www.ijecs.in
International Journal Of Engineering And Computer Science ISSN:2319-7242
Volume 4 Issue 1 January 2015, Page No. 9789-9796

A Real Time Automatic License Plate Recognition Using Optical Character Recognition

R. Ramachandran, R. Manivannan, R. Ramachandiran, N. Balachandar

Department of MCA
Sri ManakulaVinayagar Engineering College
Puducherry, India
chandran0307@gmail.com

Department of MCA
Sri ManakulaVinayagar Engineering College
Puducherry, India
manistudies@gmail.com

Assistant professor
Department of MCA
Sri ManakulaVinayagar Engineering College
Puducherry, India
ramachandiran08@gmail.com

Department of M.Tech
Sri ManakulaVinayagar Engineering College
Puducherry, India
balabara@gmail.com

Abstract

Automatic license plate recognition is used to recognize the characters from license plate image. It is widely used in localized areas such as traffic control, burglary and surveillance. The proposed method applied on yellow color license plate. It has two main stages. First, exact location of the license plate is detected from an input image by using image acquisition and optical character recognition and sobel edge is used for character segmentation. Second, template matching is used to test the recognized characters with templates. This paper also proposed vehicle authorization by checking the license plate number from database and electronic mail is send to administrator if authorization fails.

Keywords: Optical Character Recognition (OCR), Sobel Edge, Template Matching, Road Transport Office (RTO).

I. INTRODUCTION

The ALPR is key part of traffic control management system. The number of vehicles has been increase drastically as compared to the infrastructure growth. ALP technology is persistently growing popularity, especially in security and traffic control. It plays vital role in other numerous applications also, such as traffic law enforcement [1], toll enforcement by police and military force for electronic toll collection [2], and

parking [3]. In 1976 ALPR was invented in the UK Police Scientific Development Branch. The main goal of ALPR is to extract and recognize the license plate without any human involvement. The variant in license plate and environment causes problem in detection of vehicle license plate such as font size, font style, font color, location of plate on vehicle and plates may have different intensity due to headlight or due to environment .The ALPR uses image processing software to examine the images of vehicle and extract the license plate number. The main benefit is to recognize the license plate in an image which can be a static image or real time image. The most difficult job is to identity the license plate in an image.

The basic steps in ALPR are license plate extracting and character segment and license plate character recognition. Automatic license plate extraction is very significant step because it directly affects the further levels. It is used widely the license plate. The input will be an image that contain vehicle with license plate. The Optical Character Recognition and Image Acquisition is applied to detect the license plate from image. Character segmentation is used to segment the characters from license plate. The input will be the output from license plate extraction. The sobel edge is used to separate the characters from extracted license plate. The character recognition is used to recognize the characters from each segmented characters. Template Matching is used to test the characters with Templates.

II. RELATED WORK

Detecting license text and at the same time distinguishing it from similar patterns based on the geometrical relationship between the symbols constituting the license numbers is the selected approach in this research. Effectively, a new technique is introduced in this paper which detects LP symbols without using any information associated with the plate's outer shape or internal colors to allow for the detection of the license numbers in case of shape or color distortion either physically or due to capturing conditions such as poor lighting, shadows and camera position and orientation. To search the candidate objects and to allow for tolerance in the localization process, a new genetic algorithm has designed with a new flexible fitness function. An image processing is carried out first to prepare for the GA phase.

The flowchart in Fig. 1 depicts the various image processing stages that finally produced image objects to the GA phase. GA selects optimum LP symbol locations depending on the input GRM that defines the geometrical relationships between the symbols in the concerned LP.

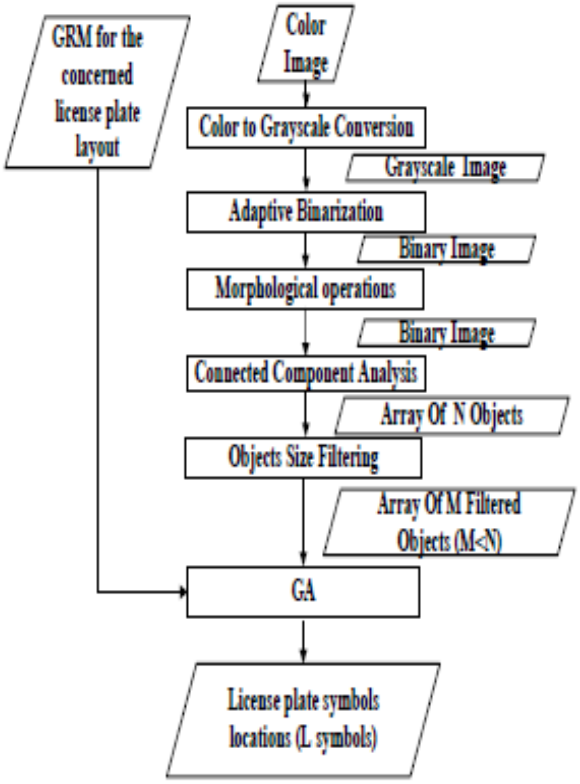


Fig.1. the system's overall flowchart for the localization of the LP symbols.

IMAGE PROCESSING PHASE

In this phase, an input color image is exposed to a sequence of processes to extract the relevant two dimensional objects that may represent the symbols constituting the LP. These processes are carried out in different stages, as depicted in Fig. 1, will presented in the following subsections.

A. Color to grayscale conversion

The input image is captured as a color image taking into account further processing of the image

to extract other information relevant to the concerned vehicle. Color (RGB) to grayscale (gs) conversion is performed using the standard NTSC method by eliminating the hue and saturation information while retaining the luminance as follows: gs=0.299*R+0.587*G+0.114*B

B. Gray to binary using a dynamic adaptive threshold

Converting the input image into a binary image is one of the most sensitive stages in localizing LPs due to spatial and temporal variations encountered in the plate itself and the environment around it resulting in several illumination problems. Hence the binarization of the image according to a fixed global threshold is not suitable to overcome these problems. In our system process a local adaptive method based on the techniques described in has been implemented to determine the threshold at each pixel dynamically depending on the average gray level in the neighborhood of the pixel. An effective rule has been adopted to differentiate between foreground and background pixels. The pixel intensity is higher than 90% of the local mean it is assigned to the background; otherwise it is assigned to the foreground. The 10% offset below the mean is chosen experimentally to minimize the sensitivity to fluctuations in illumination. The size of the window is to calculate the threshold for each pixel is selected according to the image resolution and the expected size of the license symbols. A 30x30 window has been applied on the first set of image samples used in this research, resulted in a high accuracy rate in different illumination conditions as will be presented in the results section.

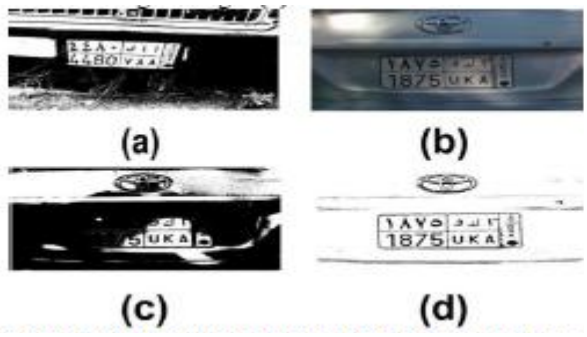


Fig.2. (a) Converted binary image for image in Fig. 2, using Otsu's method, (b) Car image with variable illumination, (c) output when using Otsu's method for image in (b), (d) output when applying local adaptive threshold method for the same image in (b).

C. Morphological operations

Morphological operations such as dilation and erosion are important processes needed for most pattern recognition systems to eliminate noisy objects and retain only objects expected to represent the targeted patterns. In LP detection, closing operation (dilation followed by erosion) is performed to fill noisy holes inside candidate objects and to connect broken symbols. On the other hand, opening (erosion followed by dilation) is applied to remove objects that are thinner than the LP symbols. The system closing is applied to fill spaces that break the bodies of symbols using a 3-pixel-disk element in the first experiment. This process is very important especially for the recent Saudi LP layout where a light gray watermark is used for authentication purposes.

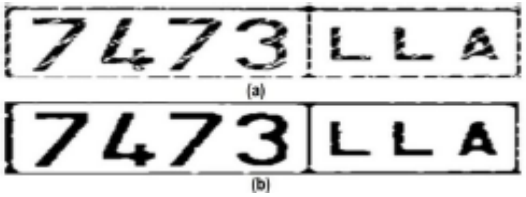


Fig.3. Morphological closing using 3-pixel disk- element (a) Input Binary Image, (b) Image after closing operation.

D. Connected Component Analysis (CCA) and objects extraction

CCA is a well known technique in image processing that scans an image and groups pixels in labeled components based on pixel connectivity [30]. An 8-point CCA stage is performed to locate all the objects inside the binary image produced from the previous stage. The output of the stage is an array of N objects in the plate. Fig. 5 shows an example of the input and output of this stage.

Fig. 4.CCA example: (a) Input image, (b) output objects

III. SCOPE OF RESEARCH

ALPR has a wide scope in Forensic Research Department and Road Transport Office (RTO). The proposed methodology is easy and fast to identify the area of license plate and recognize the text written on the extracted license plate. The recognized characters are compared with the database for verification of vehicle. It helps police authorities and other crime investigation departments to find whether the number plate is authorized or not.

IV. PROPOSED METHODOLOGY

There are lot of techniques have developed for extraction of license plate. The shape of license plate is rectangular.The Edge Detection methods are used to locate the rectangles from an image [4] [5]. This is very simple and fast technique .Morphology is used to extract the license plate from the original image helps to remove unwanted small parts from license plate. In [7] hybrid approach is proposed by combining Edge Statistics and Morphology. The accuracy of finding license plate is 99.6%. In [6] Hough transform is used to find the straight lines in an image. The straight lines locate the license plate. It is boundary based extraction. It requires lot of computational time. To reduce the computational time Contour transform is used with Hough transform. Sobel filters [4] [6] are used to find the edges due to the color change between license plate and car body. In Horizontal and Vertical Projection is use for segmentation. The vertical projection are determines the starting and ending location of characters and then Horizontal Projection is applied to segment thecharacters. Images are made up of pixels. Pixels are connected inthe binary license plate. Then it analyzed and similar sizes are considered as candidates for license plate region. In Adaptive binarization is used to convert the intensity from evening to noon. In fixed backgroundcolor is used and it reduces the edge points and removes the fake regions. In [8] Optical Character Recognition istechnique in image processing. It used to classify the scan alphanumeric text into computer – readable text torecognize the license plate. It requires preprocessing stage to remove boundaries in which helps to recognizing the characters. It process the information more quickly and accurately and effectively and also minimizes the errors. Template Matching is used to test the characters with templates which are designed. It is useful for recognizing fixed sizecharacters and non-broken. It find a small blocks of an images and match with the template image. Template design is vitalpart of template matching. Template design mustmatch templates to it corresponding image also have some amount of mismatch to other templates.

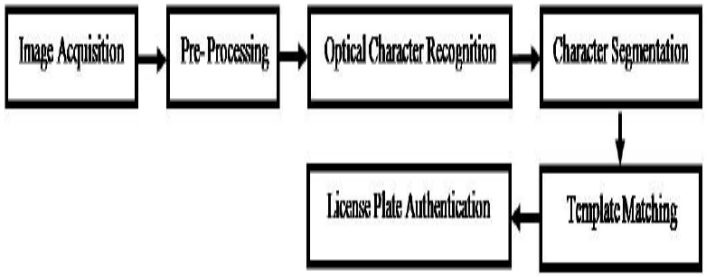


Fig. 5 Steps for the License Plate Recognition

The proposed system consists of two main stages:

1. Extraction and Segmentation

2. Template Matching And Authentication

Stage 1 consists of Extraction and Segmentation of images. Extraction locates the area of license plate from animage. Segmentation segments the each character from the license plate. Detailedexplanations of the stages are asbelow:

- Image Acquisition

The license plate has background of yellow color. So it is required to find the regions in the image which containthe intensity of three index i.e. R (Red) G (Green) B (Blue) corresponding to the yellow color. Then nearestvalues of the arena is calculated, considering arena as black. License plate is binarized on the basis of RGBindex.

- Preprocessing

Getting prop of image area and extreme points by tracing the exterior boundaries of objects and find the properties for each region of objects. Calculate the maximum area where license plate exits by coordinate based approach. Filters and morphology are apply to fill the gaps in image.

➢ Optical Character Recognition

If any RGB image left in cropped image then convert cropped image to grayscale. Based on threshold value gray image is converted to binary image and Black pixels are converted to white pixels and white pixels into blackpixels. Now the text color is white and background color is black.

➢ Character Segmentation

The characters are segmented in form of blocks by finding maximum area of each block using Sobel edge detection. Stage 2 consists of Template Matching and Authentication of extracted license plate. Template Matching recognizethe characters from the license plate and verify the license plate. Detailed stages are as below

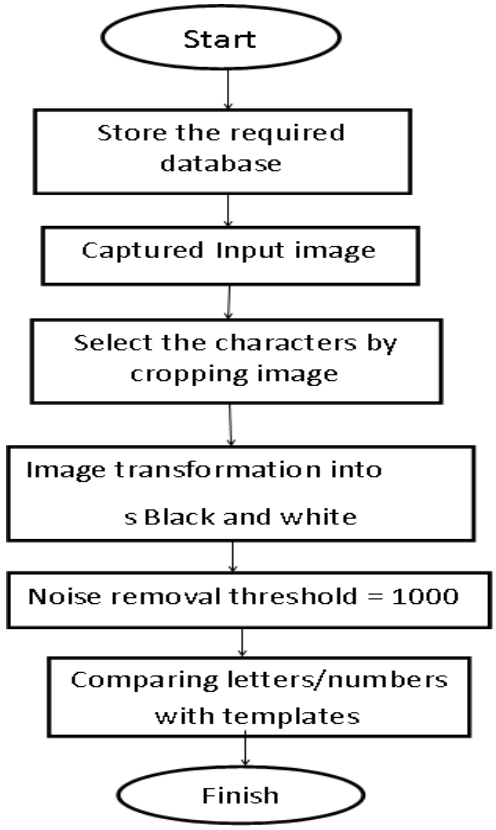
➢ Template Matching

Database of templates are created for alphanumeric text that load the database and compute the correlation between template and segmented blocks that they are match resize the letter of size of template. The output will be thenumber of license plate.

➢ License Plate Authentication

The number of license plate are matched from database if vehicle number is not found registered the electronic mail is send to the administrator with the image of license plate. The output is an image of license plate and vehicle and with message license plate is not found.

Flowchart for proposed algorithm:



➢ **Template Matching**

Database templates are created for alphanumeric text. Then load the database and then compute correlation between template and segmented blocks and if they match resize the letter of size of template. The output will be the number of license plate.

EDGE DETECTION

Edge detection is the method that the name of a set of mathematical methods that aim at identifying points in an image which are digitalized at which the image brightness changes sharply or more formally has discontinuities. The points which image brightness changes sharply is typically organized into set of curved line segments termed *edges*. The same problem of finding discontinuities in 1D signals is known as step detection and the problem of finding the signal discontinuities over the time is known as change detection. Edge detection is a fundamental tool that the image processing, machine vision and computer vision ,that are particularly in the areas of feature detection and feature extraction.

Purpose of edge detection:

The purpose of detecting sharp changes in image brightness is to capture important events and changes in properties of the world. It can be shown that under rather general assumptions for an image and the formation model are discontinuities in image brightness are likely to correspond to:

- discontinuities in depth,
- discontinuities in the area of surface orientation,
- changes in material properties and
- Variations in scene illumination.

In the ideal case, the result of applying an edge detector to an image may lead to a set of connected curves that indicate the boundaries of objects, the boundaries of surface markings the curves that are correspond to discontinuities in the area of the surface orientation. Thus, applying an edge detection algorithm to an image may significantly reduce the amount of data to be processed and may therefore filter out information that may be regarded as less relevant in while preserving the important structural properties of an image. If the edge detection step is successful and subsequent task of interpreting the information contents in the original image and therefore be substance simplified and however it is not always possible to obtain such ideal edges from real life images of moderate complexity.

Edges extracted from non-trivial images are often hampered by *fragmentation*. The meaning of the edge curves are not connected and the missing edge segments and the *false edges* are not corresponding to interesting phenomena in the image – thus complicating the subsequent task of interpreting the image data.

Edge detection is the functional steps in image processing, image analysis, image pattern recognition, and computer vision techniques.

Fig.6. Canny edge detection applied to a photograph

Canny edge detection

Edge detection is an effective preprocessing step in many computer vision algorithms that are within the project we implement one of the methods are Canny Edge Detector.

The Canny edge detector is a method for detecting edges that begins by smoothing an image by convolving it with a Gaussian given sigma value that are based on the smoothed image and derivatives in a both the x and y direction are computed; these in turn are used to compute the gradient magnitude of the image.

Once the gradient magnitude of the image has been computed, a process called 'non maximum suppression' is performed; in which pixels are suppressed if they do not constitute a local maximum.

The final step in the canny edge detector is the hysteresis operator in which pixels are marked as either these edges or non edges and in-between, that is done through threshold values. The next step is consider each of the pixels are in-between, and the connected to edge pixels these are marked as edge pixels as well.

The result of this edge detector that the binary image in which the white pixels closely approximate the true edges of the original image.

IMAGE EXTRACTION

When the input data to an algorithm is too large to be processed and it is suspected to be very

redundant (e.g. the same measurement in both feet and meters that are the repetitiveness of images that are presented as pixels) and then data as input will be transformed into a reduced representation set of features (also named features vector). The transforming input data into set of features are called *feature extraction*. Then if the features extracted are chosen carefully it is expected that the features set will extract the relevant information from the input data in order to perform the desired task using this reduced representation instead of the full size input.

IMAGE SEGMENTATION:

Image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, that are also called as super pixels). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation are mainly used to locate objects and boundaries (lines, curves, etc.) in images. Mostly the image segmentation is the process of assignment of a label to every pixel in an image such that pixels with the same label share certain characteristics.

The result of image segmentation is a set of segments that collectively cover the entire image or the set of contours are extracted from the image (see edge detection) and each of the pixels in a region are similar which are respect to some characteristic or computed property, like color and intensities or texture. Adjacent regions are significantly different with respect to the same characteristics are applied to a stack of images and typical in medical imaging to the resulting contours after image segmentation can be used to create 3D reconstructions with the help of interpolation algorithms like Marching cubes.

IMAGE RECOGNITION:

Image recognition is the process of identifying and detecting an object or a feature in a digital image or video and this concept used in various applications like systems for factory automation system, toll booth analyzing, and surveillance protection. Typical image recognition algorithms include:

- Optical character recognition
- Pattern and gradient matching
- Face recognition
- License plate matching
- Scene change detection

Detecting License Plate Using Texture and Color Information

License plate location, license plate is according to the characteristic, use regular method detection in vehicle license plate location in the image and determining its area and extract. License plate location can use has the following characteristics: (1) the edge features: license plate region contains more than one character. (2): main color feature license plate consists of 4 types: blue, white, yellow and black, white on black, black text on a white background; (3) geometry features: license plate is a rectangular in shape and size and its aspect ratio with a certain proportion; (4) other characteristics: such as license plate frame features and the statistical feature. The present license plate location method is mainly based on the first two features.

Literature [3] proposed a multiple color space to remove most of the background of the integration of rough localization method, and then through the block projection method for precise positioning license plate. But as the license plate color existence diversity the variety of color for the background and coarse positioning effect is small, and the block methods may make the license plate to be truncated.

CONCLUSION

The focus of this paper is on recognition of license plate number and authentication of the vehicle number. It helps police and military forces to locate whether license plate number is registered or not. This work proposes license plate extraction technique using optical character recognition precede by preprocessing and followed by canny edge detection in character segmentation. This increased the efficiency to recognize the license plate number. The proposed framework has some limitations also. It is implemented on static images of yellow color single line license plate. In future this methodology can be implemented on real time applications and multiline license plate.

REFERENCES

[1] Y. Qiu, M. Sun, and W. Zhou, "License Plate Extraction Based on Vertical Edge Detection and Mathematical Morphology," International Conference on Computational Intelligence and Software Engineering, pp. 1-5., 11-13 Dec. 2009.

[2] A. Ahmadyfard and V. Abolghasemi," Detecting License Plate Using Texture and Color Information," IST 2008, International Symposium on Telecommunications, pp. 804–808, 2008.

[3] G. Li, R. Yuan, Z. Yang, and X. Huang, "A Yellow License Plate Location Method Based on RGB Model of Color Image and Texture of Plate," Second Workshop on Digital Media and its Application in Museum & Heritages, pp. 42–46, 2007.

[4] X. Shi, W. Zhao, Y. Shen, and O. Gervasi, "Automatic License Plate Recognition System Based on Color Image Processing," Lecture Notes on Computer Science, Springer-Verlag, vol. 3483, pp.1159 -1168, 2005.

[5] M. Deriche, " GCC License Plates Detection and Recognition Using Morphological Filtering and Neural Networks," Int J. on Comp. Sci. and Info Security, IJCSIS, vol. 8, No. 8, pp. 263-269, Dec, 2010.

[6] O. Villegas, D. Balderrama, H. Domínguez and V. Sánchez, " License Plate Recognition Using a Novel Fuzzy Multilayer Neural Network," International Journal of Computers", Issue 1,vol. 3, 2009.

[7] S.H. MohadesKasaei, S.M. MohadesKasaei and S.A. Monadjemi, "A Novel Morphological Method for Detection and Recognition of Vehicle License Plate," American Journal of Applied Science, vol.6 no.12, pp. 2066-2070, 2009.

[8] A. Theja, S. Jain, A. Aggarwal and V. Kandanvli, "License Plate Extraction Using Adaptive Threshold and Line Grouping," International Conference on Signal Processing Systems (ICSPS), vol.1, no., pp. 211-214, 5-7 July 2010.

[9] Nelson, C., and Babu,,K., " A License Plate Localization using Morphology and Recognition", IEEE India conference, pp.34-39, 2008.

[10] Dingyun, W., Lihong, Z., and Yingbo, L., "A New Algorithm for License Plate Recognition Based on Improved Edge Detection andMathematical Morphology", IEEE International Conference on Information Science and Engineering , pp.1724-1727, 2010.

[11] Xu, Z., and Zhu, H., "An Efficient Method of Locating Vehicle License Plate", IEEE International conference on Natural Computation ,vol.2, pp.180-183, 2007.

[12] Huang, Y., P., Lai, S. Y., and Chuang, W. P.," A Template-Based Model for License Plate Recognition ", IEEE International Conference onNetworking, Sensing & Control, pp.737-742, 2004.

[13] Naito, T., Tsukada, T., Yamada, K., Kozuka, K., and Yamamoto, S.," Robust License-Plate Recognition Method for Passing Vehicles underOutside Environment", IEEE transactions on vehicular technology, vol.49, 2000.

[14] Kanayama,K., Fujikawa, Y., Fujimoto, K., and Horino, M., "Development of Vehicle-License Number Recognition System Using Real-TimeImage Processing And its Application to Travel-Time Measurement", IEEE Veh. Tech. Conf., pp.798–804, 1991.

[15] Zhang, S., Zhang, M., and Ye, X., "Car Plate Character Extraction Under Complicated Environment," IEEE Int. Conf. Syst. Man Cybern.,vol..5, pp.4722–4726, 2004.