MINI - PROJECT REPORT ON

"Automatic Number Plate Detection"

BY

Group Members (Roll numbers)
Ankur Kothawade (2193084)
Bhagyashree Dalvi (2193078)
Dhiraj Dabhade (2193094)

Under the Guidance of
Prof. Sagar Jaikar

Department of Computer Science & Engineering
MIT SCHOOL of Engineering
Loni Kalbhor, Pune

M.I.T. SCHOOL OF ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING

LONI – KALBHOR PUNE

CERTIFICATE

This is to certify that the Mini- Project report entitled

"Automatic Number Plate Detection"

submitted by

Group Members	Roll No:
Ankur Kothawade	**2193084**
Bhagyashree Dalvi	**2193078**
Dhiraj Dabhade	**2193094**

is a record of bonafide work carried out by them, under my guidance, in partial fulfillment of the requirement for the Second Year of Engineering (Computer) at M.I.T. School of Engineering, Pune under MIT Art, Design & Technology University.

Date: Place:

Guide,

Department of CSE
M.I.T. School of Engineering
Loni Kalbhor, Pune

Dr. Rajneesh Kaur Sachdeo

Dean Engineering,
Head, Department of CSE
MIT School of Engineering
Loni-Kalbhor, Pune

ACKNOWLEDGEMENT

First of all, we wish to express our sincere gratitude to our guide Prof. Sagar Jaikar and our instructor Prof. Namrata Naikwade for their valuable comments and helpful information in doing the research of our project and writing the project. We would also thank MIT School of Engineering for giving us the opportunity to present the project.

ABSTRACT

Automatic Number Plate Recognition (ANPR) is a system that captures the image of vehicles and recognizes their license number. The detection of stolen vehicles can be done in an efficient manner by using the ANPR systems located in the highways.

Traffic control and vehicle owner identification has become a major problem in every country. Sometimes it becomes difficult to identify vehicle owners who violate traffic rules and drive too fast. Therefore, it is not possible to catch and punish those kinds of people because the traffic personal might not be able to retrieve vehicle numbers from the moving vehicle because of the speed of the vehicle. Therefore, there is a need to develop Automatic Number Plate Recognition (ANPR) systems as a one of the solutions to this problem.

CONTENTS

INTRODUCTION

Automatic Number Plate Recognition is a widely used application of Digital Image Processing. It is a highly accurate system capable of reading vehicle number plates without human intervention. ANPR algorithms are generally divided in four steps:

(1) Vehicle image capture

(2) Number plate detection

(3) Character segmentation

(4) Character recognition

To detect vehicle number plate following factors should be considered:

- Plate size: a plate can be of different size in a vehicle image.
- Plate location: a plate can be located anywhere in the vehicle.
- Plate background: A plate can have different background colors based on vehicle type. For example, a government vehicle number plate might have a different background than other public vehicles.
- Screw: A plate may have screws and that could be considered as a character.

The results are highly dependent on the image quality, noisy pictures that contain a lot of details.

PROBLEM STATEMENT

The purpose of License Plate Recognition System is automatic vehicle identification by applying advanced image processing technologies which can be used to check vehicles for any applications.

LITERATURE SURVEY

S.Kranthi, in the article proposed that Automatic Number Plate Recognition (ANPR) is a method that catches the vehicle image and confirms their license number. ANPR can be used in the presentation of stolen vehicles. ANPR can be used in various manners by identifying its stolen vehicle on the highway.

Muhammad Tahir Qadri In his article for the recognition the OCR techniques is used which is susceptible to misalignment and to various sizes. The affine transformation can be used to advance the OCR

recognition from various sizes and angles. The programmed vehicle identification system using vehicle license plates is exhibited. A series of image processing techniques of the system for identifying the vehicle from the database stored in the PC.

FEATURES OF ANPR

ANPR system consists of four steps :

Image Acquisition, License Plate extraction, character segmentation, and character recognition.

Image Acquisition -> The initial step is the Acquisition of an image i.e., getting an image using the digital camera associated with the PC. These caught images are in RGB format so it can be further processed for the Number Plate Extraction.

Image Processing -> The captured image is influenced by many elements like: Optical system distortion, system commotion, lack of presentation or over the top relative motion of camera or vehicle and so forth result is the degradation of a captured vehicle image and the unfriendly influence to further image processing. Therefore, before the main image processing, pre-processing of the captured image ought to be taken out which include

converting RGB to gray, resizing image, contour detection, masking of image etc.

Character Segmentation -> Once contour detects the License Plate, we have to crop it out and save it as a new image. It separates the different logical parts, like text from graphics, line of a paragraph, and characters of a word.

Character Recognition -> It is the recognition of printed text characters from an image. Basically, on the cropped image, we apply character recognition on it and extract the characters from the image using Tesseract OCR.

PLATFORM AND TECHNOLOGY USED

Programming language used – **Python**

Python is interpreted as a high level language which provides a variety of libraries/packages.

We use libraries like: -

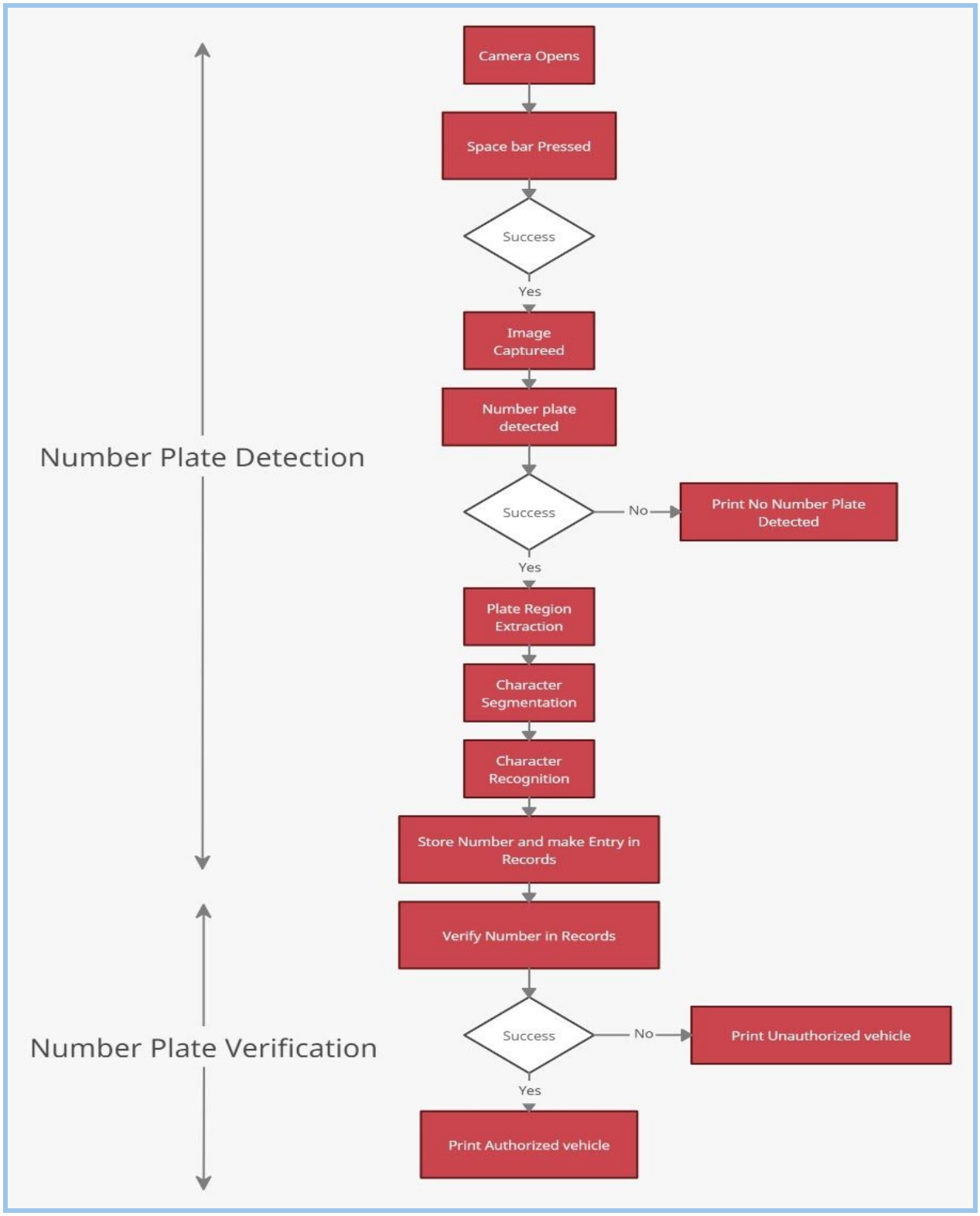
- **Imutils** -> For image Processing functions like resizing, getting landmarks, starting the camera.
- **NumPy** -> Used in masking of images
- **OpenCV** -> For image processing techniques

- **Tesseract OCR** -> To read characters from license plate image.
- **CSV (Comma Separated Values)** -> To get data from a comma separated file or text file.
- **RE (Regular Expression)** -> To check if a given regular expression matches a particular string.

Bitbucket -> It is git-based code hosting and collaboration tool built for teams, so that all team members can work on the project simultaneously.

PyCharm -> It is an integrated development environment (IDE) used in computer programming, specifically for the Python language.

FLOWCHART


Camera Opens
Space bar Pressed
Success
Yes
Image Captureed
Number plate detected
Success
No
Print No Number Plate Detected
Yes
Plate Region Extraction
Character Segmentation
Character Recognition
Store Number and make Entry in Records
Verify Number in Records
Success
No
Print Unauthorized vehicle
Yes
Print Authorized vehicle
Number Plate Detection
Number Plate Verification

MODULE (CODE)

To simplify the code and understand it better, we have divided the code into three sub-parts, i.e. we have made three different codes and using **from** and **import** library functions, we have called out those codes in the main code.

1) **main.py**

CODE -

License.py | main.py | Vehicle_Register_Manager.py | vehichle_register.txt | process_image.py

```
import cv2
from process_image import *
import random, string

path = "F:\codebase\ANPR\input\\"

def capture_image():

    cam = cv2.VideoCapture(0)
    cv2.namedWindow("ANPR-WINDOW")

    while True:
        ret, frame = cam.read()
        cv2.imshow("ANPR-WINDOW", frame)
        if not ret:
            break
        k = cv2.waitKey(1)

        if k % 256 == 27:
            # ESC pressed
            print("Thank You for using ANPR")
            break
        elif k % 256 == 32:
            # SPACE pressed
            img_name = path + "{}.jpeg".format(get_random_number())
            cv2.imwrite(img_name, frame)

            process_image(img_name)


    cam.release()
    cv2.destroyAllWindows()

    # naming the image randomly
def get_random_number():
    x = ''.join(random.choice(string.ascii_uppercase + string.ascii_lowercase + string.digits) for _ in range(8))
    return (x)

capture_image()
```

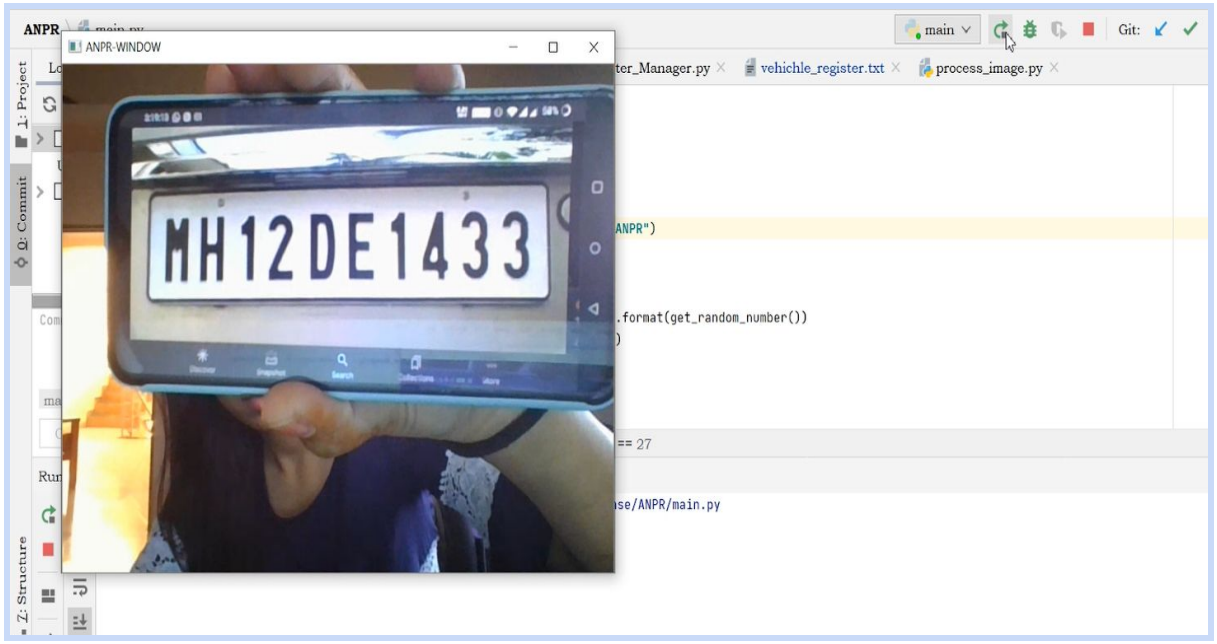
EXPLANATION -

In this code, first of all we import all the libraries that are necessary. Then we access the camera by using **open cv** and open the camera window.

When the spacebar is pressed, the image of the number plate will be captured. Else, when the esc key is pressed, the window will close. We perform this using **if and else operation.** Once the image is captured, it is named randomly and then stored in the path provided.

Thereafter, the image is processed in our next code, i.e. process_image.py .

OUTPUT -



2) process_image.py

CODE -

vehichle_register.txt | Records.txt | License.py | main.py | Vehicle_Register_Manager.py | process_image.py

```python
import numpy as np
import cv2
import imutils
import pytesseract
import re
from Vehicle_Register_Manager import *
pytesseract.pytesseract.tesseract_cmd=r'C:\Program Files (x86)\Tesseract-OCR\tesseract.exe'

def process_image(filename):
    print(filename)
    image = cv2.imread(filename)

    # Resize the image
    image = imutils.resize(image, 500, 500)

    # Show the original image
    # cv2.imshow("Original Image", image)
    # cv2.waitKey(2)

    # RGB to Gray scale conversion
    gray_img = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)

    # Noise removal with iterative bilateral filter(removes noise while preserving edges)
    blur = cv2.bilateralFilter(gray_img, 11, 17, 17)

    # Find Edges of the grayscale image
    edged = cv2.Canny(blur, 170, 200)

```

vehichle_register.txt | Records.txt | License.py | main.py | Vehicle_Register_Manager.py | process_image.py

```
    # Find contours based on Edges
    contours = cv2.findContours(edged.copy(), cv2.RETR_TREE, cv2.CHAIN_APPROX_SIMPLE)
    contours = imutils.grab_contours(contours)
    contours = sorted(contours, key=cv2.contourArea, reverse=True)[:10]
    screenCnt = None

    # loop over contours
    for c in contours:

        peri = cv2.arcLength(c, True)
        approx = cv2.approxPolyDP(c, 0.018 * peri, True)

        if len(approx) == 4:
            screenCnt = approx
            break

    if screenCnt is None:
        detected = 0
        print("No contour detected")
    else:
        detected = 1

    if detected == 1:
        cv2.drawContours(image, [screenCnt], -1, (0, 0, 255), 3)

    # Masking the part other than the number plate
    mask = np.zeros(gray_img.shape, np.uint8)
    new_image = cv2.drawContours(mask, [screenCnt], 0, 255, -1, )
    new_image = cv2.bitwise_and(image, image, mask=mask)
```

vehichle_register.txt | Records.txt | License.py | main.py | Vehicle_Register_Manager.py | process_image.py

```
59      # Character Segmentation
60      # Crop the image
61      (x, y) = np.where(mask == 255)
62      (topx, topy) = (np.min(x), np.min(y))
63      (bottomx, bottomy) = (np.max(x), np.max(y))
64      Cropped = new_image[topx: bottomx + 1, topy:bottomy + 1]
65      cv2.imshow('Crop image', Cropped)
66      cv2.waitKey(5)
67
68      # Character Recognition
69      # Print Number and remove spaces
70      vehicle_number = pytesseract.image_to_string(Cropped, config='--psm 11')
71
72      if (len(vehicle_number) == 0):
73          print("number not found")
74      else:
75          vehicle_number = vehicle_number.replace(" ", "").strip().upper()
76
77          # remove non alphanumerics(ie. garbage special values)
78          vehicle_number = re.sub("[^0-9a-zA-Z]+", "", vehicle_number)
79
80          print("Number plate detected is:", vehicle_number)
81          print(len(vehicle_number))
82
83          # update register in Vehicle_Register_manager.py
84          vehicle_entry(vehicle_number)
85
86          #check if vehicle is authorized in Vehicle_Register_manager.py
87          validate_vehicle(vehicle_number)
88
```

EXPLANATION -

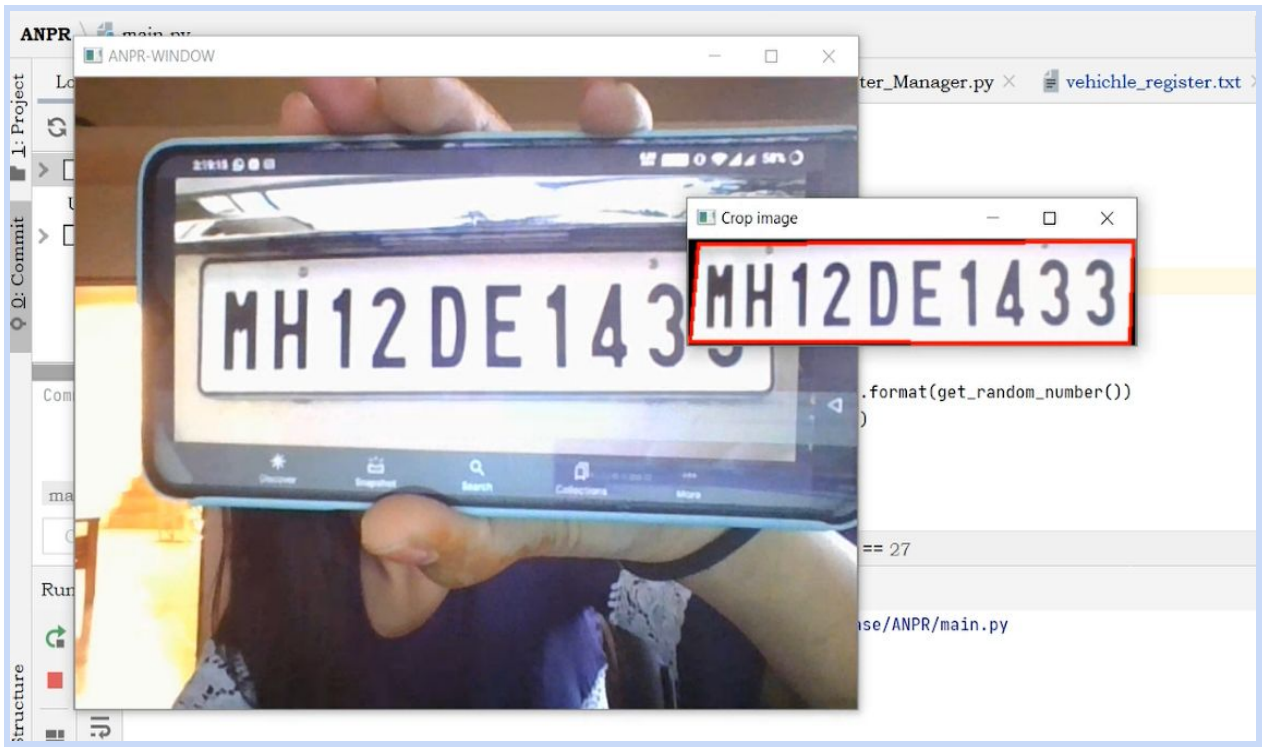
This is the code which was called in our **main.py** in the first step. Here, we use **numpy, open cv** and **pytesseract** to extract the number of the number plate from the image. Then via pytesseract the image is resized, if no number plate is recognized, the program stops. RGB to Grayscale conversion, noise removal, finding contours based on

edges, all these are performed. Parts other than the number plate are masked, i.e. are removed. Then the image is cropped and the number plate is displayed on the screen.

The number is then printed in the output window and all the garbage values are removed from it. We have further made a register (text file) where we will keep an entry of all the number plates recognized. (along with date and time).

The code will then be directed to our next code, i.e. **vehicle_register_manager.py** where we will verify whether the vehicle is authorized or not.

OUTPUT -



vehichle_register.txt | Records.txt | Lic

```
1  MH12DE1433, 07/02/2021 12:51:12
2  MH12DE1433, 07/02/2021 01:47:30
3  DL31AF4943, 07/02/2021 01:58:35
4  MH05GH4857, 07/02/2021 02:25:32
5  HR26TJ5551, 07/02/2021 02:40:43
6  MH04MA2267, 07/02/2021 04:14:58
7  MH12DE1433, 07/02/2021 06:48:22
8
```

3) vehicle_register_manager.py

CODE -

```python
import csv
from datetime import datetime

def vehicle_entry(vehicle_number):

    print("Updating Vehicle Register : " + vehicle_number)
    # enter vehile number, date, time in register
    text_file = open("vehichle_register.txt", "a")
    text_file.write(vehicle_number)
    text_file.write(", ")
    text_file.write(datetime.now().strftime("%d/%m/%Y %H:%M:%S"))
    text_file.write("\n")
    text_file.close()

def validate_vehicle(vehicle_number):
    print("Validating vehicle : " + vehicle_number)
    # reading csv file
    with open("Records.txt", 'r') as csvfile:

        # creating a csv reader object
        csvreader = csv.reader(csvfile)
        # including only first column consisting of numberplates
        included_cols = [0]
        authorization_status = False
        for row in csvreader:
            content = list(row[i] for i in included_cols)
            # Checking if detected numberplate exists in the records
            if (vehicle_number in content):
                authorization_status = True
                break;
        print("Authorized Vehicle")
        else:
            print("Unauthorized vehicle")

```

EXPLANATION -

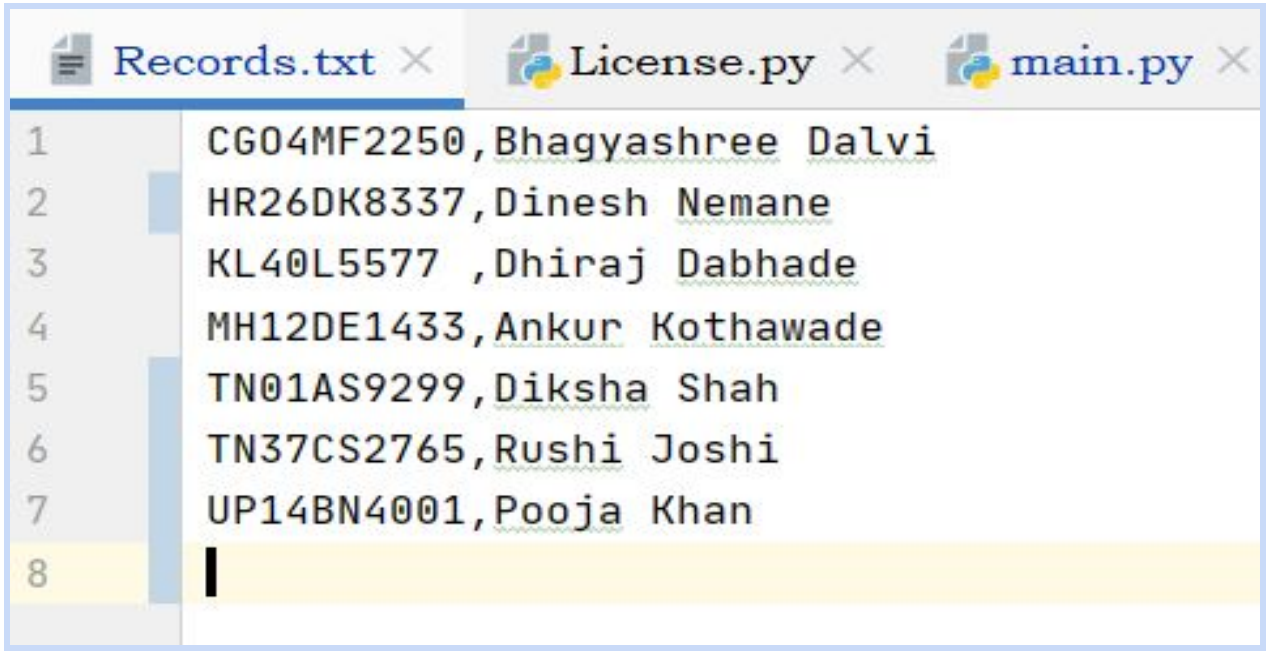
In this code, the most necessary requirement is our stored data, i.e. the vehicle records, which we have stored in a **CSV file.** It consists of

certain names and vehicle numbers of authorised people to the university. Once we get the number from the image, we have to validate whether the vehicle is authorised or not so we open the csv file, and by using lists, we select the column which consists of vehicle numbers and then it is cross checked to the number obtained from the image.

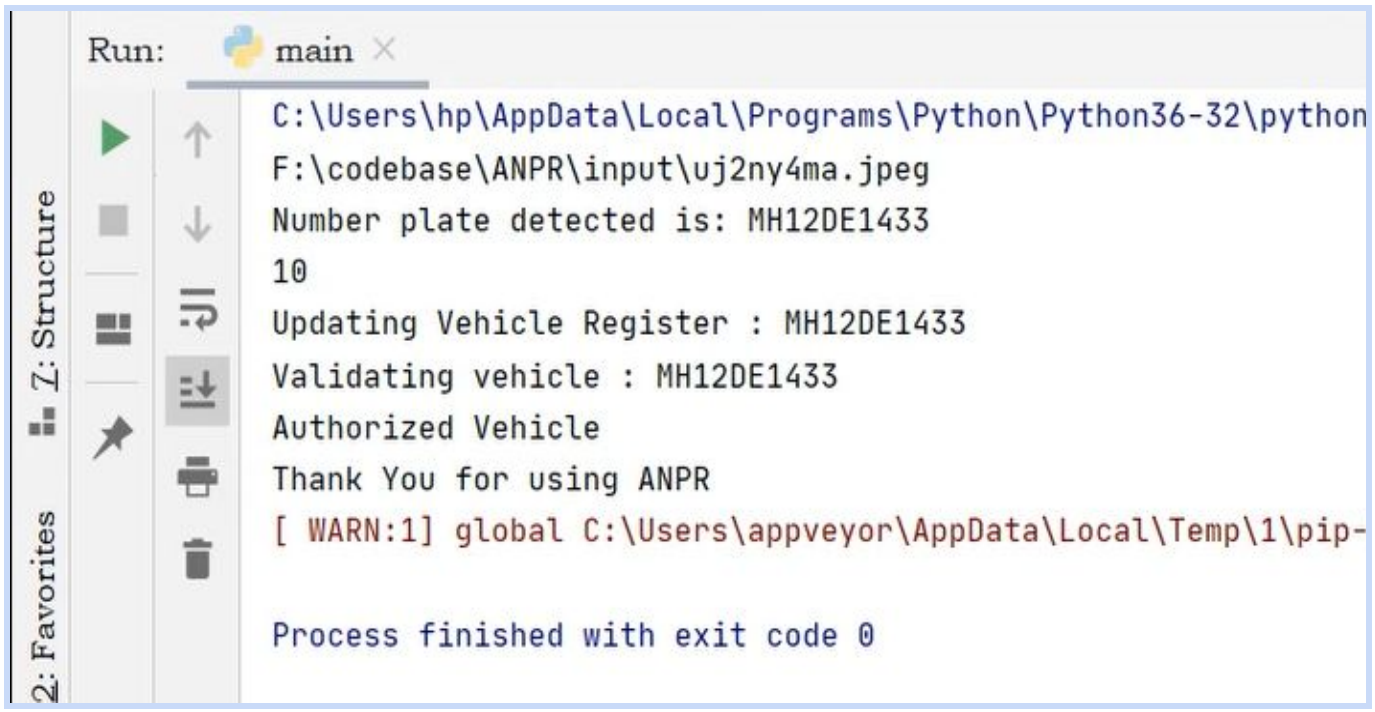
If the number recognized from the image exists in the records, a message as “Authorized Vehicle” will be printed.

But if the number recognized from the image does not exist in the records, a message as “Unauthorized Vehicle” will be printed.

THE CSV FILE (Records) -



OUTPUT -


Run:
main
C:\Users\hp\AppData\Local\Programs\Python\Python36-32\python
F:\codebase\ANPR\input\uj2ny4ma.jpeg
Number plate detected is: MH12DE1433
10
Updating Vehicle Register : MH12DE1433
Validating vehicle : MH12DE1433
Authorized Vehicle
Thank You for using ANPR
[WARN:1] global C:\Users\appveyor\AppData\Local\Temp\1\pip-
Process finished with exit code 0
7: Structure
2: Favorites

GLOSSARY

Library- It is a collection of non-volatile resources used by computer programs, often for software development. These may include configuration data, documentation, help data, message templates, pre-written code and subroutines, classes, values or type specifications.

Threshold- It is an amount, level, or limit on a scale. When it is reached, something else happens or changes

Acquisition- An asset or object bought or obtained, typically by a library.

Pre-processing – To undertake the preliminary process of data.

Character segmentation - It is an operation that seeks to decompose an image of a sequence of characters into sub-images of individual symbols.

Tesseract - It is an optical character recognition (OCR) tool for python which will recognize and read the text embedded in images.

Detection - The action or process of identifying the presence of something concealed.

Contour - An outline representing or bounding the shape or form of something.

Masking - It is simply an image where some of the pixel intensity values are zero, and others are non-zero.

Optimization – Making the code more efficient by shortening it and making it provide accurate results as desired.

CONCLUSION

This report presents a recognition method in which the vehicle plate image is obtained by the digital cameras and the image is processed to get the number plate information. A rear image of a vehicle is captured and processed using various algorithms.

For the future of ANPR we are planning to improve the project by using some Machine learning algorithms to improve the detection of number plates and can use raspberry pi and external camera to implement this project in real-life applications.

This project can be implemented at toll booths or in university.

ANPR can be further exploited for vehicle owner identification, vehicle model identification traffic control, vehicle speed control and vehicle location tracking.

REFERENCES

https://platerecognizer.com/anpr-for-india/

https://www.pyimagesearch.com/2020/09/21/opencv-automatic-license-number-plate-recognition-anpr-with-python/

https://en.wikipedia.org/wiki/Automatic_number-plate_recognition

FORM -A

MIT School of Engineering

Department of Computer Science & Engineering

Finalization of project Topic

Academic Year: 2020-21

Class: CSE II

Project Group Id: CSEII_GROUP_07

Group Members:

Sr. No.	Name	Roll No.
1.	Ankur Kothawade	2193046
2.	Bhagyashree Dalvi	2193078
3.	Dhiraj Dabhade	2193094

Proposed Project Topic:

1. Automatic Number Plate Recognition

2. Twitter Sentiment Analysis

3.IOT based Greenhouse Monitoring System

Sr. No.	Parameters	Title 1	Title 2	Title 3
1	Significance/ Applicability (out of 10)			
2	Innovativeness (out of 10)			
3	Scope (out of 10)			
4	Feasibility (Out of 10)			
5	Approved (yes/no)			

Remarks (if any):
Name and sign of Reviewer 1:
Name and sign of Reviewer 2 :
Name and sign of Project Coordinator:

FORM -B

MIT School of Engineering

Department of Computer Science and Engineering

Viability Analysis Report

Date: 07/02/2021

Class: CSE-II

Project Group ID: 07

Project Title: Automatic Number Plate Recognition

Project Viability Analysis Parameters:

Sr. No.	Parameters	Description About Project
1.	Business Ideas and Implementation from project	This project could be implemented at toll booths and colleges.
2.	Market Survey (competitors, substitute products, potential market, etc.)	The international companies like Sensys Gatso , NDI Recognition System Ltd.

3.	Market Acceptability of Product	Can be accepted by Colleges, Government
4.	Emerging Trends about Project and Product	Development of new infrared cameras to capture better images in hostile conditions.
5.	Income Generation ideas through Project	Police forces can use ANPR to check if a vehicle is registered or not.
6.	Project Profitability	Continuous as this project can be used at toll booths, and for traffic control also.
7.	Cost Benefit Analysis	No cost incurred yet.
8.	Any Other Point	No

(Name & Designation of Lab Instructor)

Signature with Date.

MIT School of Engineering

Department of Computer Science and Engineering

Mini Project Synopsis

Group ID:07

Project Title: Automatic Number Plate Recognition

Group Members:

Enrollment Number	Roll No.	Name of student	Email Id	Contact Number
MITU19BTCS0151	2193046	Ankur Kothawade	kothawade09@gmail.com	9978247319
MITU19BTCS0077	2193078	Bhagyashree Dalvi	dalvibhagyashree151227@gmail.com	9518322479
MITU19BTCS0076	2193094	Dhiraj Dabhade	dhirajnic6@gmail.com	7769091412

Problem Statement:

Abstract:

Literature Survey:

Proposed System (Block Diagram):

Mathematical Model:

Conclusion:

References:

Annexure:

Annexure I: Form A-Title Approval

Annexure II: Form B-Market and financial feasibility

Annexure III: Literature survey paper

Report formatting: Font Palatino Linotype, Font Size- Main Heading-16, Sub Heading-14, Paragraph-12, Alignment- Justified, Add Index of content, Index of Tables, Index of Diagrams.