License Plate Recognition for Security Places

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Abstract

Automatic license plate recognition (ALPR) is one of the most important aspects of applying computer techniques towards intelligent transportation systems[1].Due to this reason, detecting the accurate location of a license plate from a vehicle image is considered to be the most crucial step of an ALPR system .

The purpose of this paper is to investigate a suitable way to recognize the registration plate from an image of Iraqi vehicle. The proposed algorithm recognizes the Arabic(Hindi) digits and words within the plate area .

The approach concerns stages of preprocessing, edge detection , filtering , detection of the plate's position, and word - number segmentation and recognition.

The algorithm succeed in images that includes abnormalities such as dust.

Mathlab 7.0 is used by the researcher to develop and simplify this system .

Keywords: License plate recognition, Image processing, Segmentation and Recognition, Input – output transport information systems.

تمييز لوحة تسجيل المركبات في المناطق الأمنية

المستخلص

إن نظام تمييز لوحة تسجيل المركبات هو أحد أهم الواجهات التطبيقية لتقنيات الحاسبات في مجال أنظمة النقل الذكية .نتيجة لذلك السبب كان الكشف عن الموقع الدقيق للوحة التسجيل من الصورة التي تحتوي على المركبة خطوة مهمة ودقيقة في نظام تمييز لوحة تسجيل المركبة الاوتوماتيكي .

ان الغرض من هذا البحث هو التقصي عن طريقة ملائمة وسهلة لتمييز لوحة التسجيل من صورة المركبة العراقية . الخوارزمية المقترحة تميز الكلمات والأرقام العربية الموجودة على لوحة التسجيل. البحث يركز على الخطوات التالية:

معالجة الصورة ، كشف الحافة الخاصة بلوحة التسجيل ، فلترة الصورة ، كشف موقع اللوحة ، تقطيع الكلمات والأرقام وثم تمييزها.

كانت نتائج الخوارزمية ناجحة مع الصور التي تحتوي على بعض الأتربة .

استخدمت لغة Mathlab الأصدار ٧.٠ لتطوير وتسهيل عمل هذا النظام .

1. Introduction:-

A quick technological development in the area of computer image processing and constantly increasing need for efficient and cheap security and steering systems resulted in the development of different kinds of solutions based of computer picture analysis. One type of these solution is automatic car identification systems basing on localization and recognition of the license plates shown in photos or camera picture[4].

License plate recognition systems can be applied in different situations. They can form the bases for automatic systems steering the access to protected areas i.e. parking, Access-Control, Tolling road, Border Control, Stolen cars, Traffic control, Marketing Tool, Travel, Airport Parking. According to practical use of these systems must fulfill specific demands [4].

There has been a number of software products that can be used for LPR mainly from USA and Europe[1]. J.R.Parker, P.Federl [5] used median filter for smoothing the gray-level image. They applied Shen-Castan edge detector and genetic algorithm to find the bounding box of license plate. They applied thresholding to obtain a binary image then binary erosion and dilation to separate the foreground regions from each other that is for recognition the character location. H.K,B.W[4] thresholded the binary image then a special filter applied to it . The results of them are white and black areas because of the contrast between the characters and the license plate background . They performed grouping and eliminating of objects in connected component analysis method. Then horizontal and vertical projection character localization and segmentation was performed. To perform character recognition and syntax analysis three-layer neural network was designed .G.Sharma [6] used an algorithm initially Binarization the image by thresholding then identifying and separating the connected components in the image. Then training the system to identifying characters / numerals by presenting a few representive elements to it. Then recognizing the new patterns presented to the system by comparing them to the properties of the patterns saved already .D.Dimov,V.S.[2] undersampled the image to about 120 columns using pixel decimation. They applied Roberts edge operator to detect the vertical edge . They used rank – filter to create a bright spot. To segmentation the plate candidate they applied vertical projection to decrease the random noise. M.EL-Adawi,H.K.,M.H.[1] used otsu's method to determine the threshold value. They applied thin edge detector (convolution kernel). Then Dilation the image in both direction. Then character segmentation by used vertical and horizontal projection. Then character identification by used training neural network.

2. Proposed VLP recognition algorithm

We made the following assumptions about the plates:-

1. The plates have a rectangular shape with two columns of characters - numbers.
2. The plate has dark character on a bright white background.
3. The width-height relationship of the license plate is approximately known.
4. The orientation of the plate is approximately aligned with vertical and horizontal.

The algorithm Binarization the image by using MATLAB's inbuilt function for calculating optimal threshold and then using the threshold to achieve binarization. The connected components were then identified by separating them into different images.

3. Pre-processing plate candidate identification

We have been working with color images captured by a digital camera with specific distance from vehicle (5meter) and transferred to computer memory. Our images consist of a rectangular array of x pixels. Fig. (1) shows a sample of such images.

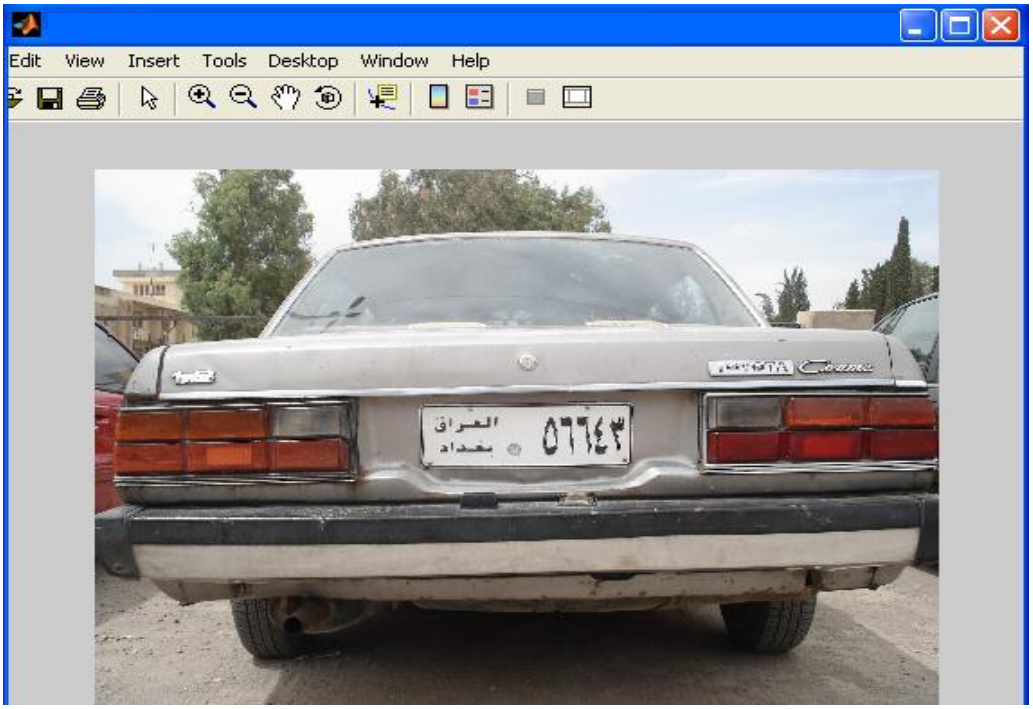

Figure (1): Car image with recognizable LP

3-1:Thresholding the input image

After turn the input color image to a grayscale, we compute a global threshold level that can be used to convert a gray image to a binary image. In a grayscale image, the thresolding transform sets each gray level that is less than or equal to chosen value T (the threshold value) to ∅ and each gray level greater than T to 1. The result is a black and white image with ∅ representing black and 1 representing white image. In our algorithm the threshold value is not constant, it depends on the average brightness of the image, as shown in fig. (2).

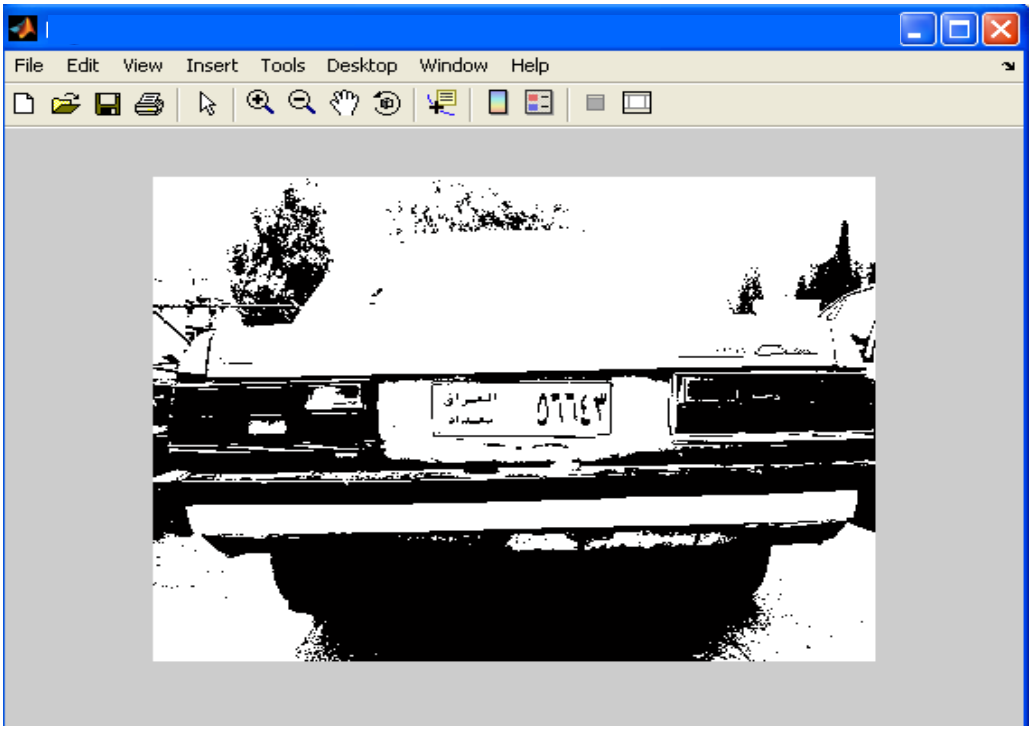

Figure (2): Thresholding image

3-2: Plate candidate segmentation

The purpose of this stage is to locate the plate that enclose the license number. The whole idea depends on the boundary of the license plate only because there are a hung data in the image. The algorithm tries to decrease the amount of data in the image and avoid unwanted areas to extract only the area which have the same properties of the license plates already. This is shown in fig. (3).

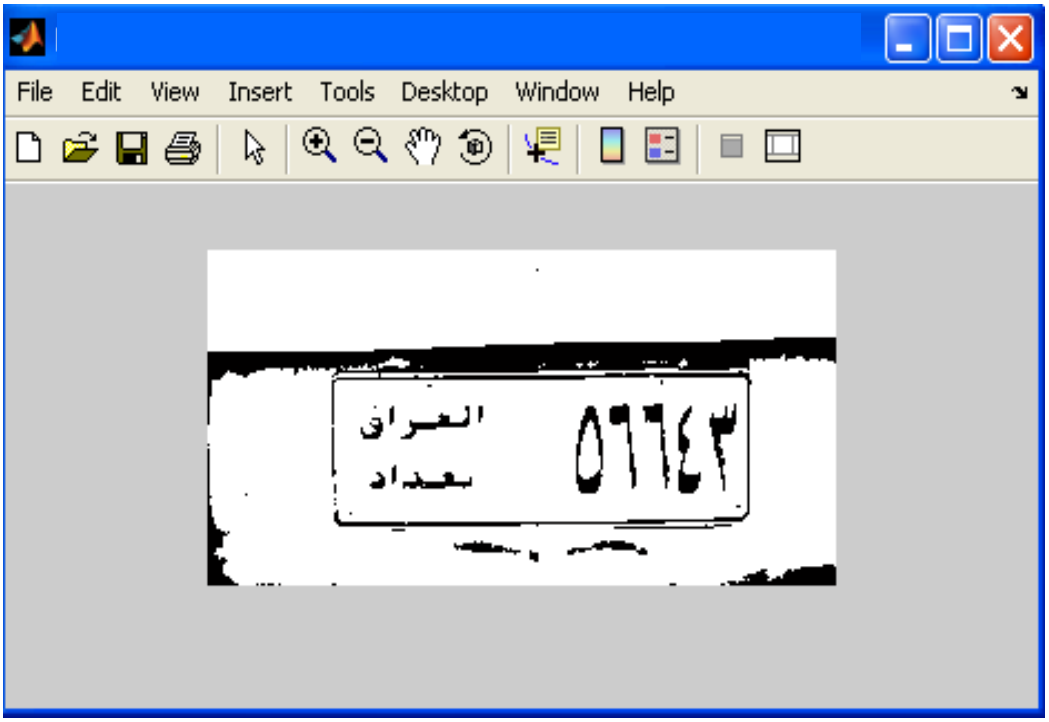

Figure (3): The Plate area segmented

4. Plate candidate verification

The extraction of license plate from the processed cutting image done by:

1. Searching about any column having the same length of the license plate (number of pixels) with the condition of that all pixels are white and the first pixel of the examined column is the same pixel of the row .
2. After finding the column in the previous step, we checked that the length of row (no. of pixels) is the same of license plate in addition of white color.
3. After verification these two previous steps we can extract the license plate from the cutting image, as shown in fig. (4).

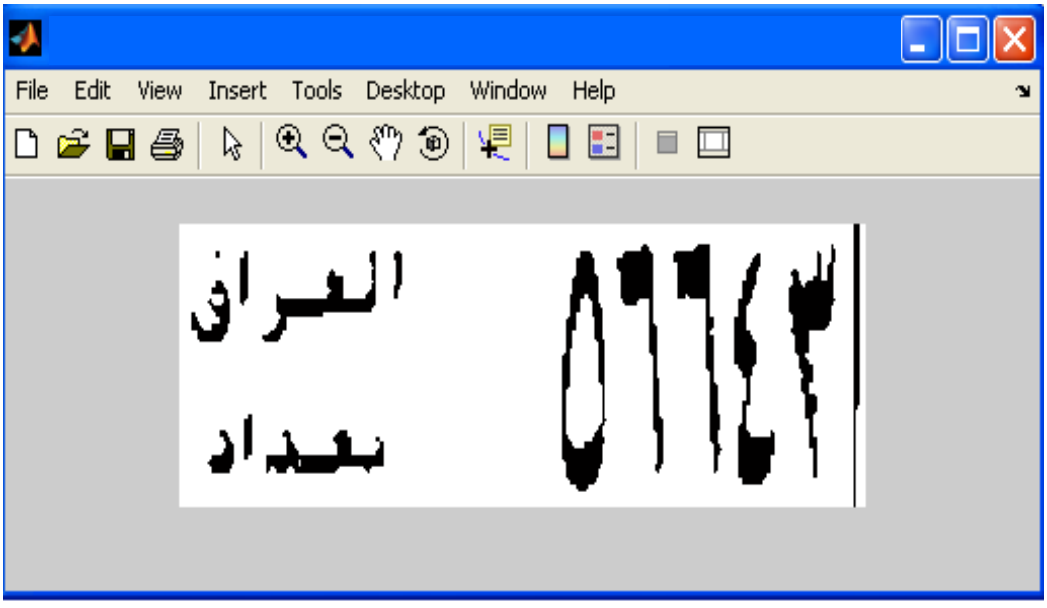

Figure (4): The extracted Plate

5. Sectioning plate (using vertical scanning)

After bounding the license plate in the previous step we done the following steps:

1. We divided the extracted plate into two parts, the left one records the number of the country and below of it is the name of state. The right one records the number of vehicle. This is done by searching (before or after the mid region of the plate) about any column have the same length(no. of pixels) of license plate and have the value 1 (white). So we can assigned the middle region of the plate which separate the number from characters.
2. The next work, for the right part of plate, is searching about the column that have the value ∅ (black) which is point to the beginning of the first digit. The value of this column is saved as variable (begin). Then we must search about the end of the digit, that is done by continued of vertical scanning until finding the column which all of its pixels are valued 1(white). This column is pointed to the end of digit. The value of this column is saved as variable (end).
3. After finding the begin and end of the digit we can sectioned this region from the number image and put it in certain variable.
4. We repeat the previous steps until finding the last digit of the number image (on the plate).

The obtained images of digits are illustrated in Fig. (5).

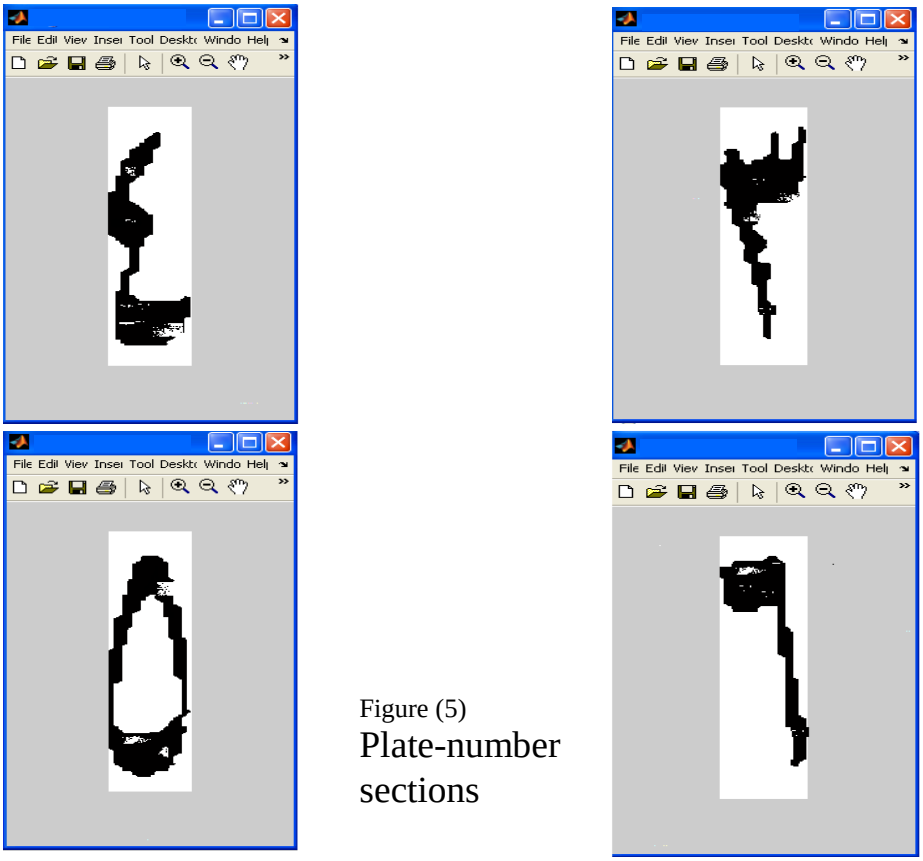

Figure (5)
Plate-number sections

6.Enhancement the extracted plate

After sectioning the number to digits we enhanced the image of every digit to obtain the clear one . This is done by searching about any white pixel that before and after it are black pixels. So we colored this white pixel (distorted one) with black,as shown in fig.(6) .

The scanning for distorted pixels is beginning for every digit image as follows:

1. from up to down
2. from down to up
3. from right to left
4. from left to right

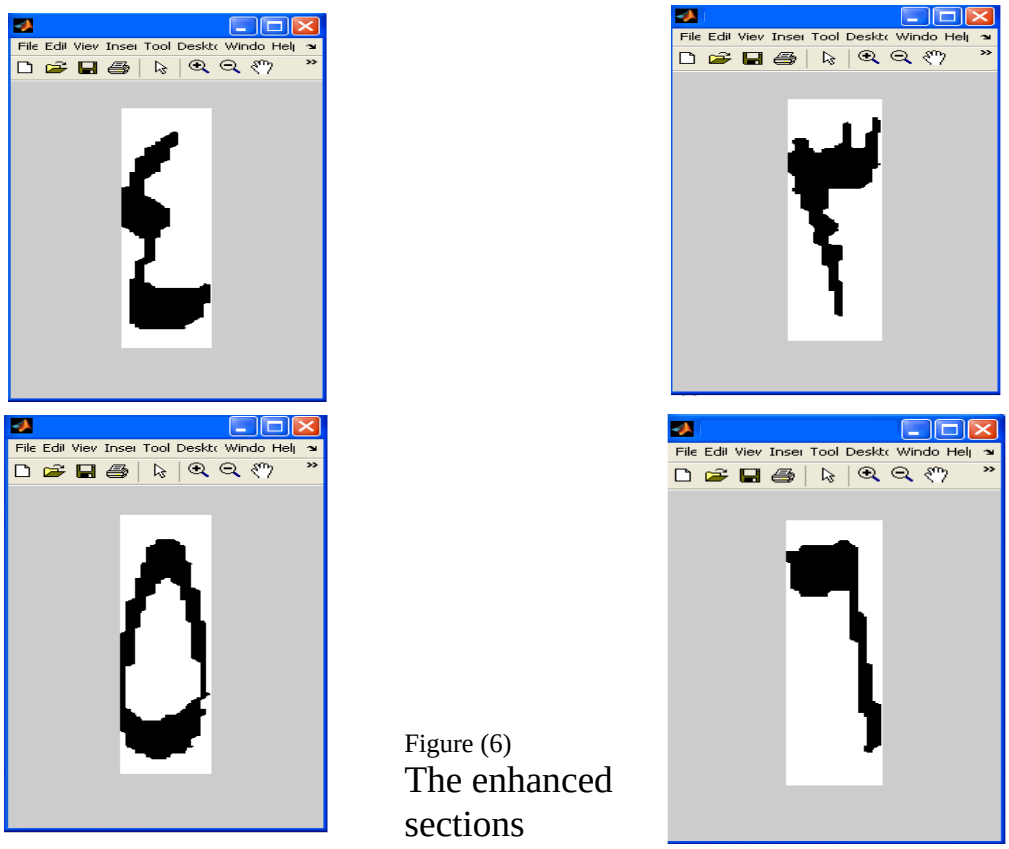

Figure (6)
The enhanced sections

7.Extraction properties of digits: -

To recognize the value of every digit. We specified the special region for every digit, as shown in fig. (7). If these special regions to be applicable to the sectioned digit, so we can know the value of every digit. The value of digit put as variable in storage then. We collected these digits to recognize the whole number for plate. As example, the digit 5 has three specific regions and the digit 6 has two specific regions, etc..

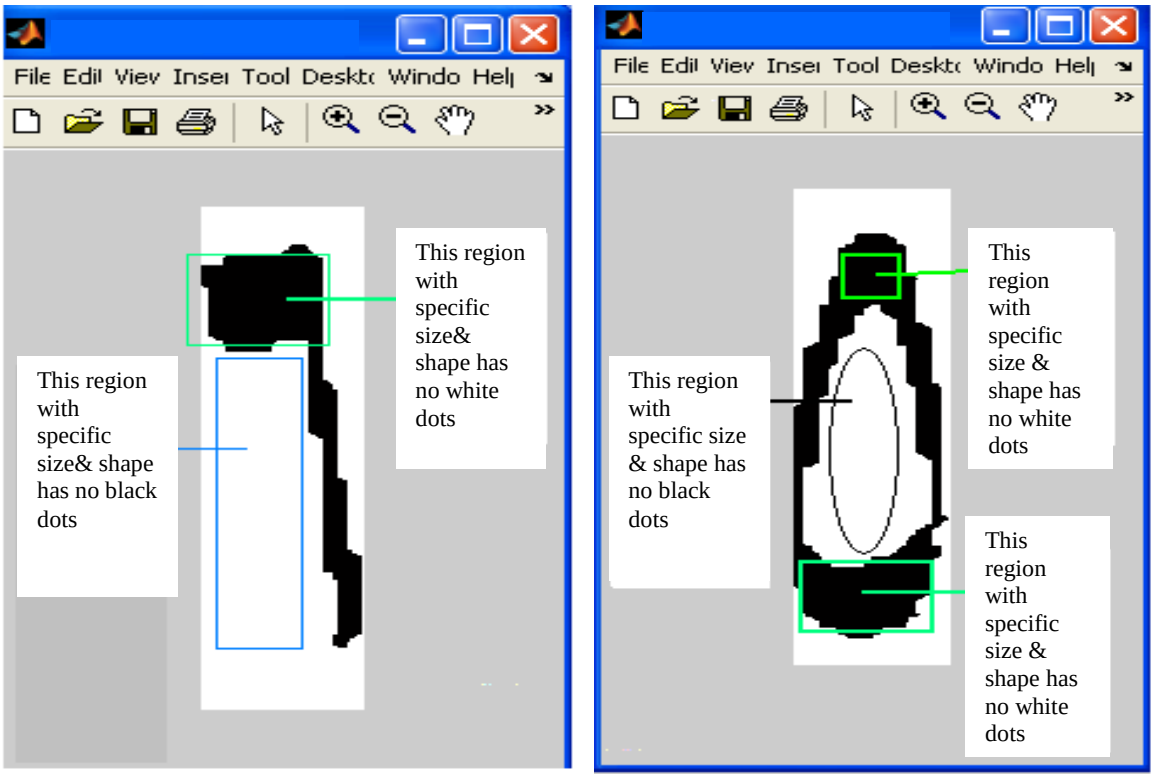

Figure (7): Some properties of digits

8. Recognition the state:-

We recognize the name of state on the plate by sectioned the word to many sections with special forms as shown in fig.(8) (circular, ellipse or rectangular form). As example, the state بغداد has three specific sections and the state نینوی has two specific sections , etc..

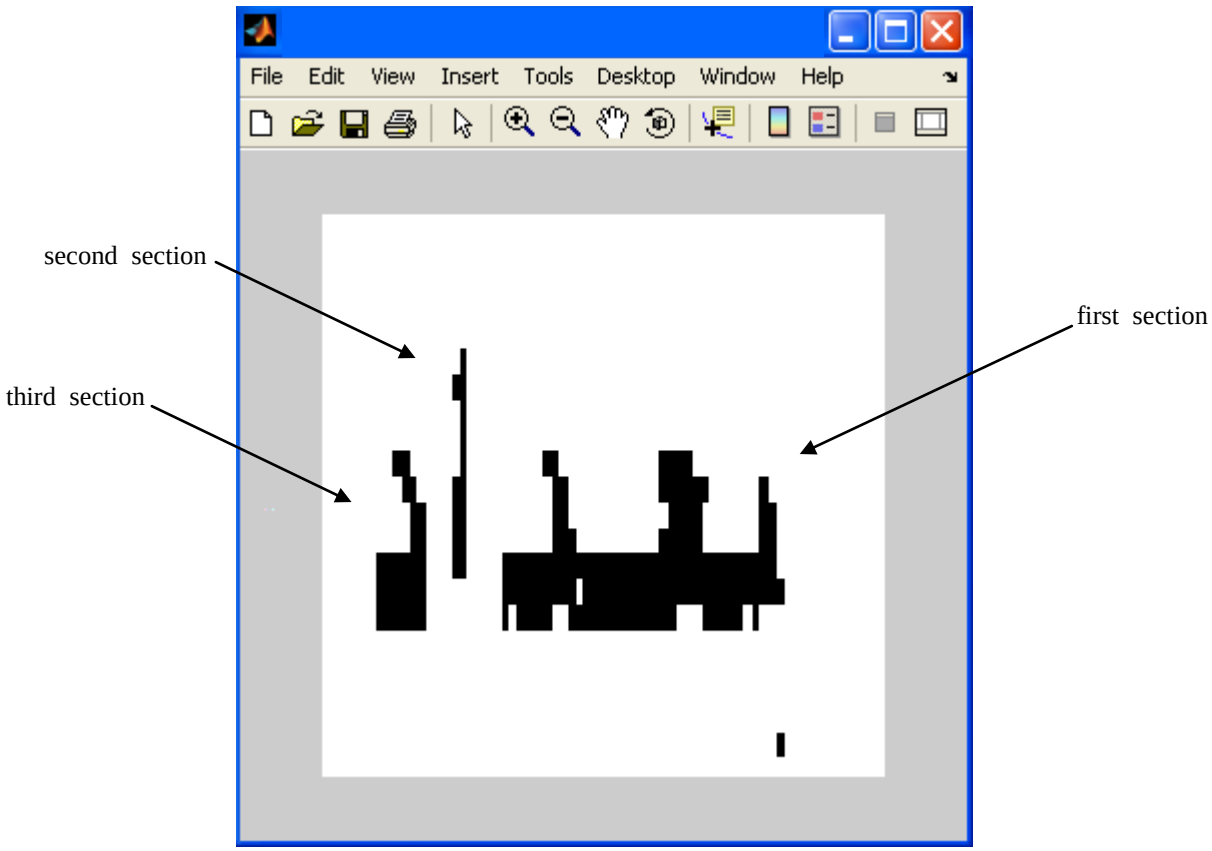

Figure (8): State- word sections

Experimental results:

The system was tested for images captured by digital camera . The recognition process was very good. The wrong identification came from the fixed screws on the plate that was recognized as zeros, and if the distance between the camera and car was larger than certain limit or major slant on the plate. If the background of the plate was not white the contrast of characters has been poor. There is possible of many problems in shadowed regions but we can solved by concentrate the illumination to the car region.

There are many methods deal with the English letters and Arabic numbers which are mainly different with the characteristics of the Arabic letters and Hindi numbers.

To evaluated effectiveness of the method proposed in this paper a few tests were performed:

1. Test of effectiveness of the connected component analysis method.
2. Test of effectiveness of the license plate localization process.
3. Test of effectiveness of the character segmentation and recognition processes.

Conclusion:

The goal of the research is to investigate the possibility to create a system for national vehicle identification based on the license plate recognition. In that no additional hardware such as transmitters mounted on the vehicle. The results obtained on real data are quite satisfactory. Only few images of poor quality (poor contrast and missing part of the plate) at temping more than three times. Finally the results could be obviously extended to other applications in Input-output transport system, ship, trains, etc. The algorithm will be extended to include different shape of plates with different registration.

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