iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 3 **Issue:** IV **Month of publication:** April 2015

DOI:

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)

MATLAB Based Vehicle Number Plate Recognition

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Abstract: ***The ANPR (Automatic Number plate Recognition) system has gained much popularity in recent years. It is a technique aimed at the extraction and recognition of license plates using image processing techniques. With the development of this system it becomes easy to keep a record of vehicle license plates and use it whenever required. The system is implemented and simulated on MATLAB and performance is tested on real images. This type of system is widely used in Traffic control areas, tolling, parking area.etc. The results show that the algorithm successfully detects the Nigerian license plates of vehicles and can be implemented in various applications.***
Keywords: Automatic Number Plate Recognition, Image Processing Techniques, MATLAB, Vehicles, Nigerian license plates.

I. INTRODUCTION

With the increasing number of vehicle in today's world, Identification of the number plate from the vehicle became an important task, which demands intelligent solution.
Automatic number plate recognition (ANPR) is a system where car plate is recognized and identified automatically [1].
This process also helps to get the correct result compared to manually one. The process of working involves that as soon as the vehicle enters the secured area the system automatically captures the images and stores it.
In this research, extraction and reorganization of number plate from vehicles image has been done using Matlab. It is assumed that images of the vehicle have been captured from Digital Camera. Alphanumeric Characters on plate has been Extracted and recognized using template images of alphanumeric characters.
The algorithm constructed is to target field programmable gate array (FPGA) as its end product. First, the number plate area is detected using edging, and then the characters are identified using optical character recognition (OCR) with correlation approach. The algorithm is successfully constructed with sample of images correctly identified. If the vehicle matches the already stored information then it's allowed to pass the gate [2]. And if the vehicle is not recognized or if its marked in the blocked list then it's not allowed to cross the gate and further checking process are followed.

II. RELATED WORK

Automatic Number Plate Recognition (ANPR) is a technique employed in the recognition of license plates of vehicles. The objective is to design an efficient algorithm which will help in the identification of vehicles. ANPR has many uses ranging from automated Toll Plaza to security systems. The image processing technique may even be extended to robotics with the robot extracting the license plate. Different algorithms have been put forward but each has its own limitations. The goal is to design an efficient algorithm which has high efficiency. A camera first detects and captures the snap of the vehicle and then the algorithm searches for the license plate. The problem of automatic VNP recognition is being studied since the 90"s. The early approaches were based on characteristics of boundary lines.
Chittode J S et al. [3] proposed an algorithm which is applied on the car park systems to access parking services. Algorithm is based on morphological operations and area criteria test used for number plate recognition. Recognition of characters in number plate is done with optical character.
Peng H et al. [4] presented an algorithm for "Document Image Recognition". DIR find most matched template for input document image in a database. The algorithm is based on the global matching of CBP.
Chunyu C et al. [5] presented a methodology which is helpful in recognition of number plate. The methodology was implemented in Matlab. The character is recognized with the help of image pre-processing, edge extraction and segmentation of characters.

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Lekhana G.C et al. [6] developed a real time on-line license plate recognition system. LPR algorithm is composed of different steps which are image acquisition, character segmentation through fusion of spectral analysis, character recognition through support vector machines.

Paunwala C.N et al. [7] proposed a method which aims to identify ROI by allowing morphological processing and sequence of directional segmentation. The ROI contains the number plate from which characters are recognized. This method is tested on a database consisting of 750 images at different conditions.

Singh M et al. [8] presented an approach based on morphological opening and closing operations. The number plate is extracted by using this approach. After localization skew correction of number plate is done for effective segmentation of characters. The character extraction is done with the help of template matching.

Kranti S et al. [9] presented a "Feature based number plate localization "method for number plate recognition and extraction. This methodology mainly focuses on two methods i.e. edge detection method and window filtering method.

Ganapathy V et al. [10] proposed a methodology which is helpful in the number plate recognition for vehicles in Malaysia. The proposed methodology is the combination of morphological process and Hough transform. An experimental result shows accuracy of 95%.

Othman K et al. [11] used texture based approach which is based on edge information for the license plate localization and recognition. Segmentation of characters is done with the help of multi-layer perceptron neural network.

III. METHODOLOGY

The purpose of this paper was to build a real time application which recognizes license plates from cars at a gate, for example at the entrance of a parking area. The system, based on regular PC with video camera, catches video frames which include a visible car license plate and processes them. Once a license plate is detected, its digits are recognized, displayed on the User Interface or checked against a database. The strategy of the project is to design automatic system for opening a gate without mounting any signal transmitter on the car. Thus, the project is to investigate and construct an application whereby the system will recognize the Vehicle license plate at a gate entrance of the parking lot. The system will be based on a personal computer and software packages available, MATLAB program and a digital camera, which help to capture the images of the vehicle license plate. We will conduct a research and developed a system that is able to extract the vehicle license plate. Next, we also need to create an algorithm to train and identify the vehicle license plate for the purpose of recognition. The general algorithm involves the following steps:

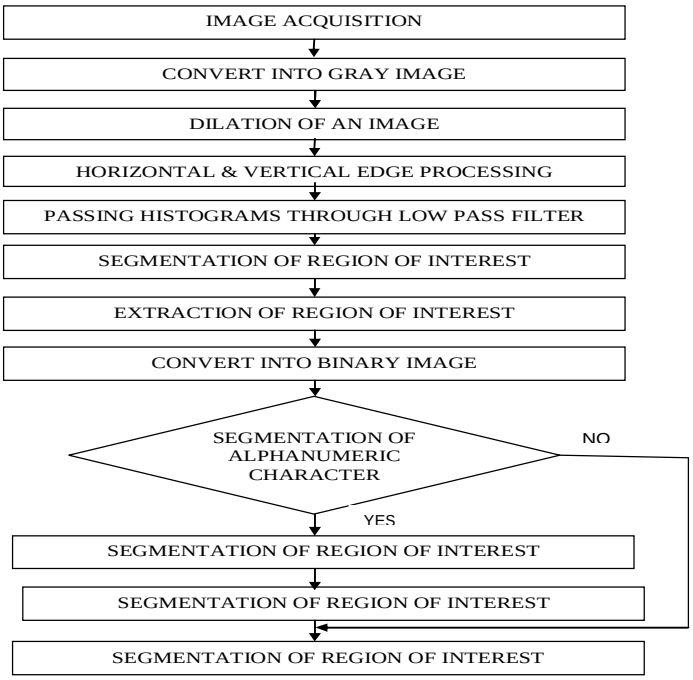


Figure 1: Flowchart

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A. Image Acquisition

In this step image is captured from digital camera. Image should be taken from fixed angle parallel to horizon. Vehicle should be stationary. Input image is shown in figure2.



Figure 2. Input Image

B. Convert into Gray image

This algorithm works on Gray level image, for pre- processing and identifying the required information. In this step coloured image is converted into the Gray scale image.

C. Dilation of an Image

In this step, image has been dilated. Dilation is a process for filling holes in an image, sharpen edges of an object maximize brightness and connect the broken lines. Dilation can remove unwanted noise from image.

D. Horizontal & Vertical edge processing

Horizontal and Vertical histogram denotes the column wise and row wise histograms. These histograms represent the row wise and column wise sum of difference of Gray scale values among neighbouring pixel values. Firstly, horizontal histogram is calculated by traversing each column then vertical histogram is calculated by traversing each row.

E. Passing histograms through low pass filter

Histogram values are passed through low pass filter because values of histogram between consecutive row and column changes drastically, to minimize loss of information smooth out changes. In this step histogram value is averaged out among both sides. This step is performed for both horizontal and vertical histograms. Filtering removes all the unwanted regions of an image.

F. Segmentation of Region of Interest

In this step all the regions which have probability of license plate has been identified and coordinates of such probable region has been stored. The following figure shows the segmented region.

G. Extraction of region of interest

From above segmented image, region with maximum histogram value is taken as the most probable region for number plate. Among all the regions, the region with highest horizontal and vertical histogram value is identified.

H. Convert into Binary Image

Image is converted into binary image from Gray scale. Intensity change value is calculated easily as compared to Gray scale and colour image.

I. Segmentation of alphanumeric character

Individual alphanumeric characters are segmented. Segmentation has been done by using smearing algorithms in both horizontal and vertical histogram. For filling space of inner part of each character the vertical smearing algorithm is applied and some

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Volume 3 Issue IV, April 2015
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

threshold value is determined. Similarly, horizontal smearing algorithm is applied. Each individual alphanumeric character is extracted by finding starting and ending points of character in horizontal direction.

J. Recognization of individual character

For Recognization of individual alphanumeric character, template based Recognization method is used. In template based algorithm, segmented image is compared with one image which is stored in database named as template image. In both images best matched similarity is compared. This similarity is matched with statistical method correlation. The image for which the correlation coefficient for template image is maximum that image is best matched.

These template images are shown in figure 3.

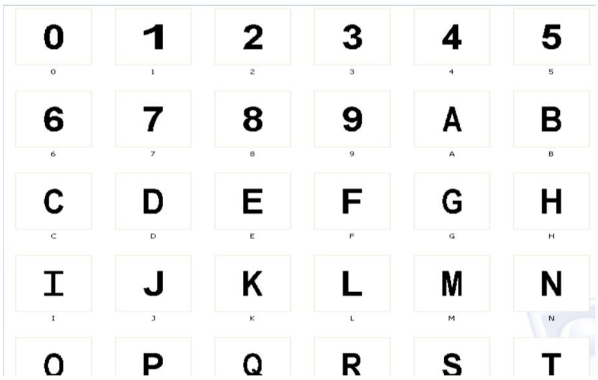


Figure 3. Template Images

K. Storing in file

After extracting, number plate is stored in file with complete information like characters on number plate and date on which it is extracted. This is shown in figure 4.

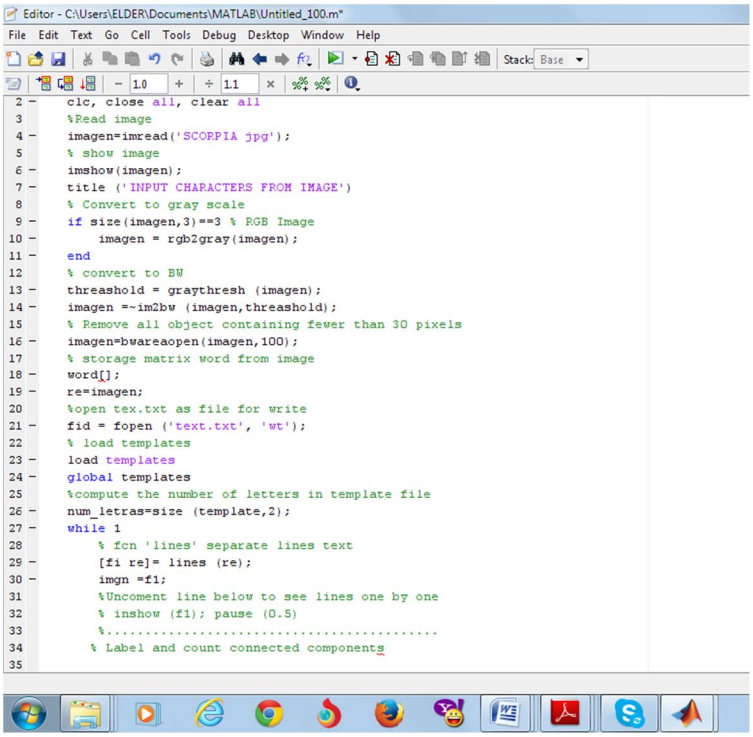


Figure 4: Storing in file

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Volume 3 Issue IV, April 2015
ISSN: 2321-9653
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IV. EXPERIMENTAL RESULTS

This section presents the simulation results of the developed ANPR system. Different images of cars having different colours and structure types are taken and stored in PC. The screenshot of the simulation is displayed below.



Figure5: The screenshot of the simulation

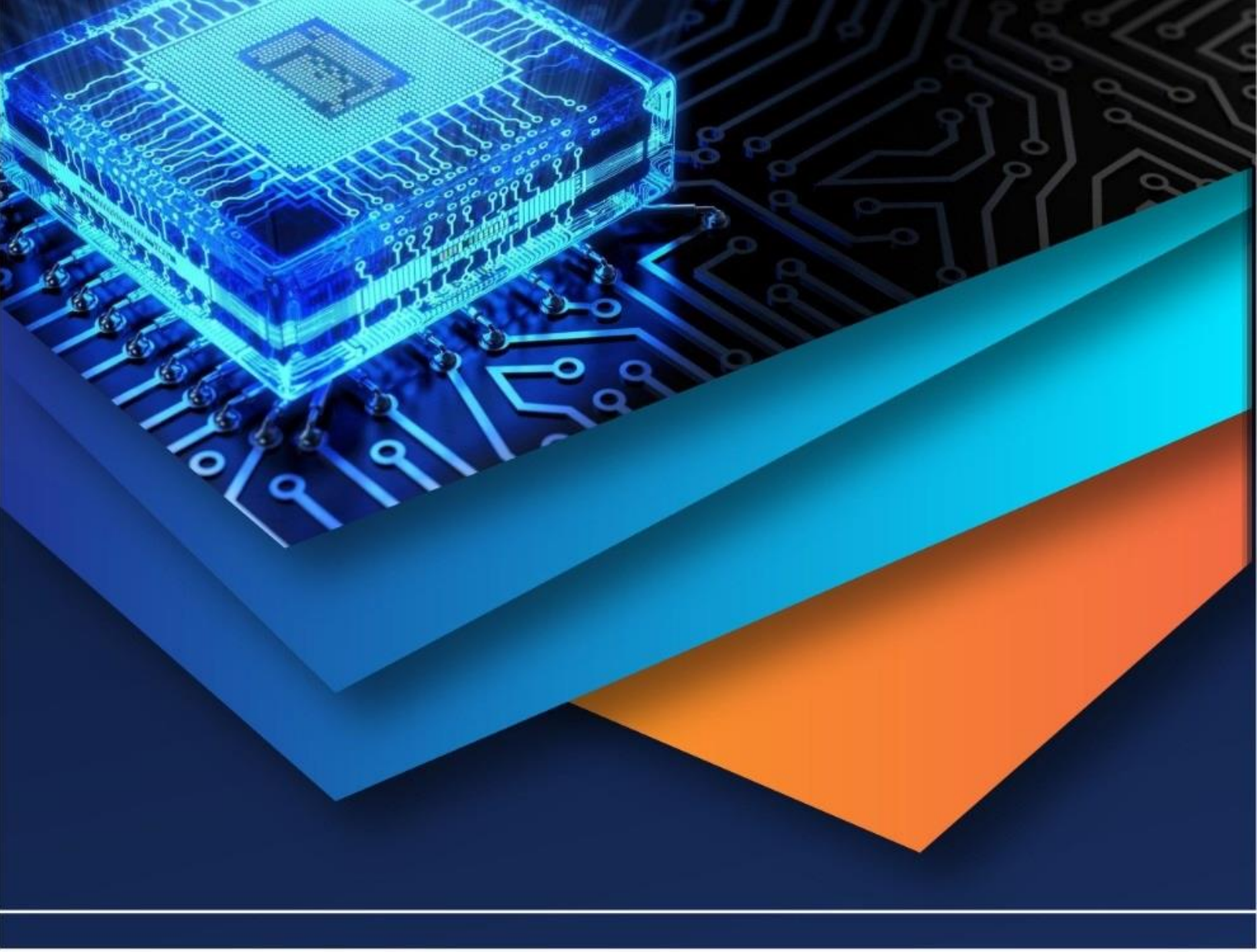
V. CONCLUSION

With number plates coming in various shapes, sizes, fonts and colours, the algorithms needs to be refined in order to increase its efficiency. We have implemented automatic number plate recognition. This system was developed based on digital images and can be easily applied to commercial car park systems for the use of documenting access of parking services, secure usage of parking houses and also to prevent car theft issues. The proposed algorithm is based on a combination of morphological operation with area criteria tests for number plate localization. Segmentation of the plate characters was achieved by the application of region props function in Matlab labelling and fill hole approach. The character recognition was accomplished with the aid of optical characters by the process of Template matching. Our algorithm successfully detects the number plate region from the image which consists of vehicle number & then character segmentation, recognition.

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