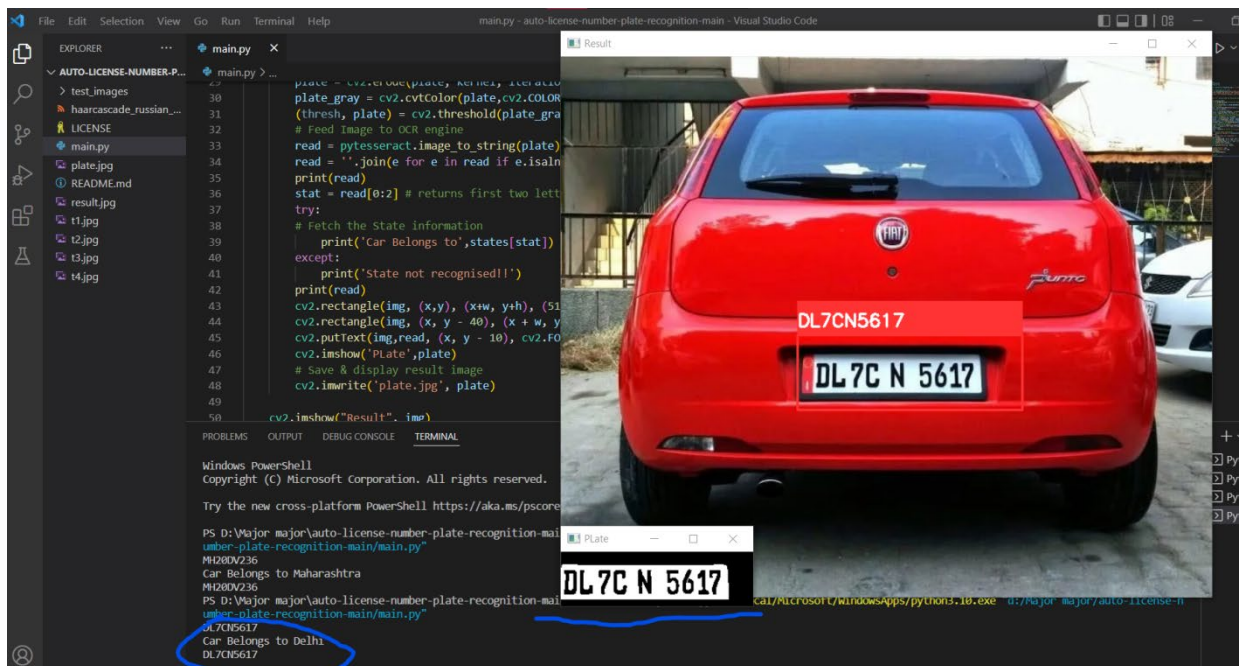
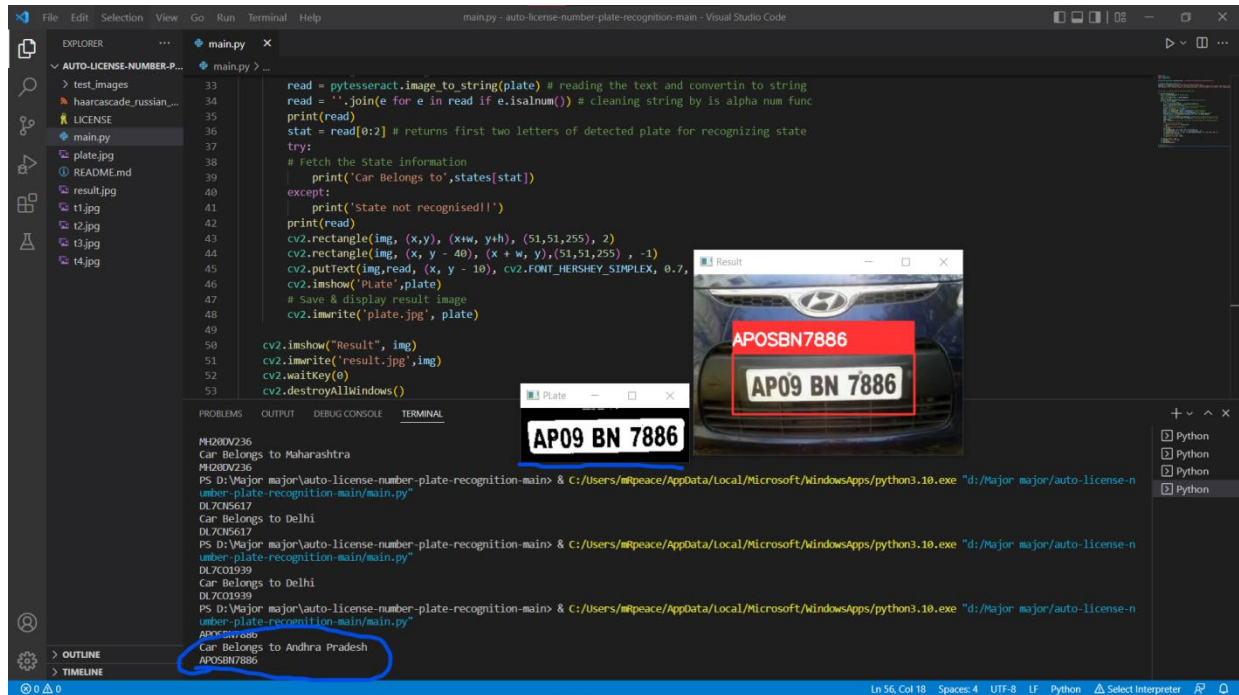


Figure 4.3&4.4: Output Images

CHAPTER-5

APPLICATIONS & FUTURE SCOPE OF WORK

Applications:

1. Parking: - The NPR is used to automatically enter prepaid members and calculate parking fee for non-members.
2. Access control: - A gate automatically opens for authorized members in a secured area, thus replacing or assisting the security guard.
3. Tolling: - The car number is used to calculate the travel fee in a toll-road or used to double check the ticket.
4. Border Security: - The car number is registered in the entry or exits to the country and used to monitor the border crossings.
5. Traffic Control: - The vehicles can be directed to different lanes according to their entry permits. The system reduces the traffic congestions and number of attendants.
6. Airport Parking: - In order to reduce ticket frauds or mistakes, the NPR unit is used to capture the number plate and image of the car.
7. Reduce paper work: - This technology is more advance as Challan will be sent directly to owner's mobile number, email and a copy of it will be saved.

Future Scope of Work

The future scope is that the automatic vehicle recognition system plays a major role in detecting threats to defence

Also it can improve the security related to the women's as they can easily detect the number plate before using cab or other services. The system robustness can be increase if bright and sharp camera is used. Government should take some interest in developing this system as this system is money-saving and eco- friendly, if applied effectively in various area

CHAPTER-6

CONCLUSION

We have implemented number plate recognition. Our algorithm successfully detects the number plate region from the image which consists of vehicle number & then character segmentation, recognition. We have applied our algorithm on many images and found that it successfully recognition. The project was designed keeping in mind the automation of the number plate detection system for security reason that could replace the current system of manual entry. This project was a success in recording the number plate of a vehicle although it has got its own limitation of image processing and other hardware requirements

In this system , an application software is designed for the detection of number plate of vehicles using their number plate. At first plate location is extracted using morphological operation then separated the plate characters individually by segmentation. Finally Neural Network is applied for recognition of plate characters.

In this system , an application software is designed for the detection of number plate of vehicles using their number plate. At first plate location is extracted using morphological operation then separated the plate characters individually by segmentation. Finally template matching is applied with the use of correlation for recognition of plate characters.

Some of possible difficulties:

1. Broken number plate.
2. Blurry images.
3. Number plate not within the legal specification.
4. Low resolution of the characters.
5. Poor maintenance of the vehicle plate. Similarity between certain characters, namely, O and D; 5 and S; 8 and B, E; O and 0, etc.

REFERENCES

- [1] <https://github.com/>
- [2] <https://www.python.org/>
- [3] https://en.wikipedia.org/wiki/Automatic_number-plate_recognition