Number Plate Recognition

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1 Problem Statement

Number Plates are the distinguished proof of any vehicle in any country. Recognition of Number Plates in this modern age is very important in many aspects. There are various applications in which Number plate recognition which is also known to people as License plate recognition is extensively used . For instance, in the parking areas of mall or talking about the toll plazas NPR is used, the camera simply take a photo of our vehicle in order to save the record of the vehicle entered in the parking lot. Moreover, in law enforcers,it is used to identify the cars which are involved in criminal activities. NPR is used to monitor the traffic violations and manage highway traffic. Also talking about its usage in border control organizations, it used to keep track of vehicles that have crossed the frontiers. Nowadays drive throughs are so in so it used there to trace the customer's vehicle and also manage the client's parking spaces in the parking area. Last but not the least it is used in automated system which are present in residential complexes or office buildings, here camera at the entry point captures the vehicle and it just allow the vehicles which are authorized and there is no need of manual security.

2 Literature View

2.1 An Efficient Approach for Number Plate Extraction from vehicles Image under Image Processing

This paper was published by Sukhvir Kaur in 2014 , main focus on Number Plate Extraction from the Vehicle Image. the process defined in this research is difficult but has detailed procedure information. This Research Paper is concerned with Indian Vehicles. The Indian Number Plate Detection is difficult as in India the number plate of Vehicle position identification is difficult respective to Vehciles of Different Countries.
Highlighted issues regarding image input in this paper are:

- The blurry image of the vehicle due to Environment(day/night, Weather problem ,Noise occurrence)
- Wrong camera angle
- Plate Position are different on vehicles

The process explained in the paper is based on 4 steps: Pre-Processing, Number Plate Extraction, Character Segmentation, Character Recognition.

As the main focus of the paper is Number Plate Extraction , the described points of this step in this paper are:

1)Image Acquisition 2) RGB to grayscale conversion 3) Noise removal by Iterative Bilateral Filtering 4) Contrast enhancement by using Adaptive Histogram Equalization 5) Morphological opening and image subtraction operation 6) Image binarization 7) Edge detection by Sobel operator 8) Candidate plate area detection by morphological opening and closing operations 9) Actual number plate area extraction 10) Enhancement of Extracted plate region.
Success Rate of ANPR of this paper is 98.3%
You can find the paper from this **link**

2.2 Recognition of Vehicle Number Plate Using Image Processing Technique

This paper was published by Faizal Patel, Jaimini Solanki, Vivek Rajguru, Ankit Saxena in 2014 , main focus on the Implementation Of NPR System. The process defined in this research is difficult but has detailed procedure information. This Research Paper is concerned with Indian Vehicles data same as the above paper.

Resources used in this research are:

- MATLAB R2010a
- Java, C, C++, Python, and FORTRAN.
- Plotting of data into graphical form.

The process explained in the paper based on 4 steps: 1)Vehicle Image Captured By camera 2)Extraction of Number Plate Location 3)Display Vehicle Number 4) Segmentaion and Recognition of Plate Character

As the main focus of the paper is region of intrigue ROI, the described points of this step in this paper are:

1)Image Acquisition 2)Convert into Grey Image 3)Dilation and Erosion of Image 4) Horizontal & Vertical Edge Processing 5)Passing through low pass filter 6)Segmentaion of ROI 7)Convert into Binary Image 8)Character Avalible un ROI 9)Segmentation of Characters 10)Recognition using Template Matching 11) Storing in File

Results of the paper is the Number of the plate converted into the text in notepad
You can find the paper from this**link**

2.3 Automatic Vehicle Identification by Plate Recognition

This paper was published by Serkan Ozbay, and Ergun Ercelebi in 2007 , main objective of work described in this paper is about the AVI system application for traffic Tool systems(highway electric tool coleection etc.)

The main condition of this paper work about number plate recognition is :

- The vehicle should be 4-5 meters aways.
- The system applicable in controlled environment.

Cross correlation function (CCF) is a measure of the similarities or shared properties between two signals. two discrete images denoting the image to be searched and the template respectively. The normalized cross-correlation between the image pair is defined as below :

$$R(m,n)=\frac{\sum_j\sum_k F_1(j,k)F_2(j-m+(M+1)/2,k-n+(N+1)/2)}{\left[\sum_j\sum_k F_1(j,k)^2\right]^{1/2}\left[\sum_j\sum_k F_2(j-m+(M+1)/2,k-n+(N+1)/2)^2\right]^{1/2}} \quad (1)$$

As the main focus of the paper is on LPR, the described points of this step in this paper are: 1)STRUCTURE OF THE LPR SYSTEM 2) PLATEREGION EXTRACTION 3) SEGMENTATION 4)CHARACTER RECOGNITION 5) EXPERIMENTALRESULTS

Results of the papers described as:

TABLE I
RESULTS OF THE TESTS

Units of LPR System	Number of Accuracy	Percentage of Accuracy
Extraction of Plate Region	332/340	%97.6
Segmentation	327/340	%96
Recognition of Characters	336/340	%98.8

You can find the paper from this**link**

2.4 Dynamic traffic rule violation monitoring system using automatic number plate recognition with SMS feedback

This paper was published by R Shreyas, Pradeep Kumar B V, Adithya H B, Padmaja B,Sunil M P in 2017, main objective of work described in this paper is related with toll system for vehicle recognition)

The method describes by this is overview to: Global System for Mobile Communication is a facility through which SMS (Short Message Service) can be sent. GSM modems are easily available in market and can be operated with the use of AT commands. With the help of Attention commands, SMS can be sent to the to the concern authority. A computer is used for programming for the computation of arithmetic and logical operations and run many applications compatible with the application platform of MATLAB that was described by:

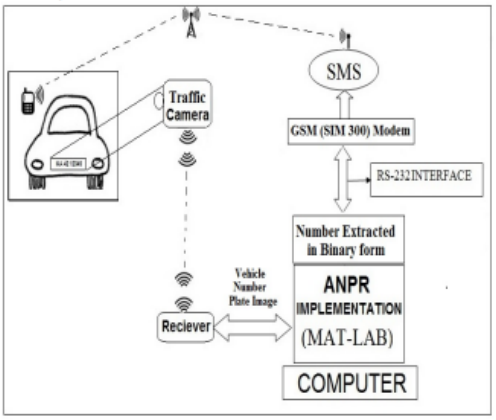

Fig.2.Proposed Block diagram

As the main focus of the paper is on LPR, the described points of this step in this paper are: 1) Input image from webcam. 2) Convert image into binary. 3) Detect number plate area. 4) Segmentation. 5) Number identification. 6) Save to file in given format

Fig.3.Licence Plate Recognition

Results of the papers described as: achieve 95 percent of success rate in number plate detection.

You can find the paper from this**link**

3 Methodology

The Methodology I used is described in the diagram as shown in figure:

- Get Annotated Data from Roboflow.
- Get Requirments From Github Repository
- Train the model using Yolov8
- Test the Model
- Predict the Data
- Pass the predicting Data to EasyOCR
- Result of License Plate Extraction

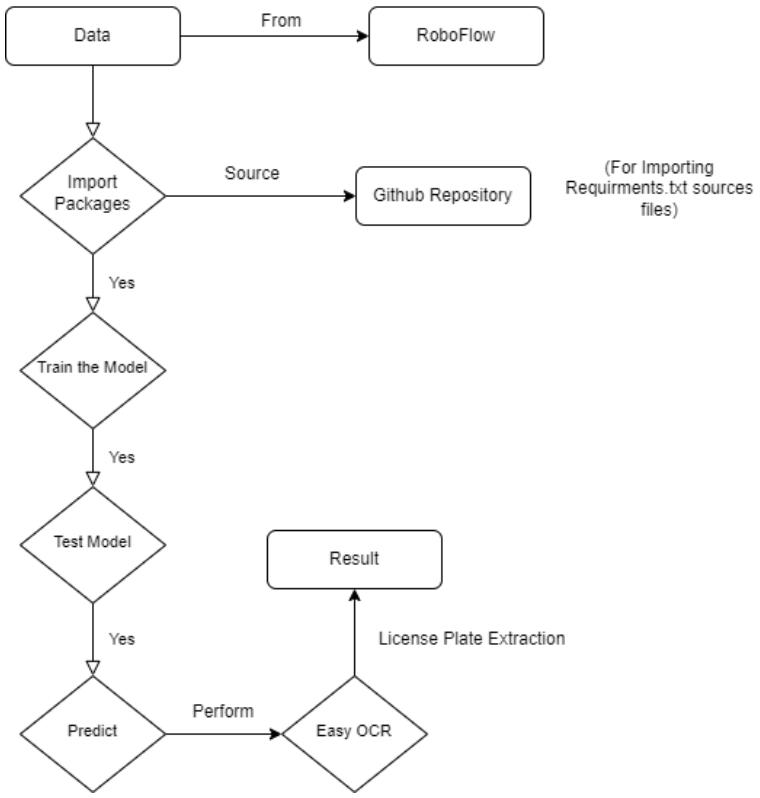

Figure 1: Methodology

4 Front End - Screens

Front end screens are shown as:

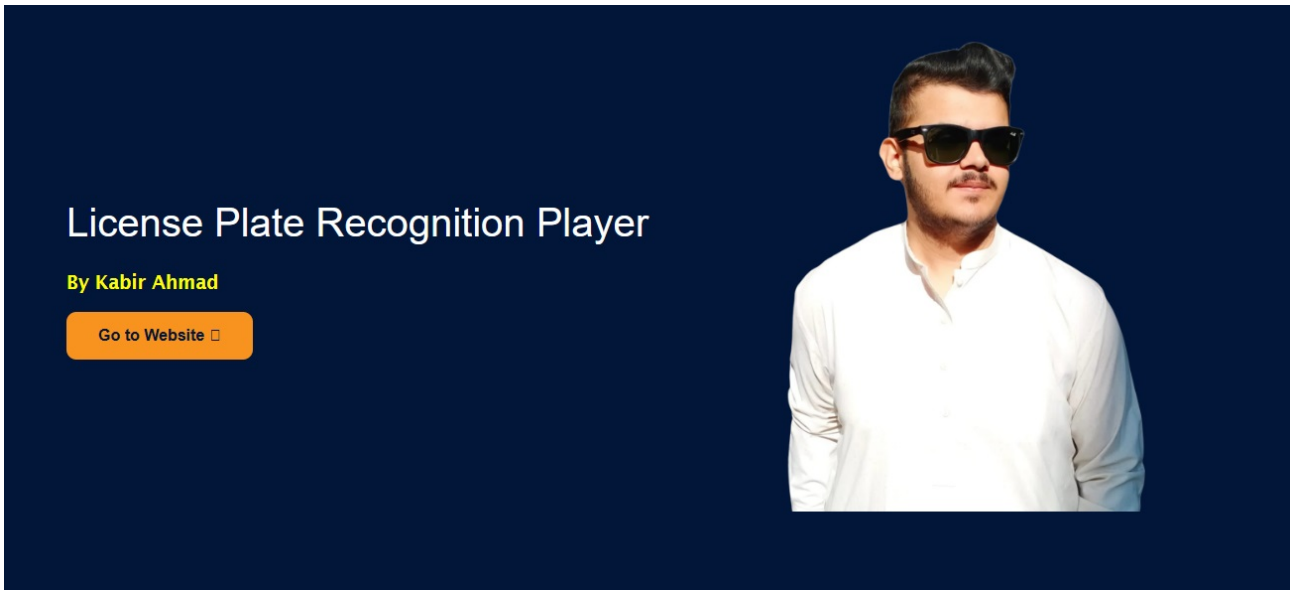

Figure 2: Main Page of Frontend

Figure 3: Main Page of Frontend

5 Dataset

Data set is taken from RoboFlow. **Dataset**
The data set contains 400+ images of Netherland and US vehicles with vehicle plate formate of [A-Z]-123-[A-Z]*2 at a major level. All types of vehicles in the data set(blurry, noisy), etc. Car, Auto , Vans are crowded or clean in this dataset.

6 Project Backend

The Backend of Project is on Collab.
Reason
Due to Computation Power of T4 GPU provided by Google Collab. To train the Model it take very long time on CPU so all the provided code is linked on Google Collab File whose Link is provided.

7 Project Frontend

The Frontend of Project is on HTML CSS JS.
Reason
Frontend of this project is deal to show the output of the results (output video/pic file) as well as a data csv file that contains the record of detected car plates that shown in frontend.

8 Evaluation Matrix

At the end of this project, a Number Plate Recognition system be developed that extracts the number from the vehicle image into text with 96% accuracy when the vehicle is at the best angle otherwise it vary with the angle.

9 Future Work

It can be done for multiple type of vehicle number plates. and can increase the accuracy of system from every angle of vehicle.