CSE4019-IMAGE PROCESSING
PROJECT REPORT

VEHICLE LICENSE PLATE DETECTION USING MATLAB

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FACULTY:

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ABSTRACT

The purpose of this report is to explain the implementation of our project, “License Plate Recognition System”. For each subsystem, we have included explanations for why we chose our methods, performance of our methods, under what conditions would our methods fail, and how can we improve our methods. The report ends with a discussion on possible future work using more evolved image processing techniques and acknowledgements.

Monitoring vehicles for law enforcement and security purposes is a difficult problem because of the vast number of automobiles on the road nowadays. An example of this lies in border patrol: it is time consuming for an officer to physically check the license plate of every car. Additionally, it is not at all feasible to employ a number of police officers to act as full-time license plate inspectors. Police patrols cannot just drive in their cars staring at the plates of other cars. There must exist a way for detecting and identifying license plates without constant human intervention. As a solution, we have implemented a system that can extract the license plate number of a vehicle from an image – given a set of constraints.

REVIEW ON EXISTING WORK

Optical character recognition, usually abbreviated to OCR, is the mechanical or electronic translation of images of handwritten, typewritten or printed text (usually captured by a scanner) into machine editable text.
OCR is a field of research in pattern recognition, artificial intelligence and machine vision. Though academic research in the field continues, the focus on OCR has shifted to implementation of proven techniques. Optical character recognition (using optical techniques such as mirrors and lenses) and digital character recognition (using scanners and computer algorithms) were originally considered separate fields. Because very few applications survive that use true optical techniques, the OCR term has now been broadened to include digital image processing as well.

	Recognition Accuracy	Retains Formatting?	Price	One Unique Feature
Google Docs	Excellent	Poor	Free	Unlimited conversions
FineReader	Excellent	Good	$3 per 10 pages	Support multilingual documents
OnlineOCR	Excellent	Excellent	$4 per 50 pages	Preserves the document layout and formatting
FreeOCR	Good	None	Free	Basic, requires no registration
OCR Terminal	Excellent	Excellent	$4.5 per 50 pages	Can extract text from Screenshot images
OCROnline	Good	Good	Free	Supports batch conversion

GAP ANALYSIS

OCR technology has been used from time to time for various purposes. Various kinds of windows application have been made till now. But using this technology and android together is a unique concept. This kind of application is not made yet. The unique feature of this application is that it will contain large amount of data. Anyone who wants to know the detail of any vehicle can directly go to this app and know the information. Even the Police can use this app to capture the criminals. By image they will instantly know on whose name the vehicle is registered which is used by criminal. So the use of technology for safety purpose is unique feature.

PROBLEM STATEMENT

Automatic number plate recognition (ANPR) is an image processing technology which uses number(license) plate to identify the vehicle. The objective is to design an efficient automatic authorized vehicle identification system by using the vehicle number plate. The system is implemented on the entrance for security control of a highly restricted area like military zones or area around top government offices e.g. Parliament, Supreme Court etc. This system can be used by every man for their security purpose.

For general public an android application will installed on their mobile phone. After that whenever he wants to know the details of any vehicle he just has to capture the image of licence plate and then that image will be processed and he will get the desired information about that vehicle. This system is very important and must needed. For defence purposes the developed system first detects the vehicle and then captures the vehicle image.

Vehicle number plate region is extracted using the image segmentation in an image. Optical character recognition technique (OCR) is used for the character recognition. The resulting data is then used to compare with the records on a database so as to come up with the specific information like the identity of owner, place of registration, address, etc. The system is implemented and simulated in JAVA, and it performance is tested on real image.

OBJECTIVE

We aim to develop an android application to capture the image of the licence number plate and to obtain all the information about that vehicle.
OCR is a field of research in pattern recognition, artificial intelligence and machine vision. Though academic research in the field continues, the focus on OCR has shifted to implementation of proven techniques. Optical character recognition (using optical techniques such as mirrors and lenses) and digital character recognition (using scanners and computer algorithms) were originally considered separate fields. Because very few applications survive that use true optical techniques, the OCR term has now been broadened to include digital image processing as well.

MOTIVATION

For the standard number plates the automatic number plate recognition becomes very easy to read and recognizes the character. In India the vehicle number plates have no standard size and font so it become very difficult to read and recognize the characters of the number plate. So flexible algorithm required solve this problem.

PROPOSED WORK

The proposed approach for automatic number plate recognition system is represented in this section. The existing ANPR method works well for dark and light images but it does not work well for low contrast, blurred and noisy images. But the proposed approach for ANPR works well for all these categories of images. The flowchart of proposed approach for ANPR is shown in fig.2 consists of following main steps:

- Image Acquisition
- RGB to Grayscale conversion
- Noise removal by median Filtering
- Morphological Operations i.e erosion and dilation for Edge detection
- Filling of the image then thinning for character isolation
- Selecting all the regions that have pixel area more then 100
- And bounding the regions of interest
- Template matching
- Output licence plate number

Module description

a. **Pre-processing**
   In this first the image is captured using camera of 13-megapixel. First we will convert RGB image to gray image. To enhance the number plate recognition further, we use median filter to eliminate noises
b. **Localization of license number plate region**
   The main aim of this work is to identify the exact location of the license plate region in the digital image, the result must be a sub-image that contains only the license number plate. This can be achieved in two steps.
   - Determining the exact location of the license plate.
   - Locating a large

   Sobel edge filter is used to identify the boundaries in an image

   For x direction [-1 -2 -1, 0 0 0, 1 2 1] and for y direction [-1 0 1, -2 0 2, -1 0 1]

c. **Character Segmentation of license number plate**
   After extracting number plate region, it scans for the connected objects in an image. Once the connected components are identified it will assign a special label to it. In bounding box method, it encloses the labelled region with rectangular box completely. Each alphanumeric characters are covered with bounding boxes which are present on number plate.
d. **Character Recognition of license number plate**
   Each characters from the license plate is compared completely against with the alphanumeric database which uses template matching. It will compare both image pixel by pixel match until the corresponding exact matching is found., if it scores more values than the previous threshold values it will update with the higher one threshold for the better match

Algorithm:

Step1. Image Acquisition-Captured the image through digital camera and given as input to process.

Step2. Converting into Colour image to gray scale image

Step 3. Image Enhancement- Removing of noise using median filter.

Step 4. Plate extraction- Find rows and columns values of the image to identify the region. Sobel edge detector is used to find the boundaries, then dilated and removed connected objects. Finally, we extracted the desired region.

Step 5. Character Segmentation- Bounding box method is used to map each character, for each letter it will be mapped a box and displayed each character into a single image.

Step 6. Character Recognition- After Segmenting each characters are compared with the template. If each character matches pixel by pixel corresponding image is found, it will be displayed into text

Software Requirements

Operating System-Android Mob OS

Matlab 7.4.0

FUNCTIONAL REQUIREMENTS

1. For static OCR, software should provide a way to load scanned document for recognition purpose.

2. If scanned image is not having black background and white foreground, facility for image inversion should be provided by software.

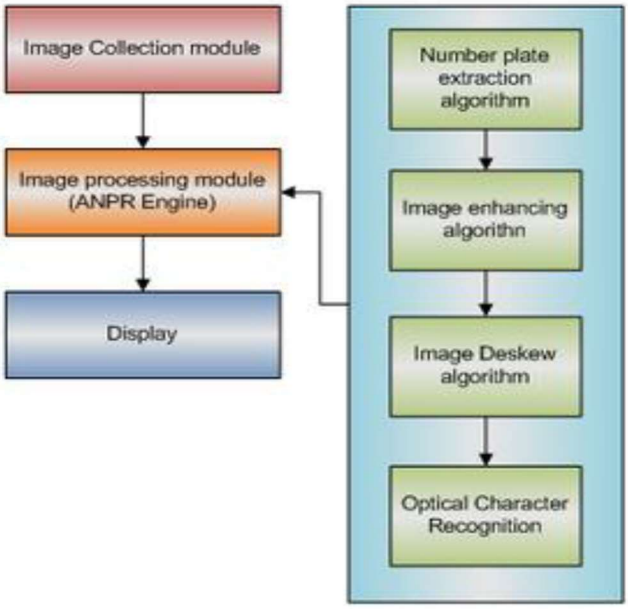
3. Software should process the image and extract characters.

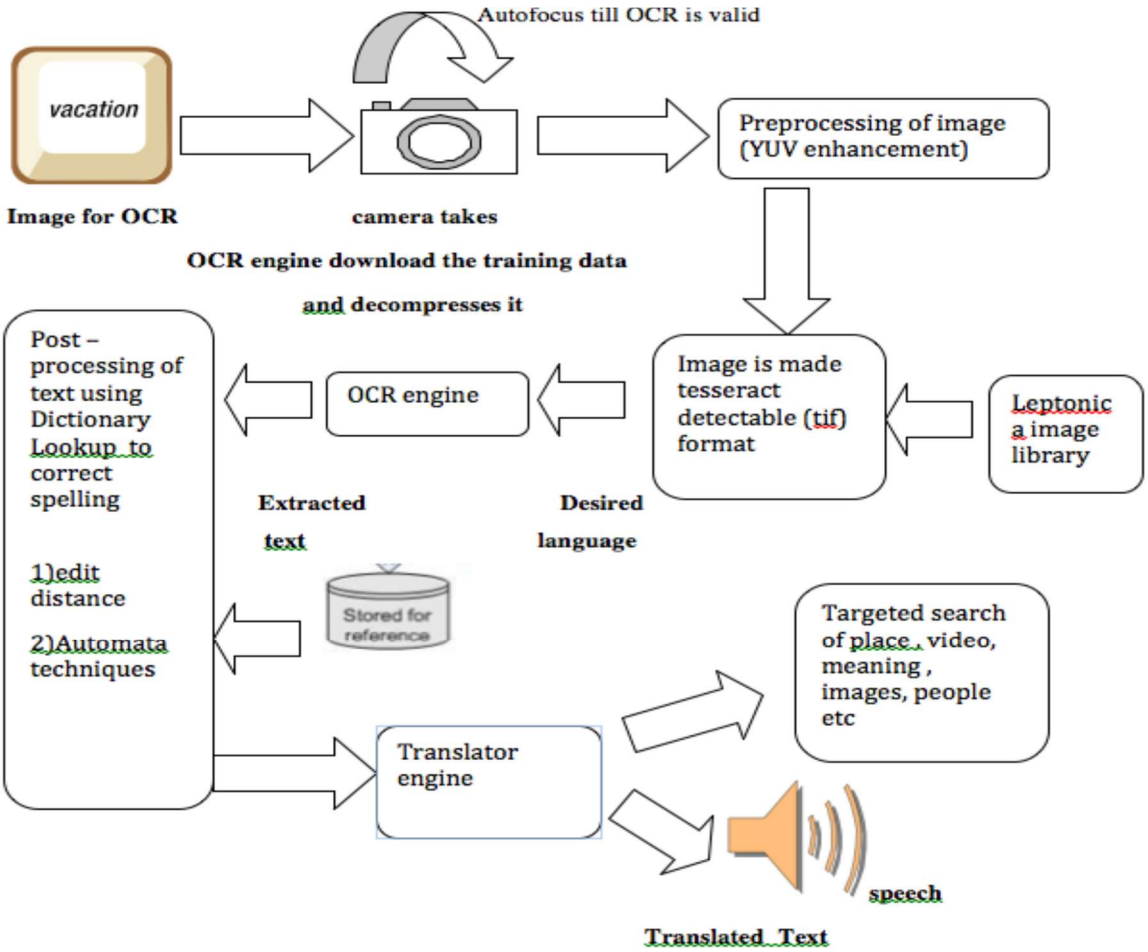
4. User should have facility to save extracted data in format of his interest.

5.For dynamic OCR, the software should recognize characters drawn by user simultaneously.

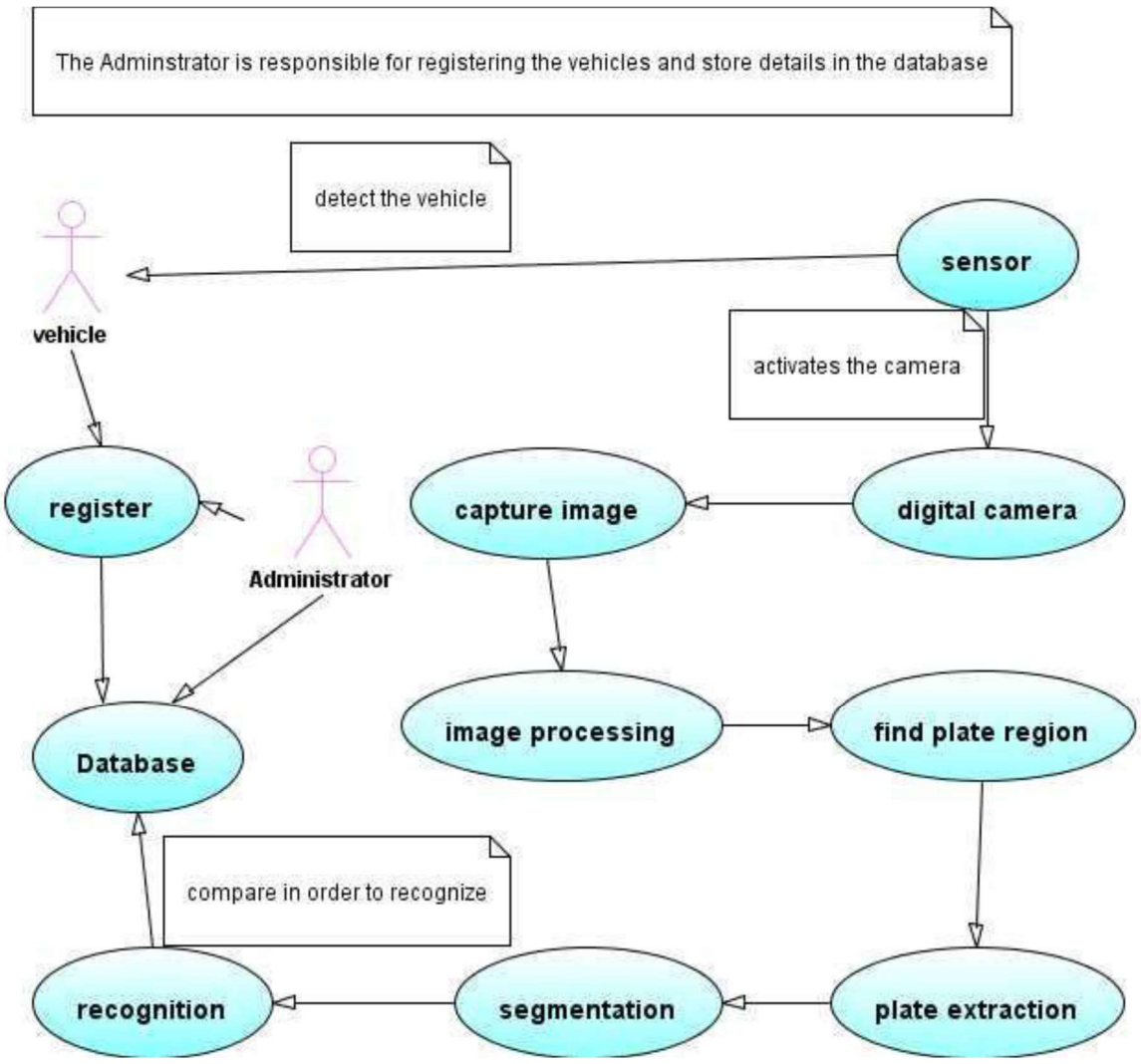
6. If software is not giving proper output, there should be a way for training the database of software.

ARCHITECTURAL DESIGN




Autofocus till OCR is valid
vacation
Image for OCR
camera takes
Preprocessing of image (YUV enhancement)
OCR engine download the training data
and decompresses it
Post – processing of text using Dictionary Lookup to correct spelling
1)edit distance
2)Automata techniques
OCR engine
Image is made tesseract detectable (tif) format
Leptonic a image library
Extracted text
Desired language
Stored for reference
Translator engine
Targeted search of place , video, meaning , images, people etc
speech
Translated Text

UML DIAGRAM

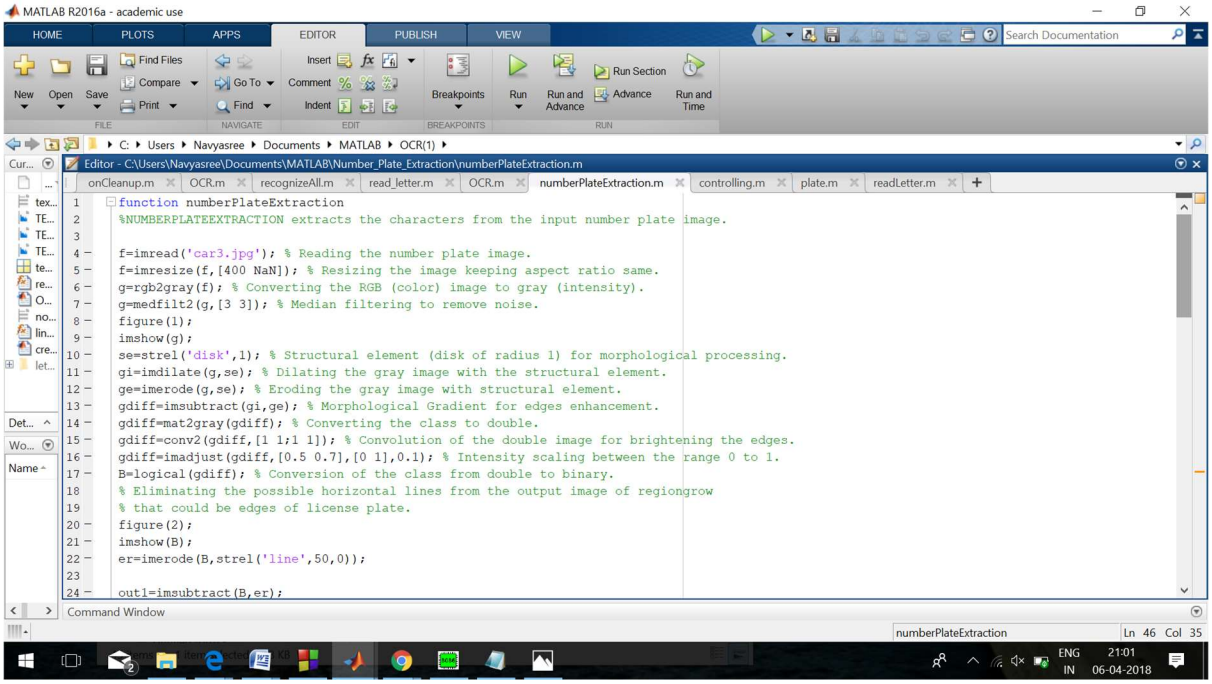

The Adminstrator is responsible for registering the vehicles and store details in the database
detect the vehicle
sensor
vehicle
activates the camera
register
Administrator
capture image
digital camera
Database
image processing
find plate region
compare in order to recognize
recognition
segmentation
plate extraction

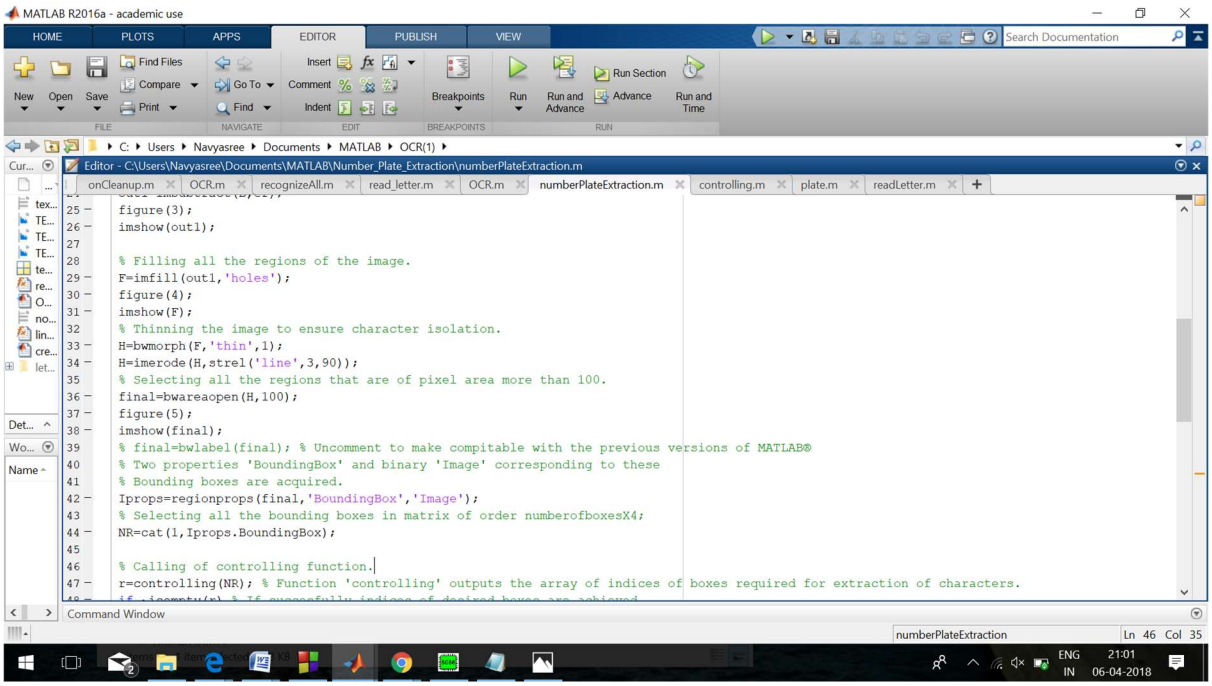
MATLAB CODE:

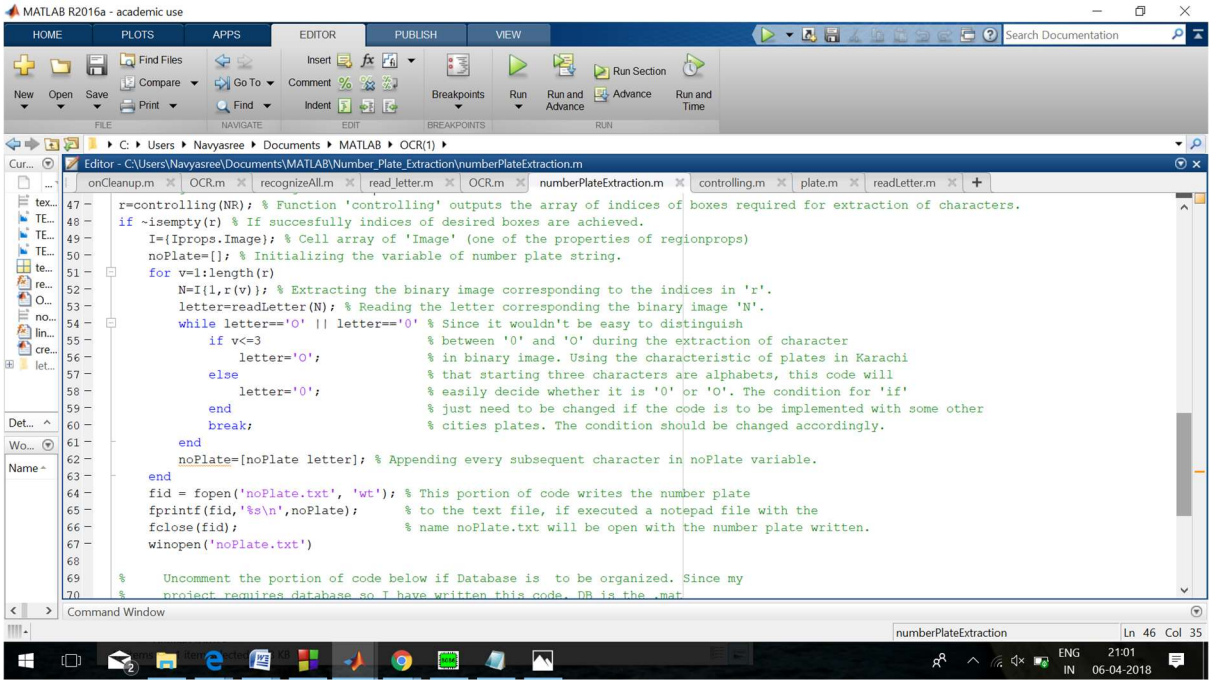
```
function numberPlateExtraction
%NUMBERPLATEEXTRACTION extracts the characters from the input number
plate image.

f=imread('car3.jpg'); % Reading the number plate image.
f=imresize(f,[400 NaN]); % Resizing the image keeping aspect ratio
same.
g=rgb2gray(f); % Converting the RGB (color) image to gray
(intensity).
g=medfilt2(g,[3 3]); % Median filtering to remove noise.
se=strel('disk',1); % Structural element (disk of radius 1) for
morphological processing.
gi=imdilate(g,se); % Dilating the gray image with the structural
element.
ge=imerode(g,se); % Eroding the gray image with structural element.
gdiff=imsubtract(gi,ge); % Morphological Gradient for edges
enhancement.
gdiff=mat2gray(gdiff); % Converting the class to double.
gdiff=conv2(gdiff,[1 1;1 1]); % Convolution of the double image for
brightening the edges.
gdiff=imadjust(gdiff,[0.5 0.7],[0 1],0.1); % Intensity scaling
between the range 0 to 1.
B=logical(gdiff); % Conversion of the class from double to binary.
% Eliminating the possible horizontal lines from the output image of
regiongrow
% that could be edges of license plate.
er=imerode(B,strel('line',50,0));
out1=imsubtract(B,er);
% Filling all the regions of the image.
F=imfill(out1,'holes');
% Thinning the image to ensure character isolation.
H=bwmorph(F,'thin',1);
H=imerode(H,strel('line',3,90));
% Selecting all the regions that are of pixel area more than 100.
final=bwareaopen(H,100);
% final=bwlabel(final); % Uncomment to make compitable with the
previous versions of MATLAB®
% Two properties 'BoundingBox' and binary 'Image' corresponding to
these
% Bounding boxes are acquired.
Iprops=regionprops(final,'BoundingBox','Image');
% Selecting all the bounding boxes in matrix of order
numberofboxesX4;
NR=cat(1,Iprops.BoundingBox);
% Calling of controlling function.
r=controlling(NR); % Function 'controlling' outputs the array of
indices of boxes required for extraction of characters.
if ~isempty(r) % If succesfully indices of desired boxes are
achieved.
    I={Iprops.Image}; % Cell array of 'Image' (one of the properties
of regionprops)
```

```
    noPlate=[]; % Initializing the variable of number plate string.
    for v=1:length(r)
        N=I{1,r(v)}; % Extracting the binary image corresponding to
the indices in 'r'.
        letter=readLetter(N); % Reading the letter corresponding the
binary image 'N'.
        while letter=='O' || letter=='0' % Since it wouldn't be easy
to distinguish
            if v<=3                      % between '0' and 'O'
during the extraction of character
                letter='O';              % in binary image. Using
the characteristic of plates in Karachi
            else                         % that starting three
characters are alphabets, this code will
                letter='0';              % easily decide whether it
is '0' or 'O'. The condition for 'if'
            end                          % just need to be changed
if the code is to be implemented with some other
            break;                       % cities plates. The
condition should be changed accordingly.
        end
        noPlate=[noPlate letter]; % Appending every subsequent
character in noPlate variable.
    end
    fid = fopen('noPlate.txt', 'wt'); % This portion of code writes
the number plate
    fprintf(fid,'%s\n',noPlate);      % to the text file, if
executed a notepad file with the
    fclose(fid);                      % name noPlate.txt will be
open with the number plate written.
    winopen('noPlate.txt')

%     Uncomment the portion of code below if Database is  to be
organized. Since my
%     project requires database so I have written this code. DB is
the .mat
%     file containing the array of structure of all entries of
database.
%     load DB
%     for x=1:length(DB)
%         recordplate=getfield(DB,{1,x},'PlateNumber');
%         if strcmp(noPlate,recordplate)
%             disp(DB(x));
%             disp('*-*-*-*-*-*-*');
%         end
%     end

else % If fail to extract the indexes in 'r' this line of error will
be displayed.
    fprintf('Unable to extract the characters from the number
plate.\n');
    fprintf('The characters on the number plate might not be clear
or touching with each other or boundries.\n');
end
end
```

SCREENSHOTS OF CODE AND ITS OUTPUT:



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Advance
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C: Users Navyasree Documents MATLAB OCR(1)
Editor - C:\Users\Navyasree\Documents\MATLAB\Number_Plate_Extraction\numberPlateExtraction.m
onCleanup.m
OCR.m
recognizeAll.m
read_letter.m
OCR.m
numberPlateExtraction.m
controlling.m
plate.m
readLetter.m
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letter='O'; % in binary image. Using the characteristic of plates in Karachi
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letter='0'; % easily decide whether it is '0' or 'O'. The condition for 'if'
end % just need to be changed if the code is to be implemented with some other
break; % cities plates. The condition should be changed accordingly.
end
noPlate=[noPlate letter]; % Appending every subsequent character in noPlate variable.
end
fid = fopen('noPlate.txt', 'wt'); % This portion of code writes the number plate
fprintf(fid,'%s\n',noPlate); % to the text file, if executed a notepad file with the
fclose(fid); % name noPlate.txt will be open with the number plate written.
winopen('noPlate.txt')
% Uncomment the portion of code below if Database is to be organized. Since my
% project requires database so I have written this code. DB is the .mat
Command Window
numberPlateExtraction
Ln 46 Col 35
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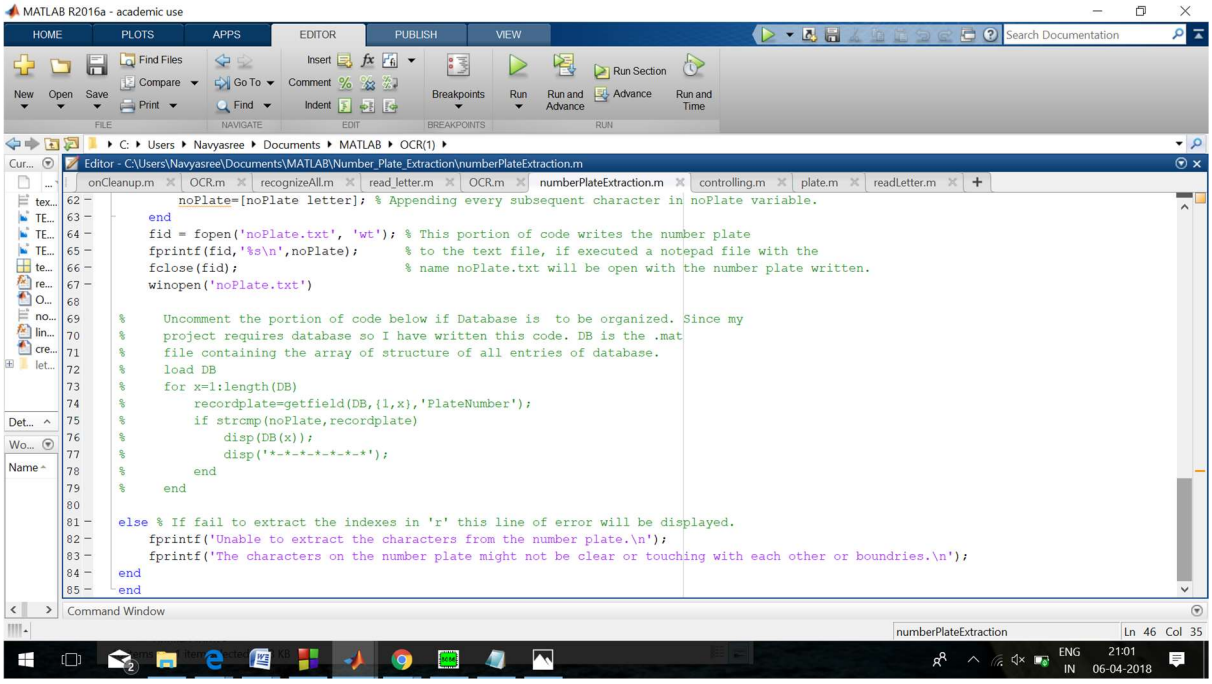
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onCleanup.m
OCR.m
recognizeAll.m
read_letter.m
OCR.m
numberPlateExtraction.m
controlling.m
plate.m
readLetter.m
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end
fid = fopen('noPlate.txt', 'wt'); % This portion of code writes the number plate
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% project requires database so I have written this code. DB is the .mat
% file containing the array of structure of all entries of database.
% load DB
% for x=1:length(DB)
% recordplate=getfield(DB,{1,x},'PlateNumber');
% if strcmp(noPlate,recordplate)
% disp(DB(x));
% disp('*-*-*-*-*-*-*');
% end
% end
else % If fail to extract the indexes in 'r' this line of error will be displayed.
fprintf('Unable to extract the characters from the number plate.\n');
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end
Command Window
numberPlateExtraction
Ln 46 Col 35
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06-04-2018

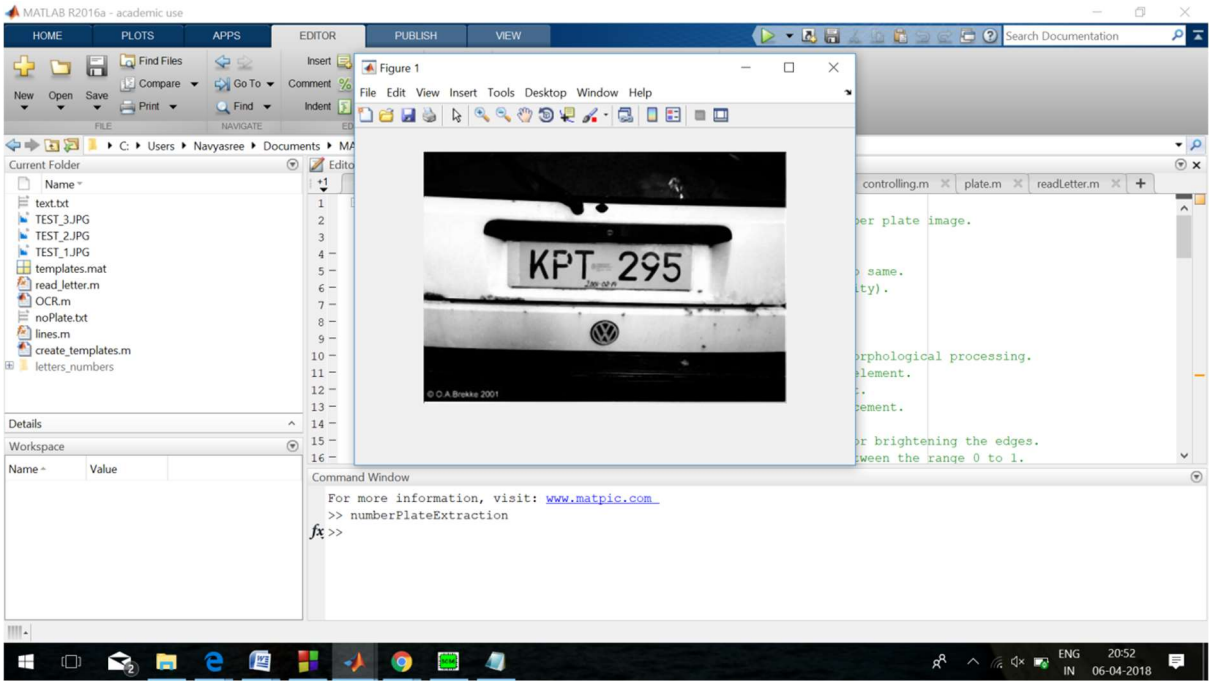
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Figure 1
File Edit View Insert Tools Desktop Window Help
KPT 295
Current Folder
Name
text.txt
TEST_3.JPG
TEST_2.JPG
TEST_1.JPG
templates.mat
read_letter.m
OCR.m
noPlate.txt
lines.m
create_templates.m
letters_numbers
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Value
controlling.m
plate.m
readLetter.m
Command Window
For more information, visit: www.matpic.com
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06-04-2018

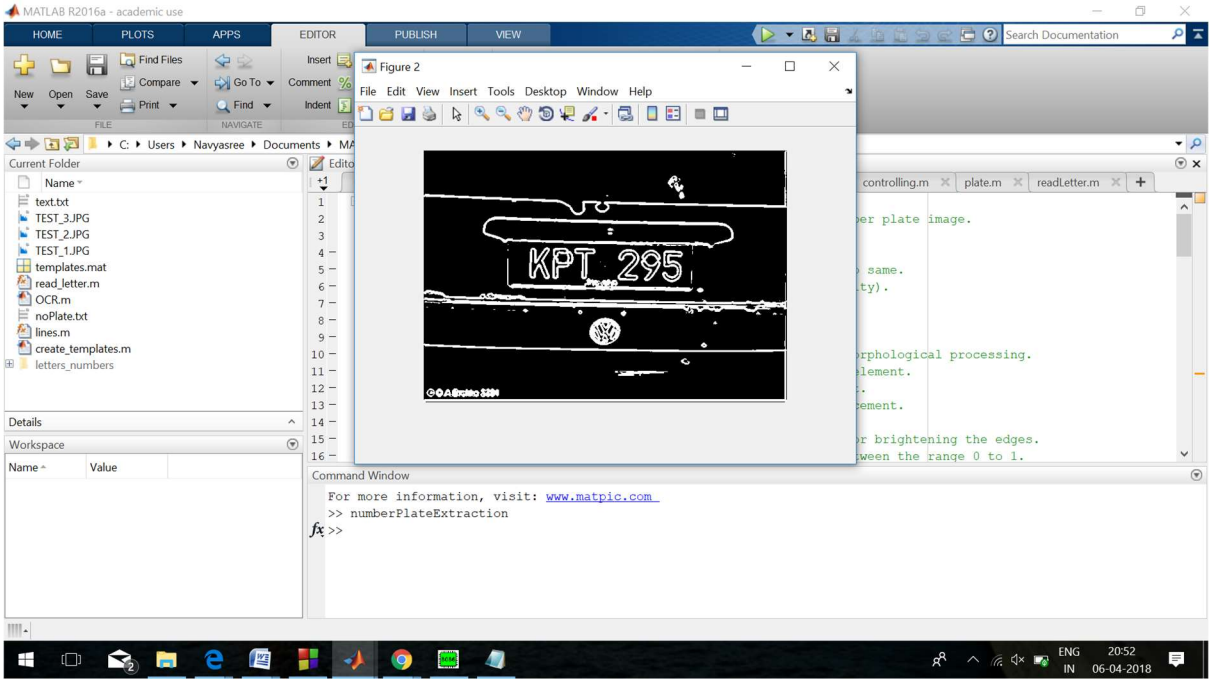
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Figure 2
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KPT 295
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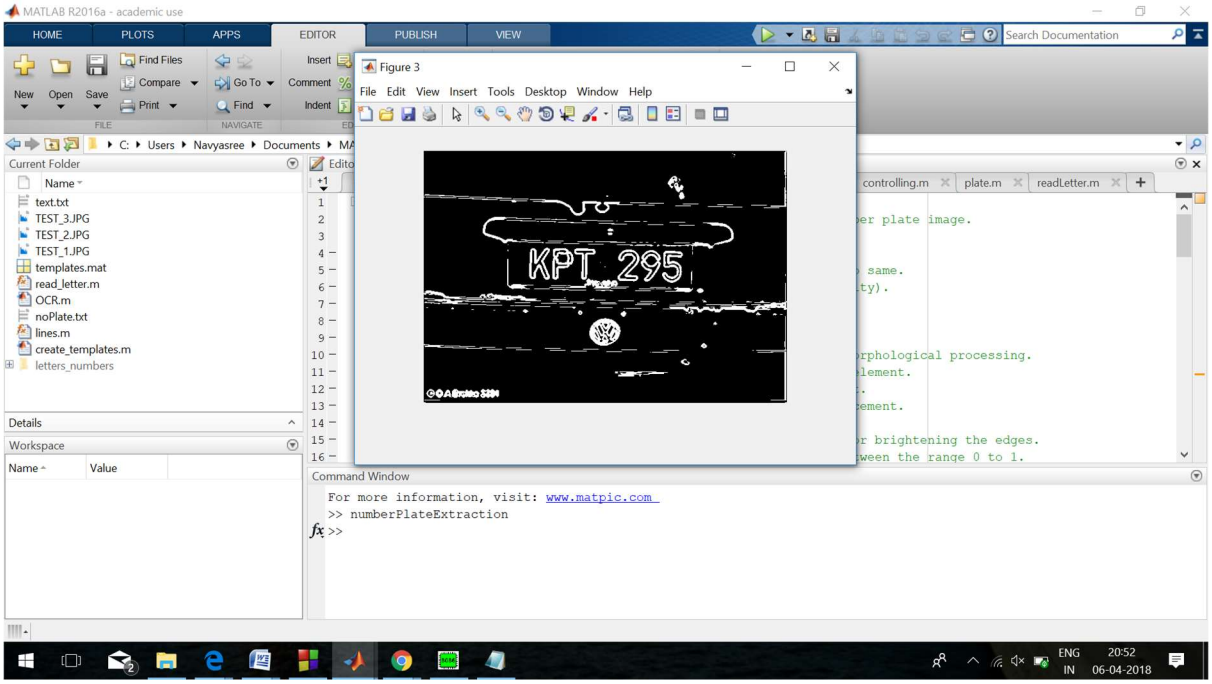
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templates.mat
read_letter.m
OCR.m
noPlate.txt
lines.m
create_templates.m
letters_numbers
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Workspace
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controlling.m
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06-04-2018

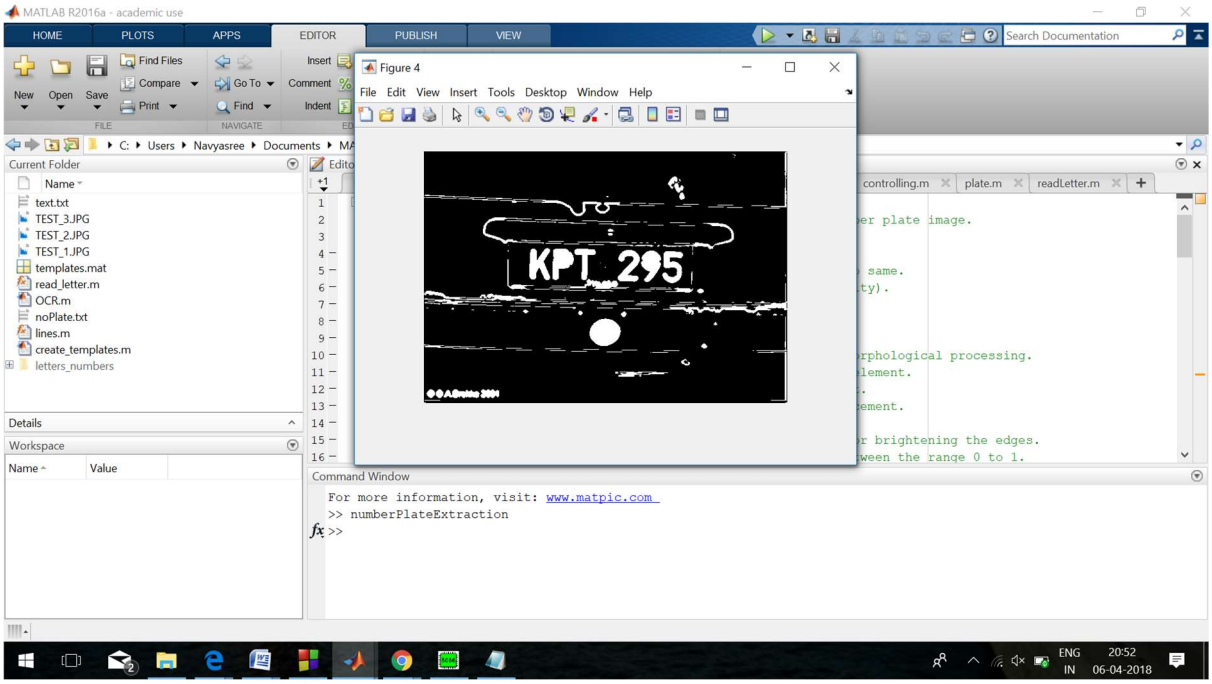
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Figure 4
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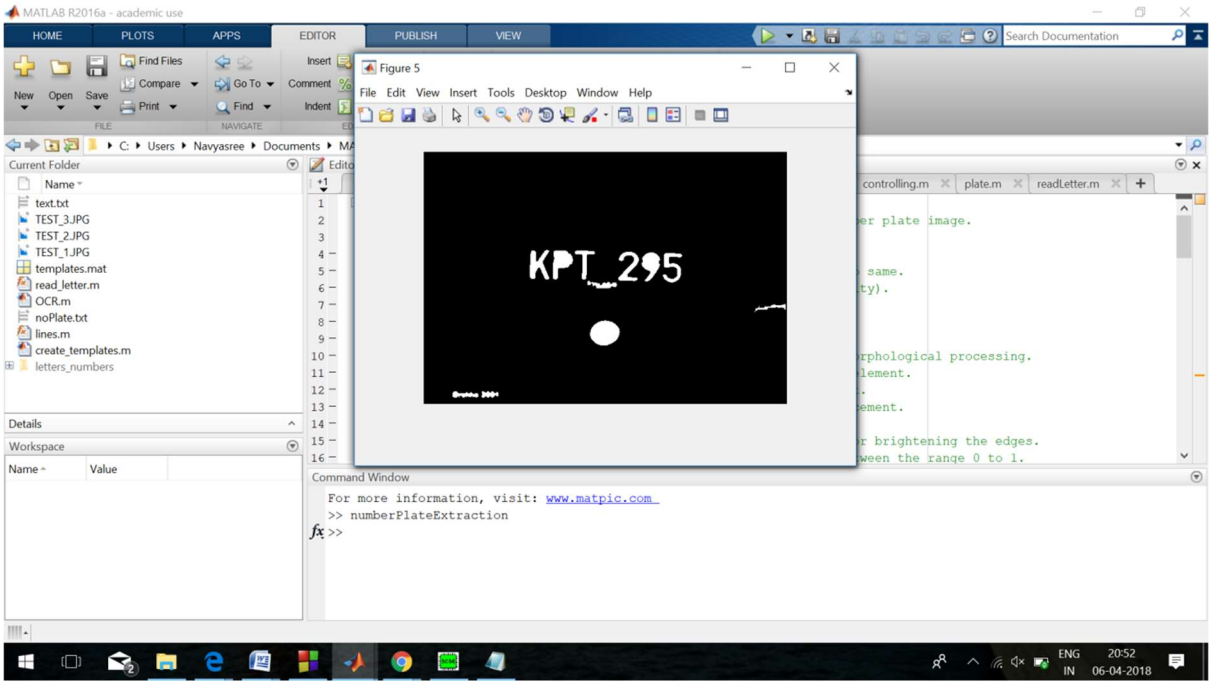
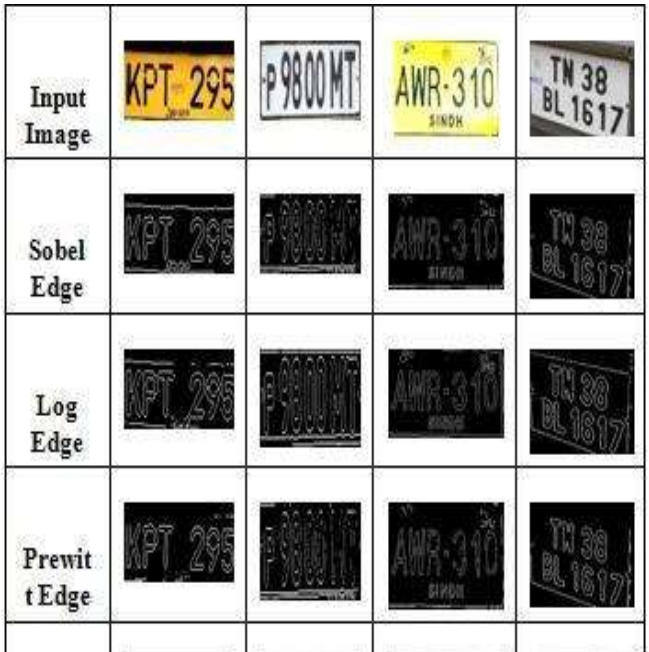


TEST REPORT

6.1 Finding

There are various ANPR applications that are already present but they do not contain man
features. Text extraction applications lack the user friendly environment hence in this
application a lot is concentrated on the user friendly environment. There is no android
application available out there. It's first of its kind.



CONCLUSION:

Algorithm is tested on large number of images with the resolution of 800 x 600 pixels. The results show that the developed ANPR algorithm successfully detects the Sindh standard vehicle number plates in various day conditions and shows the higher detection and recognition rate. It can detect and recognize vehicle plates from various distances. The distance affects the size of the number plate in an image. Once the vehicle number plate is detected, the individual characters are recognized using the OCR algorithm. The OCR use correlation method for the character recognition and the probability of the recognition can also be calculated. The system is computationally inexpensive and can also be implemented for real time vehicle identification system.