NEW HORIZON
COLLEGE OF ENGINEERING
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Accredited by NAAC with 'A' Grade.

"Car Number Plate Detection Using MATLAB"

A MINIPROJECT REPORT

Submitted by

Sowmya.L - 1NH18EC108

In partial fulfillment for the award of the degree of

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NEW HORIZON COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CERTIFICATE

Certified that the mini project work entitled "**Car Number Plate Detection Using MATLAB**" carried out by

Sowmya.L(1NH18EC108)

bonafide student of Electronics and Communication Department, New Horizon College of Engineering, Bangalore.

The mini project report has been approved as it satisfies the academic requirements in respect of mini project work prescribed for the said degree.

Mini Project Guide:
Mr. Aravinda K.
Senior Assistant Professor,
Department of Electronics and Communication

HOD ECE
Dr. Sanjeev Sharma
B.Tech, M.Tech, Ph.D.

External Viva

Name of Examiner Signature with Date

1.

2.

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Sowmya.L - 1NH18EC108

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ABSTRACT

In this project, we have detected and identified vehicle number plate that will help in the detection of car number plates easily.

This mainly follows Sobel edge detection method and morphological operation for better approach, and it is simplified to use all the numbers and letters which are in segmented fashion as it appears in vehicle number plate. Numbers and characters are recognized using neural networks and bounding box method. Our main intention is to locate the region of car number plate in a proper way and to segment all the numbers and letters to identify each number singly. Systems like ANPR, OCR, CRS are existed in this.

The image of the car number plate is captured by the camera of ANPR system and then it is processed through multiple number of algorithms and then finally we get output of the detected number plate. These are widely used in highways and airports etc.

CHAPTER 01

INTRODUCTION

In present scenario with increasing number of vehicles on road, it is getting very difficult to follow the loss and traffic rules for the traffic flow in our nations. Toll- both is constructed where a car must stop in the parking area to pay parking fees. Also, the management system for traffic are installed to check for the vehicles which are moving at high speed by not enforcing laws and traffic rules.

At the center of all the systems, there lies a vehicle. In order to monitor these processes and to make them more effective, a system is required to identify a vehicle. Identification of vehicle can be done by using vehicle number plate detection using MATLAB. In each country vehicles have its own and unique vehicle number i, e license number, which will be written on license plate of vehicle. This license number is used to distinguish one vehicle from another, which is very useful when both the vehicles are of same design and model.

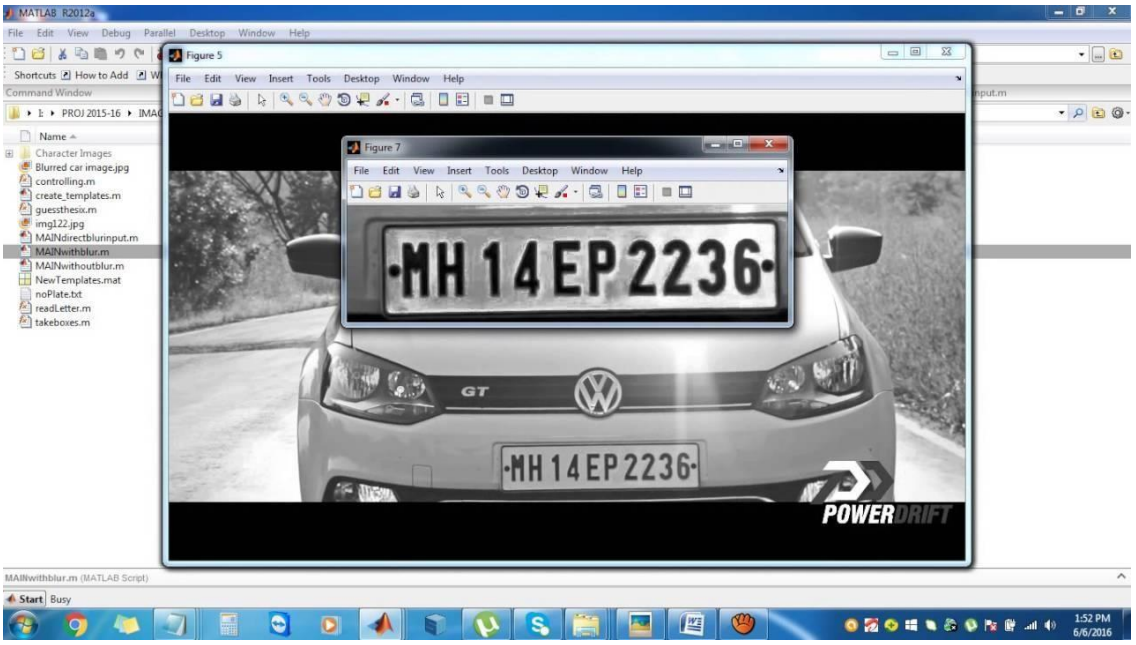

fig 1.1. Car number plate image

fig 1.2. Traffic Monitoring Solution

ANPR method can be implemented to identify the vehicle number and to extract the character from the region. This system should be smaller in size, portable and should be able to process the data in enough period. So, in order to overcome all these limitations ANPR (automatic number plate recognition) automatically detect the number plate and stores all its data. This process helps us to get accurate results compared to manual one. This process involves that as soon as a vehicle enters a parking area, the system automatically identifies and captures the image of vehicle number and stores in it. The processing of the image is done by MATLAB in the system. If the vehicle ids matched with already stored information, then it will be allowed to cross the gate and if vehicle is not matched, then it will not be allowed to cross the gate. Hence, NPR (number plate recognition) is easier method for identification of vehicles.

CHAPTER 02

LITERATURE SURVEY

Serial no.	Name of paper	Year of publish	Methodology used	Result	Limitation
1.	Efficient method for vehicle number plate Extraction and character segmentation.	2010	Removing the plate contour, edge placement calculation and vertical projection technique are utilized.	Final system efficiency=80%	The proposed manner is basically intended for constant Malaysian Number plate.
2.	VNPR using many layer back propagation neural networks.	2011	For the number plate acknowledgement initially picture transformation in paired and apply to neural system, and apply mpl calculation, at that point recognition singular image, by network mapping.	Rate is averagely recognized.	The caught picture 2-3 meters detracted from the ANPR camera.
3.	Indian CAR number plate extraction and segmentation.	2011	(1) Preprocessing of image by adjustment of histogram. (2) Extraction of plate locale by edge discovery calculation method. (3) Segmentation of characters. (4) Median filtering all above methods.	Exactness of our framework is 83.9%.	Proposed strategy is touchy to the point of view, physical appearance and environmental conditions.

4.	A real –time license plate recognition system for Saudi using lab view.	2013	Image increment. Then setting morphological operations like dilation and erosion character segmentation and recognition by neuron execution.	Works normally and casually on process.	For the overall system, while the some more work is to be done to make the technique more efficient.
5.	Automatic license plate recognition (ALPR).	2013	The authors considered the different variations in number plates detection.	This method has accuracy about 74.8%	Difficulties looked by ANPDR is mainly ecological issues or the varieties in the tag. Different elements which incorporate are recently situated on plate.

Table 2.1. Literature Survey

CHAPTER 03

EXISTING SYSTEM AND PROBLEM STATEMENT

As mentioned previously, the existing system is very imp if this is removed or changed then the function of the project completely changes. The existing systems in car number plate detection using MATLAB plate are very significant and plays very main role in the execution of output are as follows

1. ANPR (Automatic Number Plate Recognition)
2. CRS (Computer Recognition system)
3. OCR (Optical Character Recognition)
4. VNPR (Vehicle number Plate Recognition)

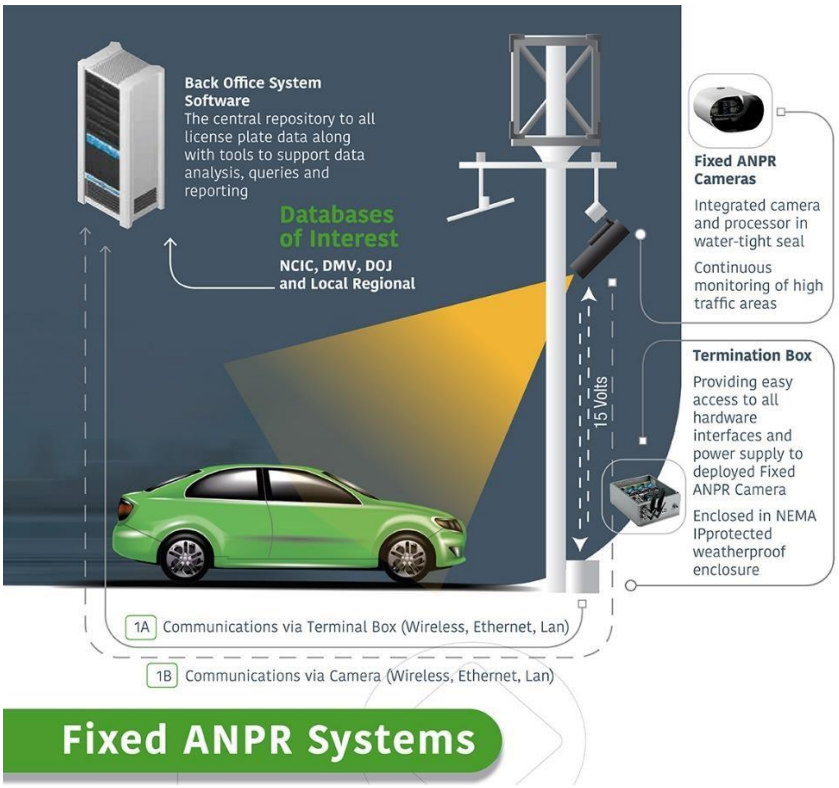

fig 3.1. Fixed ANPR System

1. ANPR (Automatic Number Plate Recognition)

This is also known as ALPR (Automatic Number Plate Region).And very useful in storing the images that are captured by the cameras and also text from the license plate, with few configurable to store photo of the driver .They commonly use infrared light to allow the camera to capture the picture at any time it may be day or night. ANPR utilizes OCR upon images that are captured by cameras. In addition to cameras usually mobile units are attached to the vehicles. And, some of the systems use infrared cameras to take the images of all the plates in clarity.

Fig 3.2. ANPR cameras used by DUBAI police to monitor vehicles.

Fig 3.3. Merseyside Police car captured with mobile.

2. CRS (Computer Recognition System)

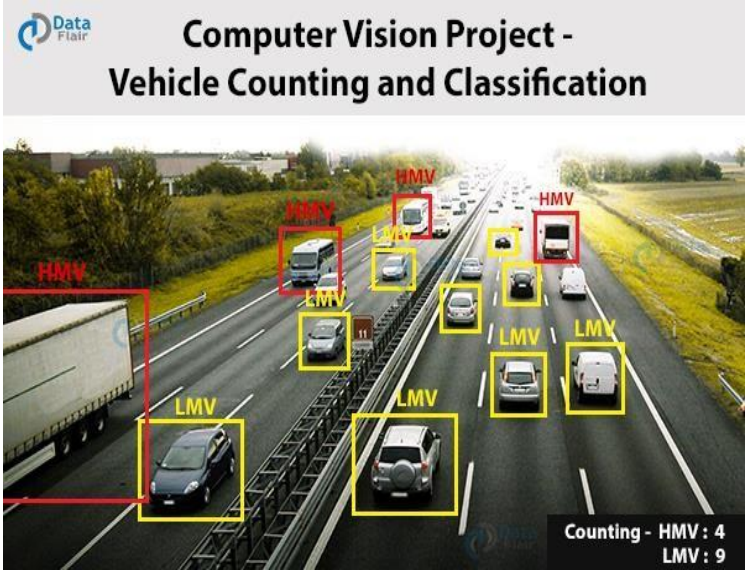

Fig 3.4. Vehicle Counting and Classification

In present scenario CRS is one of the most promising way in AI. Computer Vision, an AI technology that permits systems to understand and label the images properly. And these are used in various applications like daily medical diagnostic purpose, driverless car testing, and in checking the crop's health and livestock. These are the systems where systems recognize the image and gives details about the image completely.

fig 3.5. Self-driving car using CRS TECHNIQUE

3. OCR (Optical Character Recognition)

This is also known as Optical character reader (OCR). This is the electronic conversion of the pictures that are typed into machine encoded text from a photo or document. Mostly used as data entry form. These are used in many fields as follow

- To make electronic images of documents which are printed
- Traffic signal recognition
- Airports for the purpose of recognition of passport.
- This a very good technology for the blind impaired users.
- And finally, in ANPR.

This is very commonly method of digitalizing printed text so that they can easily be stored and edited, some of the systems can regenerate the output that closely looks like the original page or the input.

fig 3.6. OCR (Optical character recognition)

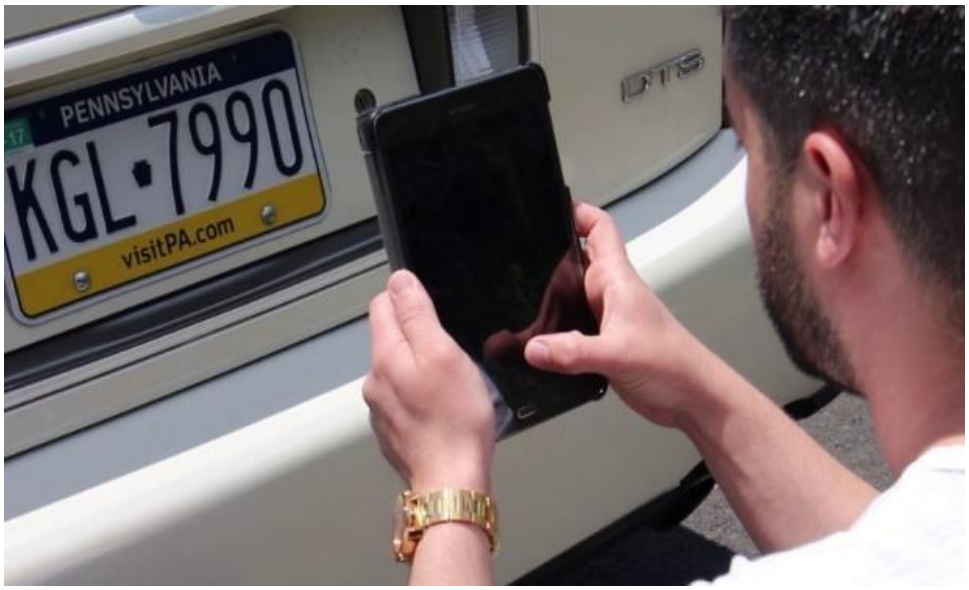

fig 3.7. Image captured by man using OCR technique through tab.

4. VNPR (Vehicle Number Plate Recognition)

Vehicle Number Plate Recognition is a method which is used to extract the license plate from a sequence of images or pictures. The extracted details in the database can be utilized in various applications like toll payment, parking area etc. VNPR can be effectively implemented based on the quality of the images captured using cameras or mobile units.

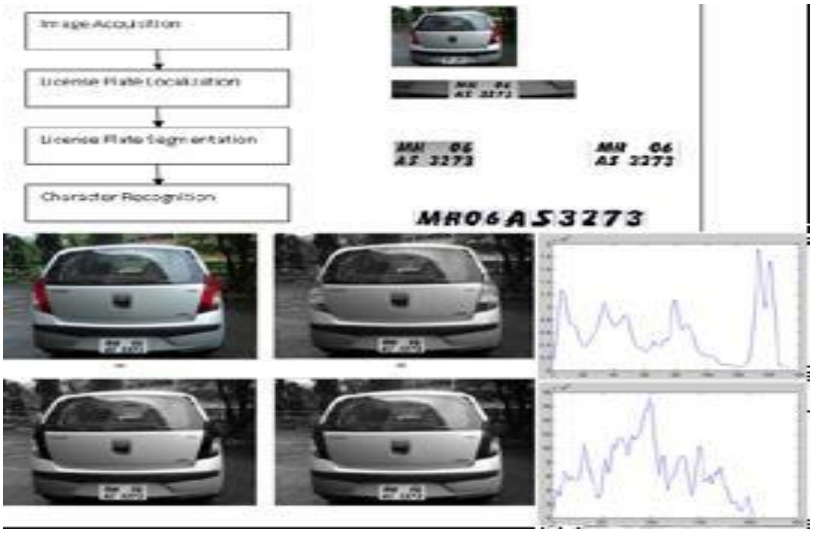

fig 3.8. VNPR System

Different algorithms have different features of the images. It should be simple to extract various types of license plates from the clicked images. This solution of VNPR can provide details regarding who's logging in or out, time spent on location, and by using remote based alarms on well-known number plates sending messages through mail.

fig 3.9. VNPR Controller

VNPR's are designed specifically to in low maintenance and effective in all kinds of environment, as previously mentioned this system uses cameras that work good in IR spectrum. The reading, processing of the number plate is done in better way during both day and night by removing the lighting changes and vehicle headlamp.' VNPR controller' plays a significant role in this system by supporting the images to be captured. And, in present scenario VISITA VNPR CONTROLLER is widely used. And the point to be notice is this VNPR is available only in few countries like UK, IRELAND.

CHAPTER 04

PROPOSED METHODOLOGY

The Software model uses the image processing technology. The project is implemented in MATLAB. The Algorithm is divided into following parts:

1. Template creation of all alphanumeric
2. Preprocessing the image
3. Plate region extraction and segmentation of character.

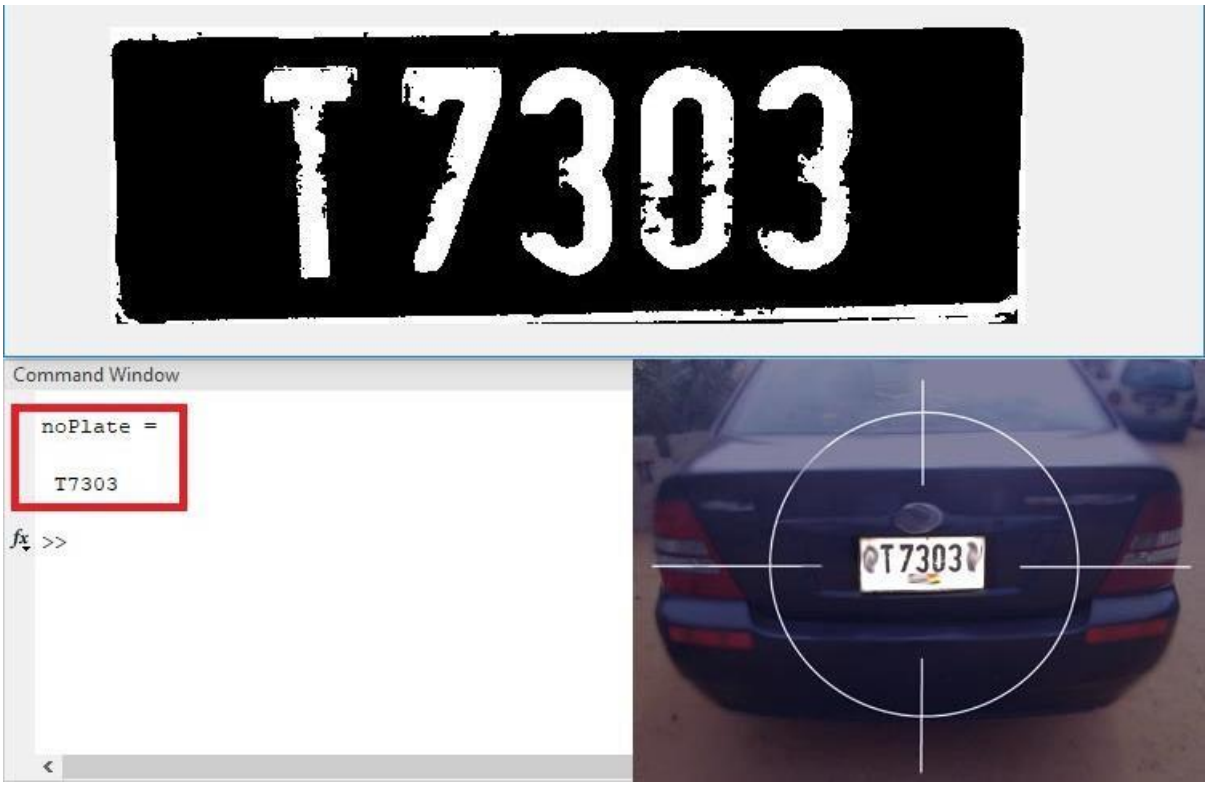

fig 4.1. Car Number Plate in Command window

The right bottom corner is having a complete input image and that image undergoes preprocessing like converting to gray image extraction of only number plate from the whole image. The characters in the converted image is compared with the templates and the highest matched character is printed in the command window.

4.1 Workflow Process

1. **Template creation of all alphanumeric:**

   This module is used to create templates in black and white images in which white pixels represents the presence of character, black represents the background. These templates for all alphanumeric are used for correlation for further characterization of images.

2. **Pre-processing the image:**

   When the image is captured there is lots of disturbances and noise present in the image for which the image can't be used properly, in order to clear the disturbances and noise we are using pre-processing.

   i. **Gray processing:** Here the colored images are converted into Gray image. According to the RGB value in the image, it calculates the value of gray value and obtain the gray image.

   ii. **Median Filtering:** As Gray processing of image might contain some noises in the image hence to eliminate such noises, we are using median filtering, which run through the image pixel by pixel, replacing each entry with median of neighboring pixels.

3. **Plate region extraction and segmentation:**

   The most important step in our project is to detect the number plate from the given image. There are various methods to detect the edge of the number plate from the image like Roberts, Sobel, Prewitt etc.

   We are using Prewitt method to detect the edges of the number plate. The Prewitt operator calculates the gradient of the image intensity at each point, giving the direction of the largest possible increase from light to dark and rate of change in that direction. The result therefore shows how "abruptly" or "smoothly" the image changes at that point, and therefore ho likely it is that part of the image represents an edge, as well as how that edge id likely to be oriented. In practice, the magnitude calculation is more reliable and easier to interpret than the direction calculation.

fig 4.2. Grayscale image

fig 4.3. Gradient with Prewitt operator of grayscale image

4. Segmentation:

The output of the extracted number plate undergoes some commands like finding properties of image region, calculating number of array elements etc. Then correlate each element in the image of 0-9 and A-Z if both the values are matched then save the element.

4.2 Code Description

1) Template creation:

There are many image processing tools available for number plate detection, we are using MATLAB image processing to get the vehicle number plate into the text format. As we mentioned before first step in our project is creation of template which consists of all the alphanumeric [0-9 and A-Z] are read and an array is formed.

In the code we read the alphanumeric images using a command **imread (),** then created a matrix of 'letter' and 'number' and saved it in 'NewTemplate' using a command **save (filename, variable)**.

2) Letter Detection:

In letter detection we are correlating each alphanumeric element from input image to the alphanumeric element in template. We have created a function named letter which gives us the alphanumeric output of the input

image from the folder by using command **readletter ()** and then load the saved templates.

Then we have resized the input image so it can be compared with the template's image. using the command **imresize (filename, size).**

```
for n=1: length (NewTemplates)
   cor=corr2(NewTemplates {1, n}, snap);
   rec= [rec cor];
end
```

The above for loop is used in the code to correlate the input image with every image in the template to get the highest match. Matrix **'rec'** is created to record the index value of correlation for each alphanumeric template with the characters template from the input image.

```
ind=find(rec==max(rec));
```

The command **find ()** is used to calculate the index value which corresponds to the highest matched character. then according to index value, the character is printed using 'if-else' statement.

3) Number Plate Detection:

In number plate detection code, the input image of a car or any vehicle is read and the will undergoes preprocessing such as converting RGB to gray, removing the noises, knowing the properties of the image etc.

```
Iprops=regionprops (im, 'BoundingBox','Area', 'Image');
area = Iprops.Area;
count = numel (Iprops);
maxa= area;
boundingBox = Iprops.BoundingBox;
```

```
for i=1: count
  if maxa<Iprops(i). Area
     maxa=Iprops(i). Area;
     boundingBox=Iprops(i). BoundingBox;
  end
end
```

The above code is used to detect the location of the number plate in the entire input image.

```
Iprops=regionprops (im, 'BoundingBox','Area', 'Image'); %read letter
count = numel (Iprops);
noPlate= []; % Initializing the variable of number plate string.

for i=1: count
  ow = length (Iprops(i). Image (1, :));
  oh = length (Iprops(i). Image (:1));
  if ow<(h/2) & oh>(h/3)
     letter=Letter_detection (Iprops(i). Image); % Reading the letter corresponding the binary image 'N'.
     noPlate= [noPlate letter] % Appending every subsequent character in noPlate variable.
  end
end
```

This is used to process the cropped number plate image and to display the detected number in the image and text format.

4.3 Block Diagram

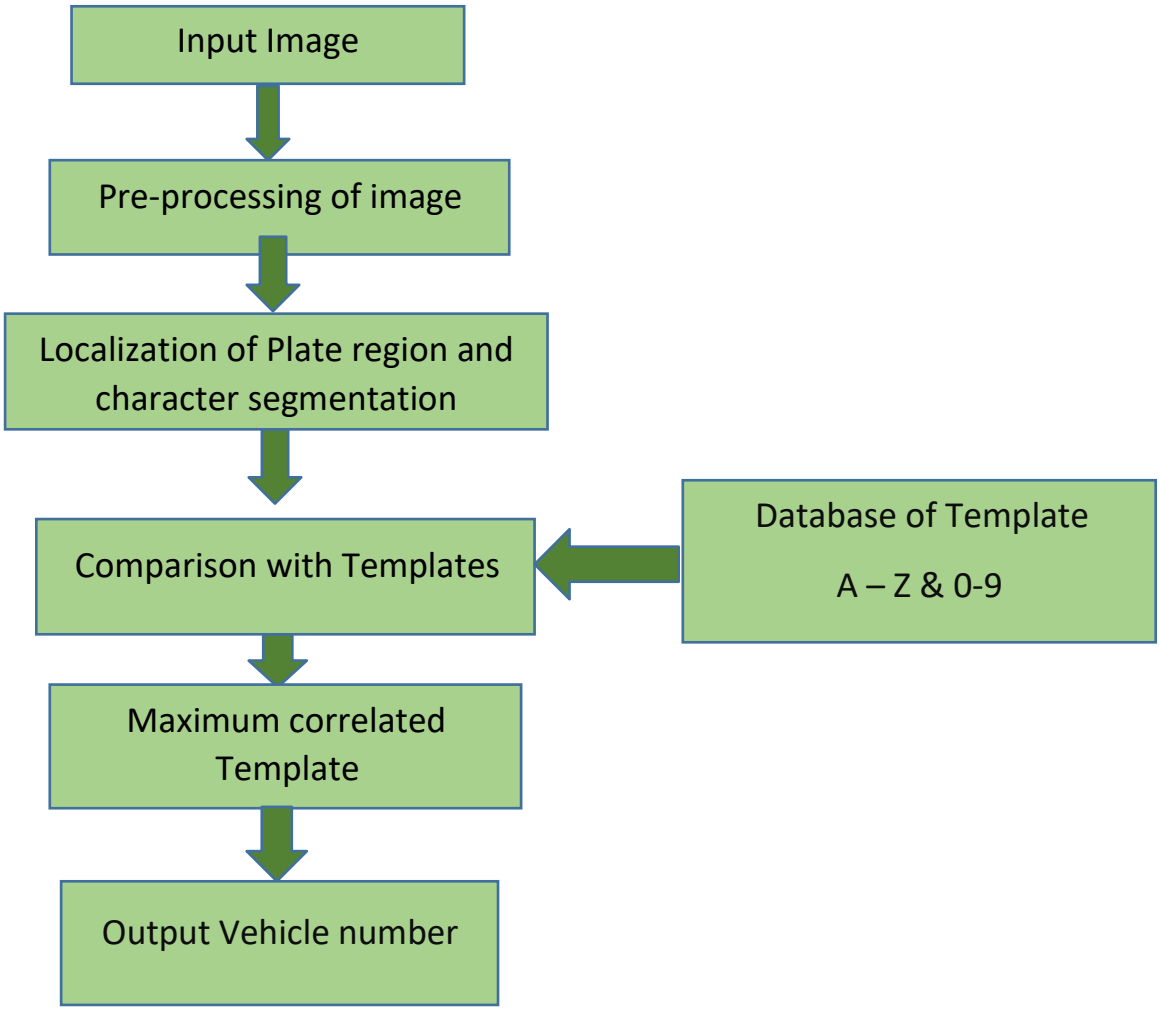

fig 4.4. Block Diagram

4.4 Working

In the number plate detection, the input is called to the MATLAB, that image undergoes many preprocessing like converting the image from RGB to gray image, removing noise and small disturbances from the image. By knowing the properties of the image, we found the location of number plate. In the template_creation.m file we have design the code to save all the binary images of alphanumeric into a directory 'NewTemplates'. Then the directory is called in the Letter_detection.m then in the Plate_detection code file Letter_detection.m is called. When we run the program, we will get the number plate image

in the popup window and the same number is printed in the command window as well.

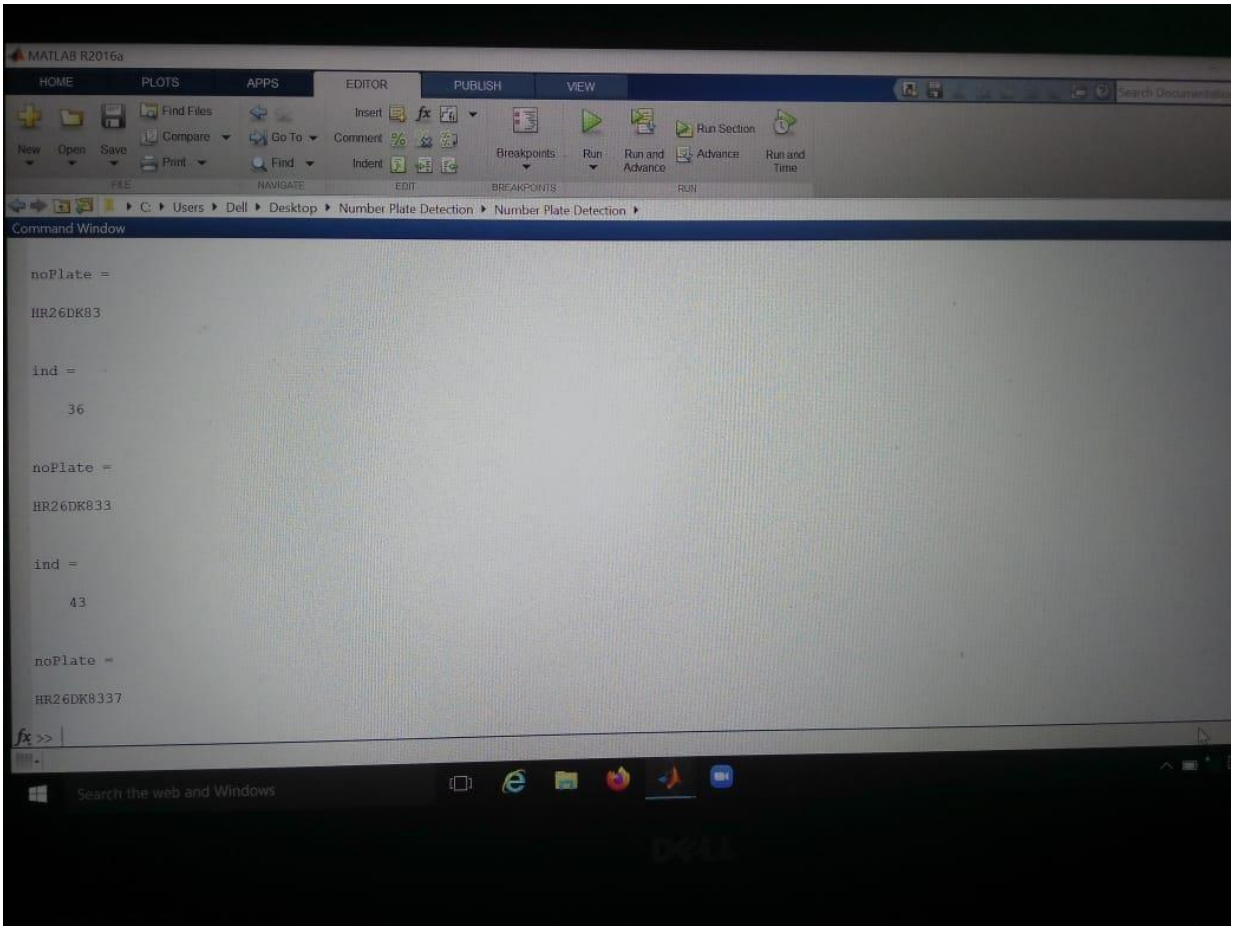

fig 4.5. step by step printing of characters

Each character index value is calculated then it is matched with every character in template and the highest matched character is printed, and all the characters are printed in the sequential order as shown in the above image.

fig 4.6. Final output of the project

CHAPTER 05

PROJECT DESCRIPTION

5.1 Software Description

MATLAB (matrix laboratory) is a multi-paradigm numerical computing environment and proprietary programming language developed by MathWorks. MATLAB allows matrix multiplication, plotting of functions and data, implementation of algorithms, creation of user interfaces and interfacing with programs written in other language.

MATLAB was first adopted by researchers and practitioners in control engineering, little's specialty, but quickly spread to many other domains. It is now also used in education, the teaching of linear algebra and numerical analysis. The image processing can be performed in MATLAB, it can be used to perform image segmentation, image transformations, image registration and 3D image processing operations. Our project5 is purely involves the image processing which is a technic to convert an image into digital format and perform operations on it to get an enhanced image or extract some useful information from it. Changes that takes place in images are usually performed automatically and carefully designed algorithms.

The commands used in our code are mentioned below:

I. Imread ()

II. rgb2gray ()

III. imbinarize ()

IV. edge ()

V. regionprops ()

VI. numel ()

VII. imcrop ()

VIII. bwareaopen ()

I. imread (): This command is used to open the image into the MATLAB from the target folder

Syntax

A= imread (filename, fmt);

Reads the image from the file specified by filename and the format of the file with the standard file extension indicated by fmt.

II. rgb2gray (): This command is used to convert RGB into grayscale. There are two methods for conversion

1) Average method
2) Weighted method or luminosity method

1) Average method:

Average method is a very simple method of converting RGB to gray. It is calculated by taking the average of three colour

Grayscale=(R+G+B)/3

Average method works as it brings the changes in the image from the input image, but we wanted to convert image into grayscale, but we got the output as almost black image.

fig 5.1. A. Normal image

fig 5.1. B. Gray image (Average method)

2) Weighted method or luminosity method:

The solution for the problem in average method is provided by the weighted method. Red colour has more wavelength of all the three colour and green is the colour that has not only less wavelength then red but also green is the colour that gives more soothing effect to the eyes.

It means that we must decrease the contribution of red and increase the contribution of the green and put blue contribution in between these two.

grayscale image = (0.3 * R) + (0.59 * G) + (0.11 * B)).

By this equation we can say that red has contribution of 30%, green has 59%which is greater, and blue is 11%.

fig 5.2. A. Normal image

fig 5.2. B. Gray image (weighted method)

III. imbinarize(): it creates a binary image from 2-D or 3D grayscale image by replacing all values above a globally determined threshold with 1s and setting other values to 0s. if you say in normal words binarize is just converting the image into black and white format where white represents the object where as black represents the background.

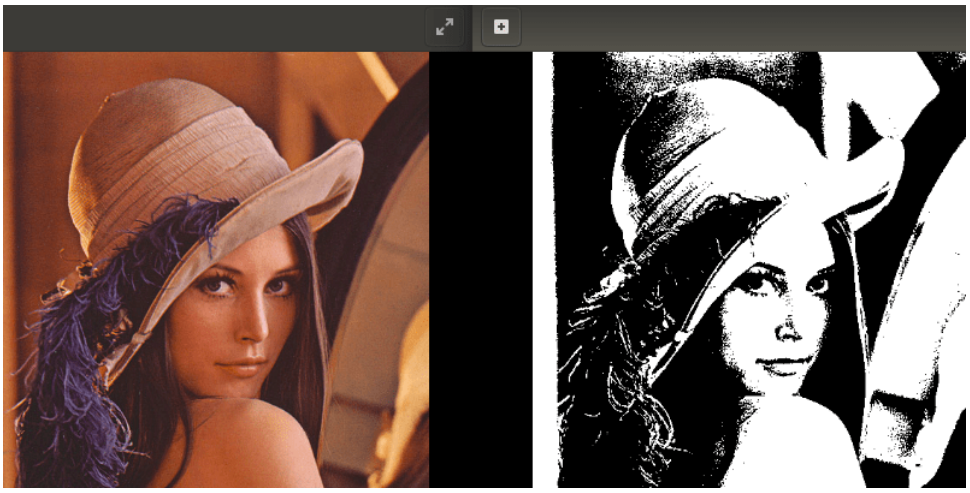

fig 5.3. Binarized image

IV. edge (): This command is used to detect the edge of the number plate in the input image, this is done by using various methods like Roberts, Sobel, Prewitt etc.

syntax

im=edge (I, method)

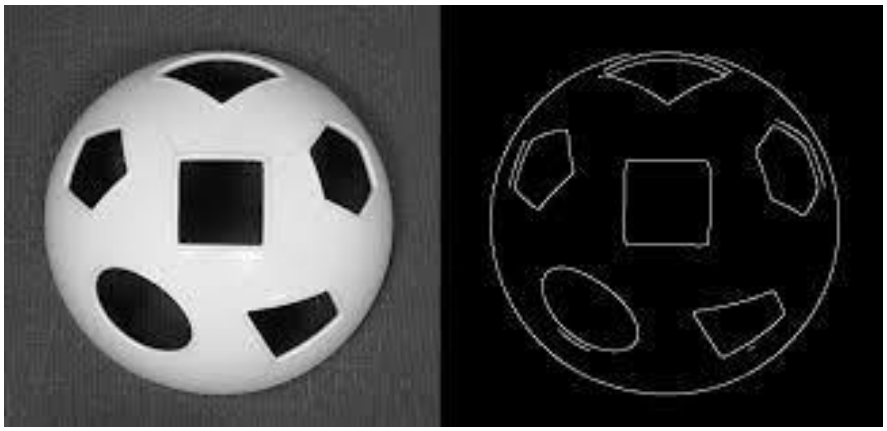

fig 5.4. Edge detected image

V. regionprops (): It returns the measurements of set of properties for each 8-connected in the binary image.

Syntax

S= regionprops (I, properties)

VI. numel (): Returns the number of elements, n in array S.

syntax

n=numel(S)

VII. imcrop (): This command is used to crop the image in the entered image.

fig 5.5. Cropped image

VIII. bwareaopen (): It removes all the small objects from binary image.

Syntax

B1= bwareaopen (B, P)

It removes the objects which have a pixel value less than P.

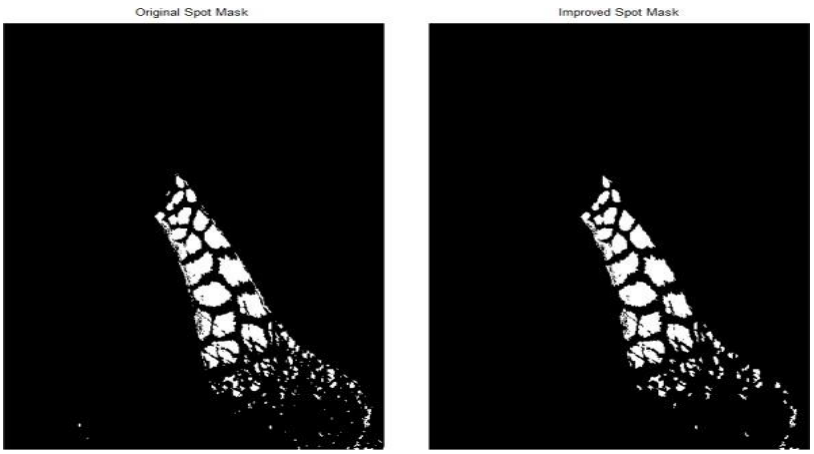

fig 5.6. Small objects removed image

Advantages of MATLAB:

- It is used to test and implement algorithms easily.
- Development of computational code is very easy.
- Debugging is also easy.
- By using MATLAB, processing of image and simulating of videos is easy.
- We can call external libraries.
- Use of large database with built in algorithms.

Disadvantages of MATLAB:

- MATLAB complies SDK, MATLAB complies and packing tools for add on are not supported.
- xlsread and xlswhite will work only in basic modes.
- The cost of license for MATLAB software is very high.

CHAPTER 06

RESULT AND DISCUSSION

The software Project, Car number plate detection using a software MATLAB is working perfectly as per our objectives. The input image is taken then the image undergoes preprocessing in order to remove the unwanted disturbances and it calculates the properties of the image and correlates with the template image. The matched number plate is displayed on the command window.

fig 6.1. Detected Number Plate 1

The input image is having the number plate **HR26DK8337**, the system correlates every element in the image with the template and highest matched elements are displayed on the command window. Here the same number plate elements are displayed on the command window as well.

fig 6.2. Detected Number Plate 2

Advantages

a) Surveillance and Monitoring

Automatic number plate recognition removes the difficult process of recording number manually. when a car speeds up, it is impossible for humans to spot the recognition number to the system records the number in real tune and gives a clear picture of the traffic insights.

b) Video and Still Footage

Most of the automatic number plate recognition systems include both video and still footages some of them are designed to take the snaps when the vehicle speed, violates the traffic signal rules or takes a long turn. There are different camera angles and positions to record under different weather conditions as well. The video footages can help the traffic department and asset legal counsel.

c) Improved Security

This system can help us to identify and address potential safety issues. Alerted to someone driving in a hazardous way or speeding, anyone can combine this with the system to identify the employee or person in question and quickly address the problem before an accident occurs.

d) Less Human Surveillance

Though the importance of maned surveillance has reduced, it is necessary the traffic police who works on the streets can now concentrate on all the information's given by this system software and can be even more efficient. The systems accuracy is way too high.

Disadvantages

a. Privacy Concerns

The information is stored within the system, chances of hacking can increase.

b. Extreme weather conditions

Due to hindrance and bad weather, the system may not work effectively. The security measures could turn off and maned surveillance will we muchly needed this time.

Applications

➢ Parking

System automatically captures the prepaid members and calculates the fee for non-members.

fig 6.3. Car Number Plate Detection in Parking

➢ Access Control

The gate automatically opens on recognizing authorized members in a secured area thus reducing the work of security guard.

fig 6.4. Car Number Plate Detection in Access Control

➢ Tolling

The number of the car is used to calculate the travel fee on the highways and to double check on tickets.

fig 6.5. Car Number Plate Detection in Tolling

➢ Border Security

It checks on entry and exit of people across the border limits. Police and security authorities use automatic number plate recognition to monitor and control regional and national borders. All over the world, vehicles crossing borders are being controlled. The main objective is to quickly identify crime and thereby increase civil security.

➢ Airport Parking

It reduces the risk of ticket frauds or any other mistakes. Car number plate detection system plays a very important role in managing the car parking infrastructure, increasing footfall and revenues and reducing operating costs.

CHAPTER 07

CONCLUSION AND FUTURE SCOPE

The major idea of the modern society is not to destroy people's privacy and gather information about the activities of the citizen unless they are doing anything that is incorrect.

Despite all the privacy concern, LPR system not doing such things. The only reason of collecting the information is that it might keep people more safe and secure when they are in road and punish the violators.

Most of the cities and developing and including their system to help in monitoring the flow and moment of vehicles around the roads. LPR system has become a necessity for this purpose.

Challenges Faced

The developers are how working on case of customizing the software that provides a very high quality of footages with extreme accuracy. Most of the challenges are now overcome and the only thing that must be looked upon is the protection and security of the gathered data.

Future scope

- The plate number is used to automatically enter pre-paid members and calculate parking fee for non-members.
- The car number is used to calculate the travel fee in a toll-road or used to double – check the ticket.
- As image changes the algorithm changes inefficient for other input image. So, there may be the future work on the algorithm that will be image independent making the algorithms dynamic. During the survey it is observed that preprocessing plays the major role and extracting the ROI from the image is the difficult and tricky task because the position of the number plate in the image is not fixed for vehicle image.

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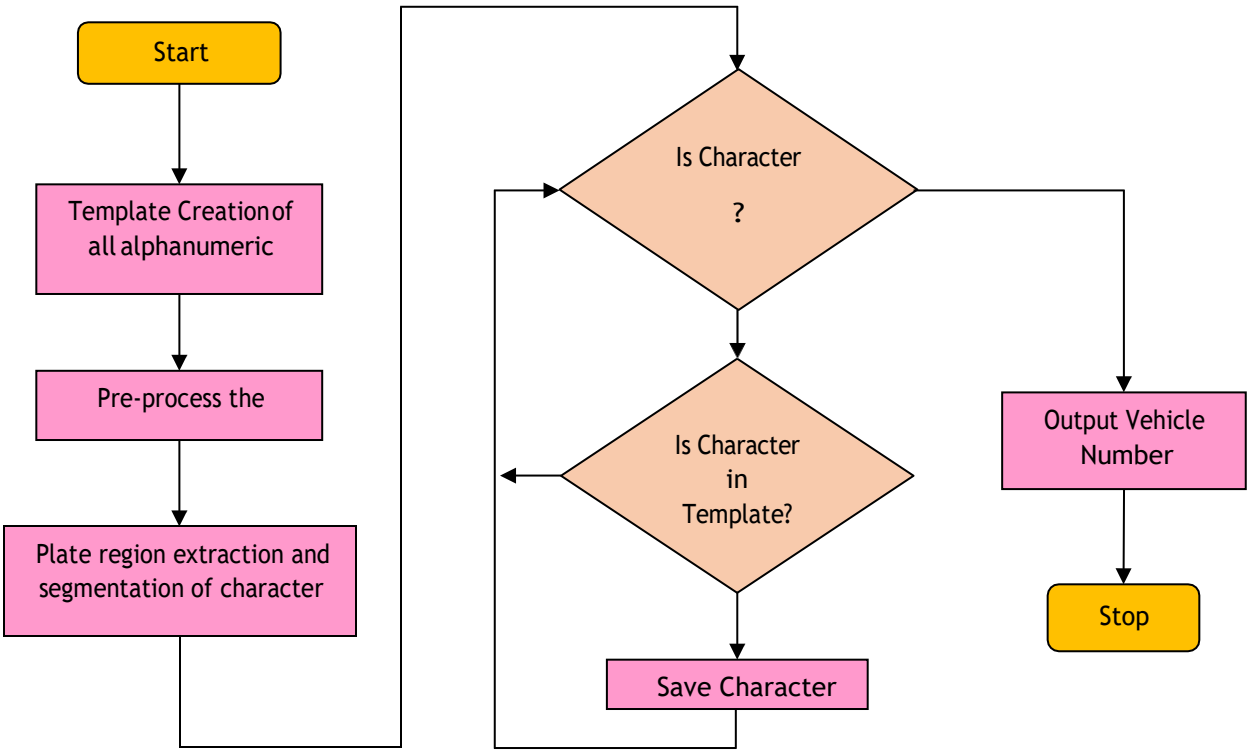
APPENDIX

Flowchart



%CREATE TEMPLATES

%Alphabets

```
A=imread('alpha/A.bmp'); B=imread('alpha/B.bmp'); C=imread('alpha/C.bmp');

D=imread('alpha/D.bmp');E=imread('alpha/E.bmp');F=imread('alpha/F.bmp');

G=imread('alpha/G.bmp');H=imread('alpha/H.bmp');I=imread('alpha/I.bmp');

J=imread('alpha/J.bmp');K=imread('alpha/K.bmp');L=imread('alpha/L.bmp');

M=imread('alpha/M.bmp');N=imread('alpha/N.bmp');O=imread('alpha/O.bmp');

P=imread('alpha/P.bmp');Q=imread('alpha/Q.bmp');R=imread('alpha/R.bmp');
```

```
S=imread('alpha/S.bmp'); T=imread('alpha/T.bmp');U=imread('alpha/U.bmp');
V=imread('alpha/V.bmp');W=imread('alpha/W.bmp');X=imread('alpha/X.bmp');
Y=imread('alpha/Y.bmp');Z=imread('alpha/Z.bmp');

%Natural Numbers
one=imread('alpha/1.bmp');two=imread('alpha/2.bmp');
three=imread('alpha/3.bmp');four=imread('alpha/4.bmp');
five=imread('alpha/5.bmp'); six=imread('alpha/6.bmp');
seven=imread('alpha/7.bmp');eight=imread('alpha/8.bmp');
nine=imread('alpha/9.bmp'); zero=imread('alpha/0.bmp');

%Creating Array for Alphabets
letter= [A B C D E F G H I J K L M N O P Q R S T U V W X Y Z];
%Creating Array for Numbers
number= [one two three four five six seven eight nine zero];

NewTemplates= [letter number];
save ('NewTemplates','NewTemplates')
clear all

%Letter detection
function letter = readLetter(snap)
```

```
load NewTemplates

snap=imresize(snap,[42 24]);

rec= [];


for n=1:length(NewTemplates)

   cor=corr2(NewTemplates{1,n},snap);

   rec=[rec cor];

end


ind=find(rec==max(rec));

display(ind);


% Alphabets listings.

if ind==1 || ind==2

   letter='A';

elseif ind==3 || ind==4

   letter='B';

elseif ind==5

   letter='C';

elseif ind==6 || ind==7

   letter='D';

elseif ind==8

   letter='E';
```

```
elseif ind==9
   letter='F';
elseif ind==10
   letter='G';
elseif ind==11
   letter='H';
elseif ind==12
    letter='I';
elseif ind==13
    letter='J';
elseif ind==14
   letter='K';
elseif ind==15
    letter='L';
elseif ind==16
  letter='M';
elseif ind==17
   letter='N';
elseif ind==18 || ind==19
    letter='O';
elseif ind==20 || ind==21
    letter='P';
elseif ind==22 || ind==23
```

```
    letter='Q';
elseif ind==24 || ind==25
    letter='R';
elseif ind==26
    letter='S';
elseif ind==27
    letter='T';
elseif ind==28
    letter='U';
elseif ind==29
    letter='V';
elseif ind==30
   letter='W';
elseif ind==31
    letter='X';
elseif ind==32
    letter='Y';
elseif ind==33
    letter='Z';
    %*-*-*-*-*
```

% Numerals listings.

```
elseif ind==34
    letter='1';
```

```
elseif ind==35
   letter='2';
elseif ind==36
   letter='3';
elseif ind==37 || ind==38
   letter='4';
elseif ind==39
   letter='5';
elseif ind==40 || ind==41 || ind==42
   letter='6';
elseif ind==43
   letter='7';
elseif ind==44 || ind==45
   letter='8';
elseif ind==46 || ind==47 || ind==48
   letter='9';
else
   letter='0';
end
end


close all;
clear all;
```

```
%Plate detection
im = imread ('Number Plate Images/image1.png');
imgray = rgb2gray(im);
imbin = imbinarize(imgray);
im = edge(imgray, 'prewitt');

%Below steps are to find location of number plate
Iprops=regionprops(im,'B oundingBox','Area', 'Image');
area = Iprops.Area;
count = numel(Iprops);
maxa= area;
boundingBox = Iprops.BoundingBox;
for i=1:count
  if maxa<Iprops(i). Area
     maxa=Iprops(i).Area;
     boundingBox=Iprops(i).BoundingBox;
  end
end

im = imcrop(imbin, boundingBox); %crop the number plate area
im = bwareaopen(~im, 500); %remove some object if it width is too long or too small than
500
 [h, w] = size(im); %get width
```

```
imshow(im);
Iprops=regionprops(im, 'BoundingBox' , 'Area', 'Image'); %read letter
count = numel(Iprops);
noPlate= []; % Initializing the variable of number plate string.
for i=1:count
  ow = length (Iprops(i). Image (1, :));
  oh = length(Iprops(i).Image(:,1));
  if ow<(h/2) & oh>(h/3)
    letter=Letter_detection (Iprops(i).Image); % Reading the letter corresponding the binary image 'N'.
    noPlate=[noPlate letter] % Appending every subsequent character in noPlate variable.
  end
end
```