

Vehicle Number Plate Detection and Character Segmentation Using Image Processing

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Abstract

In this paper, we present an Automatic License Plate Recognition System (ALPRS) to identify license plates which is an application of image processing. The main process of ALPRS is divided into four steps: The noise in the image is removed by using Gaussian filter. A simple algorithm is used for background subtraction.

Canny edge detection is used to localize the license plate location. Finally, letters and digits are extracted through template matching technique. The proposed algorithms have two advantages: First, the method has strong robustness against noise. Second, it can deal with license plates with different color. The proposed system has been tested using various NP images of vehicles extracted from real-time images that vary along the dimensions of light, scale, and orientation. The experimental results demonstrate the robustness of the proposed method.

Index terms: Vehicle number plate recognition, Indian vehicles, Region-of-interest, Image thresholding, Morphological processing, Sobel operator, canny edge detector.

Introduction

The process of detecting the vehicle number plate is a challenging and interesting project to be done in today's life. Most of the people nowadays are not following the traffic rules properly, which leads to many accidents. This has to be changed by imposing fines on them, which will be big task to observe all the vehicle manually. In the Intelligent Transportation Systems (ITS), the Automatic License Plate Recognition System (ALPRS) is a must. Nowadays, vehicles play an important role in transportation and their application is increasing rapidly. ALPRS usage have shown to have positive effect on controlling vehicle traffic. It is also very important for the development in the transportation infrastructure globally, especially in the developing countries such as Iran, where the ITS have been rising since few years ago. ALPRS is an image processing technology that

identifies vehicles by tracking their number plate without direct human intervention.



Figure1:working of a NPR

ALPRS is also known by other various terms such as automatic license plate recognition, automatic license plate reader, number plate tracking, car plate recognition, vehicle number plate recognition, automatic vehicle identification, etc. The features of a standard number plate are as follows: background color, character color, character size, aspect ratio of number plate, font style, etc. Aspect ratio is a very important factor in vehicle's number plates and it is deduced by dividing number plates' width by it's height. Vehicle Number Plate Detection (VNPD) System for Indian vehicles contains three basic modules namely image preprocessing, candidate area extraction and character recognition [12]. In pre-processing, the image is being loaded and converted to gray or binary, followed by some denoising techniques. In candidate area extraction, detection of number plate area and segmentation of characters is carried out. In character recognition, template matching and retrieval of characters is performed. Character recognition can also be performed by neural network but it needs periodical training for better efficiency. It also takes a lot of time and expertise for satisfactory results.

Advantages of Vehicle Number Plate Detection:

Using canny edge detection algorithm and morphological operators, system detects vehicle number plate. Experiment shows that system can effectively capture the vehicle video and detect the license plate whether it has been taken at daytime, night time or under complicated environments and show accuracy up to 90%. Using canny edge detection method, Produces very thin and clean edges. Similarly, to CCTV, automatic number plate recognition systems can provide you with the details regarding when someone was at your premises, whenever they are required. The images taken by this camera can be used as evidence and can provide valuable information that can be used in investigations.

Applications

This project can be used in the following areas:

1. Analysis of city traffic during peak hours.

2. Automation of weigh-in-motion systems.
3. Enhanced vehicle theft prevention.
4. Effective enforcement of traffic rules.
5. Flexible and automatic vehicle entry and exit from a car parking area.
6. Car parking management system.
7. Improved security for the car parking operators.

III. Proposed Method

Each step of the algorithm procedure has its role, priority, and contribution toward having a comprehensive algorithm. This results in a satisfying plate recognition system. Reading the overall image is a starting point in order to construct the general impression of the plate itself. Resizing the image to match a systematic analysis approach is formed. Several edge-detection approaches may be used to obtain the plate of a vehicle [12, 13, 14, 15]. The edge-detection process leads to identifying various objects within an image. Therefore, using suitable filters, unwanted objects are easily removed and essential objects of the image remain. These objects are separated in such a way that a plate is familiarized, identified, and acquainted to its appropriate place.

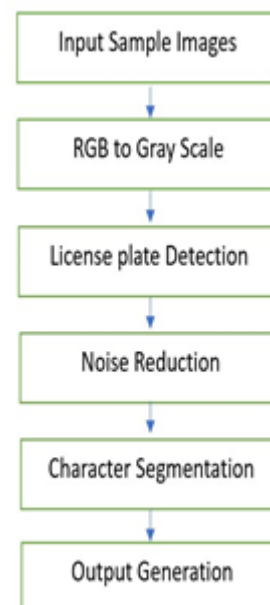


Figure2: Proposed Work

1. Input sample images:

Here we take a dataset with image samples of vehicle number plates and apply the image processing algorithms to detect the number plate and give the characters of the plate as output.

2. RGB to gray scale conversion:

The input RGB image is converted into gray scale for obtaining better results, as it is easier to identify the objects in a monochrome image than in the images with RGB pixelization.

3. License plate detection:

We use morphological image processing techniques like edge cutting to detect the number plate and separate it from the rest of the image.

4. Noise Reduction:

Reducing the noise in the picture will be one of the finest techniques to improve the accuracy of the model.

5. Character Segmentation:

From the detected license plate, the characters are to be segmented.

6 .Output generation:

The separated characters are given as the result of the model. This can be done with the help image processing algorithms implemented in matlab.

By using Canny edge detection we will improve the accuracy and usage of existing methodology.

The proposed algorithms have two advantages:

- o First, the method has strong robustness against noise.
- o Canny edge detection is a technique to extract useful structural information from different vision objects and dramatically reduce the amount of data to be processed

Canny Edge Detection

Edge-detection is a basic tool that is widely used within image processing. It is applied practically in applications such as object determination, in which feature detection aims to sharply identify certain objects of an image. Several edge-detection methods are widely used based on several possible optimization techniques. For example, error minimization, maximizing an object function, fuzzy logic, wavelet approach, morphology, genetic

algorithms, neural network and Bayesian approach. Various edge-detection methods perform to wavering degrees of quality within altered conditions. Therefore, it is possible to apply multiple edge-detection algorithms.

III. Experimental Analysis

In this paper, for the purpose of detection of vehicle number plate detection and character segmentation using image processing, Objects are separated and each object has a specific characteristic that enables the system to know the plate like object as shown in figure 5. This step is essential in simplifying the remaining processes based on various separated objects with in the image. In order to identify the license plate from those objects an image consisting of object is desired. We use the background subtraction algorithm for the detection of the moving object in the surveillance area. Also canny edge detection is used to localized the license plate location. The experiment is carried out in MA TLAB to show the basic process of the image processing. Experiments have been performed to test the proposed system and to measure the accuracy of the system. We used the RGB color images at 640x480 resolution. The Total of 70 vehicle's images were tested. Images are taken in different illumination conditions. Here the reference image is initialized in the code and then the subtraction of the current frame is done. After the subtraction of both frames, the subtracted image is displayed on the screen. The following figure shows the reference image, current image, the subtracted image, extraction of plate region and recognition of characters. .A suitable description of the license plate is based on solidity, the ratio between the height and width, convex area, and bounding box. Accordingly, the plate can be identified by multiplying the plate object with the original image as illustrated in figure.

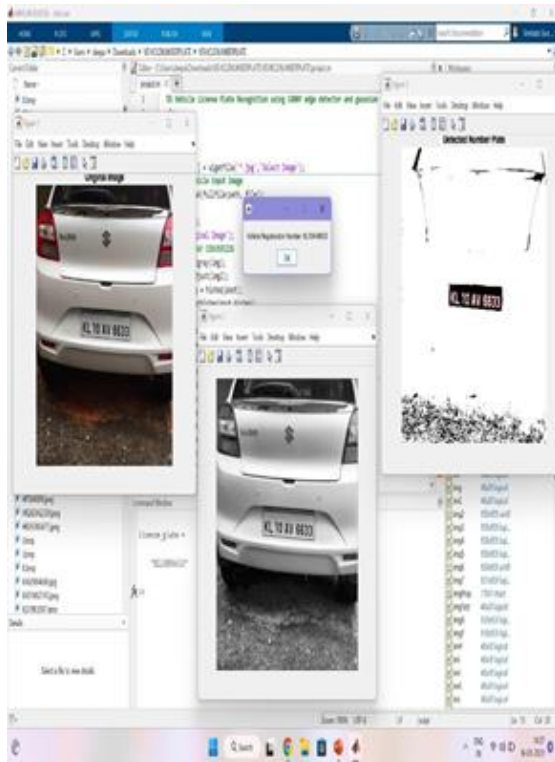


Fig2: Output of the given sample input image

Conclusion

In this paper, we developed an automatic number plate recognition system customized for real-time Indian vehicles 60 number plates. Vehicle LPR has several applications. It also has several approaches and algorithms. Given an input image of a vehicle, an automatic recognition system is discussed leading to extracting the license plate numbers and its characteristics. Practical image processing tools have been used to enable the system to obtain the desired objects and so to identify license plate numbers. This proposed approach enables the system to zoom smoothly toward the exact frame of the plate. Therefore, unwanted objects are easily removed and the license plate is recognized. According to our pilot experiments, our proposed extraction process works well for low resolution, noisy and low contrast images. The system was tested on several vehicles images

under different weather and illumination conditions including daytime, sunny, cloudy and rainy days.

FUTURE SCOPE:

As our future work, we will focus on the extraction of multiplate multi-vehicle tracking, use of a better template matching algorithm can possibly yield in a better result.



Fig3: Automatic number plate detection

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