

Vehicle License Plate Recognition from the given image of Vehicle/License Plate

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Abstract: Vehicle License Plate Recognition System (VLPR) is the system which recognizes the License Plate. In recognizing the license plate, system undergoes several processes like License plate localization, license plate detection, segmentation of characters which is present on the license plate and finally recognition of characters is done. In today's world, like as we know as the population is increasing and number of vehicles that too mainly number of cars are rapidly increasing. Because of this it is difficult to note down the license plate number which is required for some investigation manually. With the development of this system, it will be easy to recognize license plate approximately which reduces the manual work. Developed system recognizes license plate of car mainly and also other vehicles license plate which is of rectangular shape only. Recognizes Image of front view, back view and also some slanted view image. System recognizes license plate of different countries consisting of English alphabets and number and doesn't matter whatever the font style is. Also recognizes license plate which is of yellow color as well. But recognizes one-layer license plate only and the aim is to recognize the characters maximum that is rate of recognizing the characters should be more than the rate of failing to recognize characters. No matter if the system fails to recognize max 3 to 4 characters but recognition rate should be more than the failed recognized characters. This type of system is widely used in Traffic control areas, tolling, parking area etc. This system can be used for the purpose of security system.

IndexTerms - VLPR, License Plate Detection, Localization, Segmentation, License Plate Recognition, K-Nearest Neighbour (KNN)

I. INTRODUCTION

Vehicle License Plate Recognition is a computer vision technology that competently categorizes vehicle number plates from pictures without the necessity of human involvement. Currently, it has become more significant due to three main reasons: the rising number of cars on the roads, the fast development of image processing techniques and the great number of real-life applications [1] that this technology offers. Some of the most typical applications of VLPR systems are traffic law application, toll collection or parking lot access control.

But, the improvement of VLPR systems is not a relaxed task, since it faces many challenges due to ecological and number plate differences. As for the past, variable brightness or background designs greatly distress number plate recognition. In result, varying brightness can reduce the eminence of the image and background designs add extra difficulty to the license plate localization process [3]. And, as for the last, the position, capacity, scope, font, color or inclination of number plates establish very interesting factors in the improvement of a reliable VLPR system.

Mainly in this project, the images of vehicle will be given considering car images as input. Not only the static images but also, we can use dynamic images to detect and recognize license plate. Firstly, model is trained with classification images and flattened images [2]. These two text files consist classification and flatten images in the form of hexadecimal. These two text files used for training the model taken from the google. No separate data used for testing, training only this text files is used. So, after giving the image, if training is successful then the preprocess of image takes place to detect license plate. Firstly, the given image converted to grayscale image then it is converted to threshold image that is binary image in order to visualize the image and detect proper license plate.

Then we find contours from the threshold image. Then from the contours will include only the characters. Then grouping of all the possible characters takes place. Then rectangle box is drawn around the grouped characters and then shows all the possible license plates. Then pre-process of obtained possible plates takes place. Possible plates converted to grey scale then to threshold image then find the contours [6]. Then considers only the character contours and group them. Then segmentation takes place and detects each character separately. At last, the detected characters size us seen. The one with highest characters detected will be considered as the required text of the license plate.

II. RELATED WORK

In this paper, mainly explanation about the Automatic Vehicle License Plate Recognition system using Optimal K-Means with CNN for Intelligent Transportation Systems is given. Also Offered a different OKM-CNN [1] method for lively detection and recognition of License plate of image only if image of vehicle is of front facing and the image should be clear enough with zoom format.

In this paper, mainly explanation about the Chinese vehicle license plate recognition system is given. System built using kernel-based exciting learning machine with deep convolutional structures. And also, it is the fresh deep CNN-KELM [2] construction for CLPR. Planned the construction which shows good enactment and good generalizability in a much tinier period of training. But this project applicable to only Chinese license plate. It fails to detect other countries license plate and recognize it.

In this paper, mainly explained about the Collaborative method of adaboost forces of 3L-LBPs classifiers [3] which is used for license plates finding. Along with high eminence image it also includes low eminence images for recognition. Established a new discovery method for finding vehicle license plates under low eminence images using image processing techniques but the work was satisfactory because the performance was low. It was able to detect only 2 or 3 characters properly.

In this paper, mainly explanation about a system which is designed for license plate recognition by making use of edge finding and convolution neural network [4] methods is given. Also, the framework for LPR system is designed. Figure verification of the image which is given as input is done by robust DBs vectors. But the system designed is applicable only to the Bangladesh license plates. System recognizes the license plates of Bangladesh only.

In this paper, mainly explanation about a well-organized license plate recognition system which is designed using CNN is given. Also projected a well-organized ranked [5] license plate recognition system. Accuracy of recognising is high accuracy and also performance is good but the system recognizes license plate of image only if image of vehicle is of front facing and should be clear enough otherwise it doesn't detect license plate only.

In this paper, mainly explanation about the Recognition of automobile license plate using Raspberry pi [6] is given. This Raspberry Pi based Automobile license plate recognition project is a gainful key for the toll collection, parking zones and road traffic presentations. But the designed system fails to read image if the image is little bit blur means it doesn't detect license plate only if it is blur and font changes.

In this paper, mainly explanation about automatic license plate recognition using connected component analysis (CCA) algorithm [7] is given. The algorithm designed is efficient one. Mainly it is suitable for identifying the vehicles rather than recognizing the license plate. But feature of recognizing license plate is also included. Unfortunately, it works only for Punjab license plates.

In this paper, mainly explanation about Segmentation and annotation free number plate recognition with the technique's deep localization and failure identification [8] is given. Detailed explanation about the proposed end-to-end ALPR system that can be mounted to numerous US authorities and republics with slight physical explanation and human involvement is also given. But Optical Character recognition enactment in the arena is tarnished due to the discrepancy between training and target data circulation if insincerely generated pictures is used.

In this paper, mainly an CNN based method for involuntary number plate recognition in the wild is given. This proposed CNN-based ALPR system is efficient one because design accepted distinct RPN and R-CNN [9] for number plate finding and turn facts reversion. But should apply resolution to other kinds of number plates and appraise its simplification ability.

In this paper, mainly explanation about Riesz miniscule [10] ideal for improving number plate detection and recognition is given. In this design, proposed a new Riesz miniscule model for improving number plate appearance quality to increase the enactments of number plate detection and recognition methods. But the reports show poor results in license plate detection only.

III. SYSTEM DESIGN

System design is the procedure of essential construction, components, crossing point, and information for a structure to mollify quantified necessities. Systems enterprise could be seen as the tender of structures philosophy to artefact growth. In this design, first we need input store which consists of vehicle images which is given as input. Then image processing techniques used for plate localization and then recognition of license plate that is characters takes place.

System Architecture

The framework of Vehicle License Plate Recognition System is as shown in Figure 1: In the design, the first thing we need to do is input the image from the image store. This is the place from where we give the input to the model. Then some pre-processing steps takes place to detect all the possible license plates. Then all these possible license plates also undergo pre-processing steps for character recognition. Then segmentation of characters is done to recognize each character and finally output is given that is the text which is present on the license plate using OpenCV techniques.

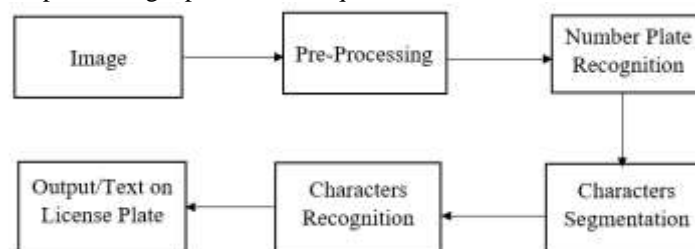


Figure 1: System Architecture

Dataflow Diagram

The data flow diagram of Vehicle License Plate Recognition System is explained as shown in Figure 2. Includes the pre-process techniques used to localize the plate and extract it. Same pre-process techniques used for recognition of characters on the plate. For detection and recognition of plate OpenCV functions is used.

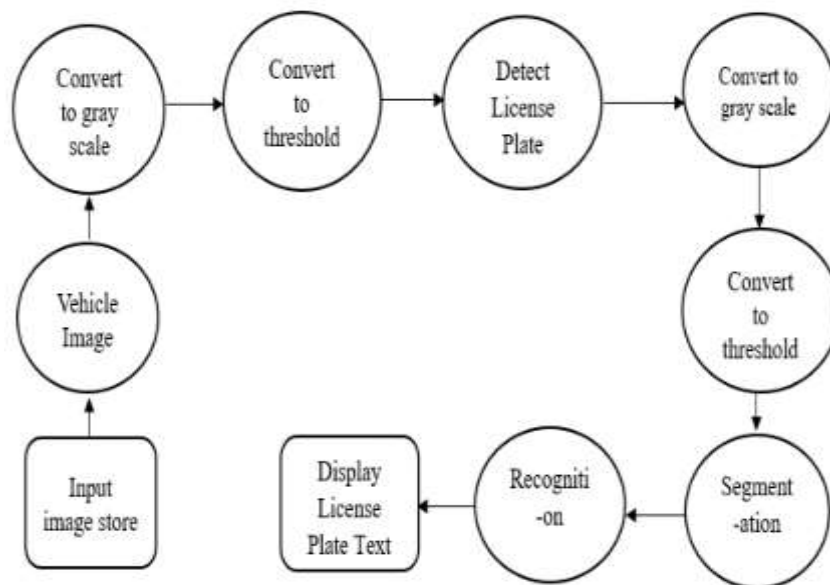


Figure 2 Data Flow Diagram

IV. IMPLEMENTATION

The implementation of a system is done after the development effort is completed. Before moving to actual implementation that is coding, some basic things which is needed for the implementation should be collected and select the required tools, libraries etc.

STEPS

After designing the system, next step is to implement according to the design done. Before implementing the design done, some basic needs which is required for implementing the design should be collected and keep it ready.

Collecting the input images/video stream

So, first step is to collect the images of vehicles and also the video stream required and this images/video is used as an input to the system. I have taken all the images/video stream required for input from the google. Particular built dataset is not used.

Selecting the Programming language to implement the code

Here mainly, making use of Python language for the coding purpose. Python is a strangely commanding lively, object-oriented programming language that is used in a extensive diversity of tender fields. Its proposals robust provision for mixing with other idioms and tools, and comes with widespread typical lending library.

Selecting tool for Detection and Recognition of license plate (OpenCV)

Here mainly computer vision techniques are used for detecting and recognizing the license plate. Most of the cv2 functions is used in the implementation. OpenCV is a lending library of programming purposes for actual period computer vision initially industrialized by Intel and now maintained by Willo garage. OpenCV is the best open-source computer vision lending library that creators and scholars can ponder of.

Selecting the suitable software to implement the code

PyCharm is the software program which delivers keen cipher achievement, code reviews, on-the-fly error importance and quick-fixes, along with automatic code and rich triangulation competences. PyCharm is intended by computer programmer, for program writer, to deliver all the tackles we need for creative Python growth. All the lending library required for application of code is fixed in PyCharm software itself.

Algorithms/Pseudocodes

Mainly the designed system has four modules. They are-

- Plate Localization
- Plate Extraction
- Segmentation
- Character Recognition

Plate Localization

In this design, the first task is to give a static image of vehicle/video stream as input to the VLPR system. If video given as input, then the system captures the image of vehicle from the video. After giving the image input, the image undergoes pre-process steps using image processing techniques. An image processing technique used are converting the input image to greyscale and then greyscale image to threshold image. Using threshold image all the possible contours is found. From the contours only possible characters are included. Then grouping of characters takes place and rectangle is drawn for all the possible plates.

```
imgOriginalScene = cv2.imread("image label")
if imgOriginalScene is None:
    print ("\n error: image not read from file \n\n")

    listOfPossiblePlates=DetectPlates.detectPlatesInScene(imgOriginalScene)
    imgGrayscaleScene, imgThreshScene=Preprocess.preprocess(imgOriginalScene)
    listOfPossibleCharsInScene=findPossibleCharsInScene(imgThreshScene)
    listOfListsOfMatchingCharsInScene=DetectChars.findListOfListsOfMatchingChars(listOfPossibleCharsInScene)
```

Plate Extraction

After localizing the plate that is grouping of characters from the contours is done and rectangle drawn around the grouped characters and then extraction of all the possible plates is done. This is the important step in license plate recognition because if we want to recognize the characters on the plate then plate detection should be proper and plate detection plays very important role.

```
for listOfMatchingChars in listOfListsOfMatchingCharsInScene:
```

```
    possiblePlate = extractPlate (imgOriginalScene, listOfMatchingChars)
```

Then,

Calculation of center point of the plate, calculation of plate width and height, calculation of correction angle of plate region, then get the rotation matrix for our calculated correction angle, copy the cropped plate image into the applicable member variable of the possible plate.

Segmentation

After license plate detection, recognition of characters present on the plate should be done. Before recognition of characters plates should undergo preprocess steps. After that segmentation of characters takes place. Then each individual character recognition is done.

```
possiblePlate.imgGrayscale, possiblePlate.imgThresh=Preprocess.preprocess(possiblePlate.imgPlate)
```

```
for currentChar in listOfMatchingChars:
```

```
    pt1 = (currentChar.intBoundingRectX, currentChar.intBoundingRectY)
```

```
    pt2 = ((currentChar.intBoundingRectX + currentChar.intBoundingRectWidth), (currentChar.intBoundingRectY +
    currentChar.intBoundingRectHeight))
```

```
    cv2.rectangle(imgThreshColor, pt1, pt2, Main.SCALAR_GREEN, 2)
```

```
        # Draw green box around the char
```

Character Recognition

Finally, after the segmentation of each character, recognition of characters takes place. So, here KNN algorithm is used for classifying the characters based on the classification txt used for training and flatten images txt used for recognition of characters. Using this algorithm and OpenCV functions character recognition is done.


```

possiblePlate.strChars=recognizeCharsInPlate (possiblePlate.imgThresh, longestListOfMatchingCharsInPlate)
# Finally, we call findNearest

retval, npaResults, neigh_resp, dists = kNearest.findNearest(npaROIResized, k = 1)
strCurrentChar = str (chr (int (npaResults [0] [ 0])))
# Get character from results

strChars = strChars + strCurrentChar # append current char to full string

```

V. EVALUATION MEASURES

Mainly in this project, there is four steps which has to be performed properly so that the end result will be of high accuracy. The first step which has to be performed is pre-process of the given input image. Here mainly image processing techniques is used for the pre-process of given input image. In order to evaluate this, considered some 100 images and applied pre-process steps to evaluate the process whether the images undergoing the pre-process steps properly that is converting the given input image to greyscale and then to threshold image.

Then the next step is to localize the license plate and extract it. Basically, this step is known as plate detection. Here also in order to evaluate the performance of detecting the license plate, considered some 100 images which undergone pre-process steps and applied method of detecting plate using python language and OpenCV functions like first finding contours and considering only characters contours. Evaluation of this character contours considering is also important because based on this, grouping of characters, localization and extraction of plates takes place.

Next is segmentation of characters should be done. Same way considered some of the plates detected from the previous steps. Applied segmentation function to all the considered plates and checked for the results to know how much of them segmented properly and evaluated the results.

Finally, recognition of characters is done. Same way considered some of the segmented characters license plates and applied KNN algorithm to recognize the characters and evaluated the results like how much plates segmented characters has been recognized properly. Results of the evaluation measures is given in the table 1.

Stages	Accomplishment rate
Greyscale image	100%
Threshold image	100%
Plate detection and extraction	98%
Segmentation	97%
Character Recognition	93%

Table 1: Analysis table

VI. RESULTS AND DISCUSSIONS

This explains about the results obtained after the implementation of the designed system. This includes all the screenshots obtained as result which includes the screenshot of license plate localization, plate detection, segmentation of the characters and recognition of characters. Mainly here for performance analysis graphs/plots are not used for knowing the accuracy of the system. Instead of this, took some of the images and used for implementation and note down the passed results and failed results of pre-process, plate detection, segmentation and recognition steps.

After note down the passed and failed results, it is converted to percentage form and given in the above table. In this section, all the stages results is given which includes pre-process step, Plate detection, segmentation and character recognition.

Pre-process step



Original Image

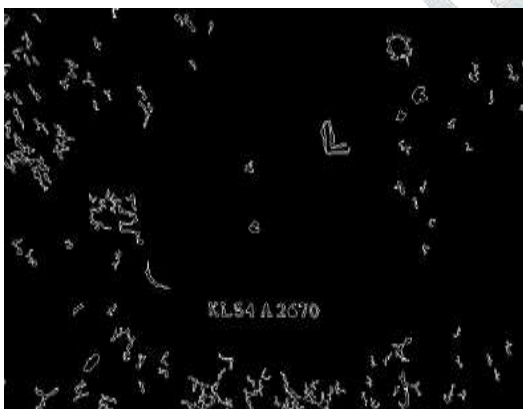


Greyscale Image



Threshold Image

Plate Detection



Contours



Possible Plates

Extraction (Shown two plates among the possible several plates)



Correct license plate

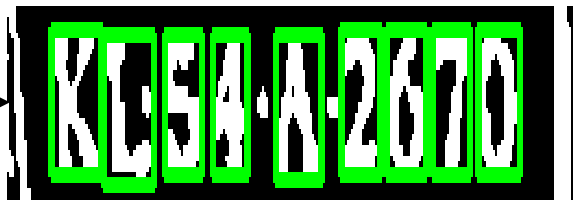


False license plate

Segmentation



Threshold plate



Segmented characters

Recognition of characters



Output/Text on license plate

VII. CONCLUSION AND FUTUREWORK

In this project, Vehicle license plate recognition system from the given image of vehicle/License plate is designed. This project mainly focused on recognizing all the countries license plate which is of having English alphabets and numbers using KNN model. So, recognition is not restricted to only Indian license plate. And also focused on recognizing all the possible views of vehicle like front view, rear view, from side view, little bit blur, in dark, in sunny. Also, the execution time is also considered. This system provides output fast compared to other built systems.

System can be improved further by using different algorithm for training the system, image processing techniques so that all the characters on the license plate will be recognized properly. Also, can build the algorithm which recognizes two layered license plates. Also, can be improved to recognize license plate text other than English text and letter like Chinese license plate, kannada alphabets and numbers license plate etc.

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