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Detecting the License Plate and Segmentation by Using Digital Photos

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Abstract
Large number of traffic accidents and the difficulty of identifying whom are doing those irregularities such as skip the legal speed or skip the traffic signals and other irregularities and the difficulty of controlling the traffic, all these complex reasons make this research more important. In this research (digital image processing) concepts and pattern recognition concepts applied to building a system increase the efficiency of the traffic process and reduce the mistakes in the manual systems that are managed by human **.** It is possible to determine the system area from image acquisition stage by cameras until identifying the content of the plate. Where it pass from every initial operation for processing images to enhancement them then locate the plate then make image segmentation and extract basic symbols to identify them in the last stage. The result will be the vehicle plate. This research aims to identify the offending or stolen vehicles by security cameras. Provides help, saving in time and in effort for traffic police.
Keywords: Digital image processing, Pattern recognition, License plate, Plate Segmentation.

1. Introduction
Images are a display manner and record data visually. Formerly it carved on the rocks then painted on papers until arising computer and digital image concept. Digital images are representation for tow dimensional image on the computer by zero and one (0,1). Every digital image in the computer consist of pixels, it is smallest bit in the image. Every image is a matrix that content from rows and columns of pixels. Whenever the numbers of pixels are increased, the image will be clearer. It is not mean just insertion some decorations and drawings on images to appear in a different appearance from the original, digital image processing is exceeds that. In fact it hardly not care to this side of image processing, where the focus be on the digital encryption that appropriate for images and determine ways to process these digital data to be usable from machines which can be a computer or any robot or other machines. Digital image processing can used in different fields such as pattern recognition or objects. Also it used in medical field in the discovery of tumors by radiation images and industrial field and monitoring systems [1,2,3].

2. Related Works
2.1 Types of digital photos
2.1.1 Gray Scale Image
It represent the image matrix with two-dimensional (m*n) and it's element type is (double) located in the area [1,0], 0 is a black color and 1 is a white color, while the values that located between them represent the gray tones that Up to 256 degrees [4]. Figure 1 shows the gray scale image.

Figure 1. Gray Scale Image

2.1.2 True RGB Image

It is the image matrix that represented by three-dimensions (m*n*3) and it's element type is (double) located in the area [1,0], each pixel of the image resulting from the integration of the red, green and blue colors to represent the color of that pixel . Also for each color from these there is a two dimensional matrix (n*m). E.g. for the red color (0 represent black, 1 represent red), for the green color (0 represent black, 1 represent green), for the blue color (0 represent black, 1 represent blue) [5]. Figure 2 shows the true RGB image.

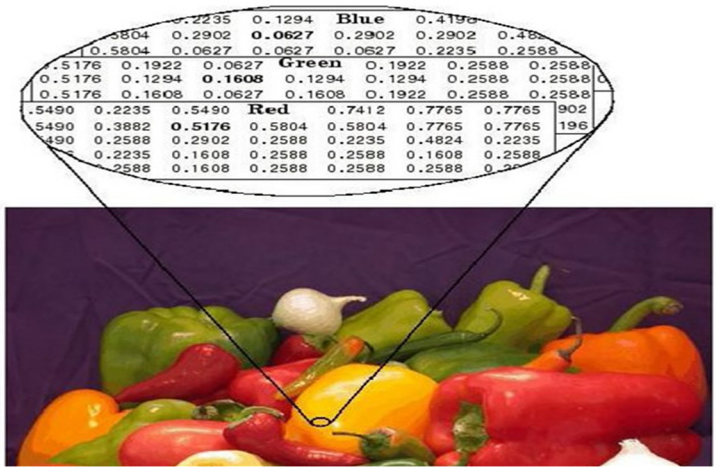

Figure 2. True RGB Image

2.1.3 Indexed Image

Indexed image is the image that represent by two matrix. The first is called index matrix and it is two-dimensional (m*n). The second is called colors map also it is two-dimensional (m*3) and it contains all colors in the image. (m) is colors number and the three column contain the degrees of three colors red, blue, green. Index matrix containing the image pixels, which refers to the matrix colors map. Each pixel carries a number refers to a particular row in the colors map matrix [6]. Figure 3 shows the indexed image.

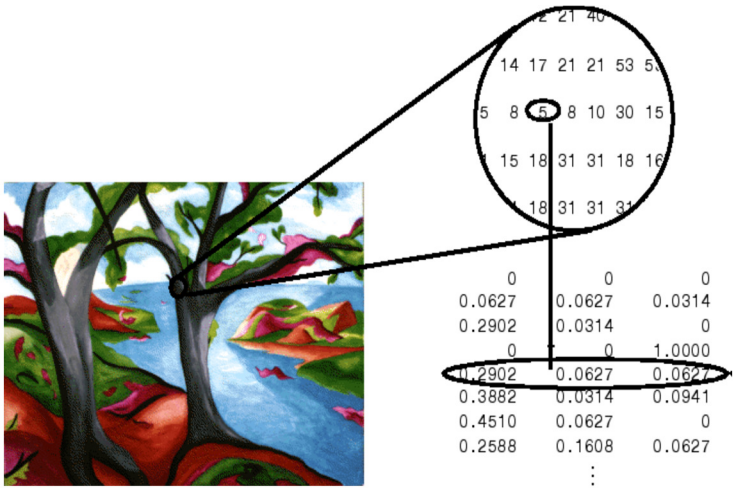

Figure 3. Indexed Image

2.1.4 Binary Image

It is the image that represented by two-dimensional matrix (m*n). Each pixel contains (0 or 1) Where 0 represents black color and 1 white color [7]. Figure 4 shows the binary image.

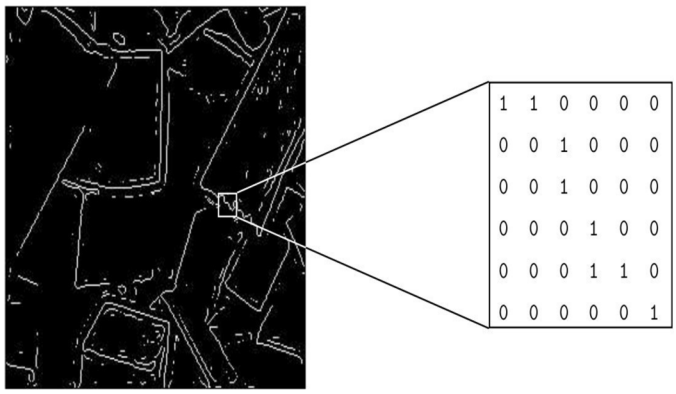

Figure 4. Binary Image

2.2 Image files type

There are many standards that distinguish image files from each other.

2.2.1 Compression

Some image files type compress data and this compression has many type, some of them are keep data while the others affects on data but insure greater compression average.

2.2.2 Size

The image size varies depending on the file type.

2.2.3 Number of colors

Some flexible formulations accept multi-color formulations (real colors) and others only accept specific pattern.

2.2.4 Tagged image file format (TIFF)

This is more flexible format where algorithm details under this file are often lossless so the image size will be very big even it considered the largest among all types ,also it can be set as (compress with loss or compress with lossless).

2.2.5 Portable Network Graphics (PNG)

This type also saves the image lossless. This formula discovered to display images through the web site. It used to deal with transparent parts lossless images which size is up to 24 bit.

2.2.6 Bit Map (BTM)

It is one of the early formulas, which was the basic formula in (windows XP). This format is not compressed and the accuracy of the number of colors can be controlled thus determination the file size.

2.2.7 Joint Photographic Experts Group (JPEG)

It is the optimum formula for photographic images and multi-color images. Digital images are captured by them and allows to storing the largest amount of images in the memory. In addition, it commonly used in World Wide Web and it balancing between image compressing and quality where achieve high compression ratio with keeping image quality.

2.2.8 Graphic Interchange Format (GIF)

This format used to display the image from its source directly such as images displayed on the internet. It creates a plate of 256 color from 16 million. If the image contains less than 256 color, it will be as it is. However, if it contain more, the algorithm will create image of 256 color and this type considered lossy.

2.3 Digital Images Format

2.3.1 *Double*

Represent the pixel value in real number. The pixel values for image matrix with gradients, indexed images, red green blue color images(RGB) and gray scale images are ranging between 0 and 1 as for binary images it be 0 or 1 .

2.3.2*Unit 8*

Represent the pixel value in an integer image consist of 8 binary bit. The pixel values for image matrix with gray scale images, indexed images and red green blue color images (RGB) are ranging between 0 and 255 but the binary images it be 0 or 1.

2.3.3 *Unit 16*

Represent the pixel value in an integer image consist of 16 binary bit. The pixel values for image matrix with gray scale images, indexed images and red green blue color images (RGB) are ranging between 0 and 65535 and this

type do not support binary images and color images.

3. Proposed work

Tracking moving objects to measure movement parameters and obtain a visual record for the moving object is an important area in digital image processing application. There are two way to tracking objects:
1- Recognition-based tracking:-
In this type, the system will identify the moving object in sequential images. This tracking is done by identifying the location of the moving object in each image [8].
2- - Motion based tracking:-
This type is used in systems that tracks goals particularity. When an object is interred to the cameras domain, the system will get an image for that object automatically without human intervention [8].

4. Research result

4.1 Overall workbench

The system aims to identify the plate of car after capturing an image for the plate and then process the image to the extraction the properties and characteristics of the image and then segmentation the plate to extraction the letters and numbers and then compare them with letters and numbers stored in the program (Template). If found a match, the program will bring the value of the letter or number until the end of the components of the plate. In this part, the succession system and the system stages will be illustrated [9].
The system going through four stages:-
The first stage is improving image by eliminate all noises in the image to minimize details that dealing with in following stages. The second stage is determination the plate location this will done by three steps:
First, extracting the edges in the image.
Second, attach the edges to each other.
Third, locate the plate.
In the third stage the plate will dividing and extract the parts, which content symbols to be identified and send it to the last stage.
The fourth stage is identifying symbols. Figure 5 shows the Overall Workbench for the Proposed.

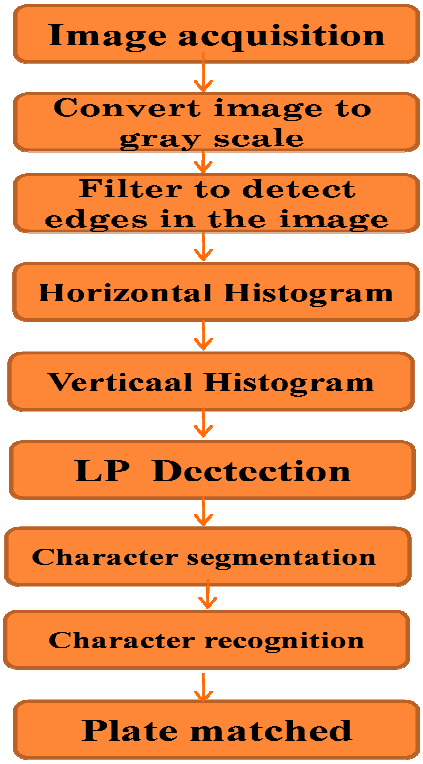

Figure 5. Overall Workbench for the Proposed

In this project, the proposed system will be illustrated and it is going through four stages:-
1-(Image Enhancement):- get ridding of noise from existing image.
2- Located the plate, consists of two steps.
- Extracted edges in the image.

- Features-based detection.

3- (Plate Segmentation):- divided plate and extract the parts that are not have symbols to be identified and send it to the last stage.

4- Identify the contents of the plate (Character Recognition)-:

Enhancement phase

Histogram equalization.

Segmentation phase: - Divide image.

Recognition phase: - Template matching.

Figure 6 shows the flow chart of localization in Matlab

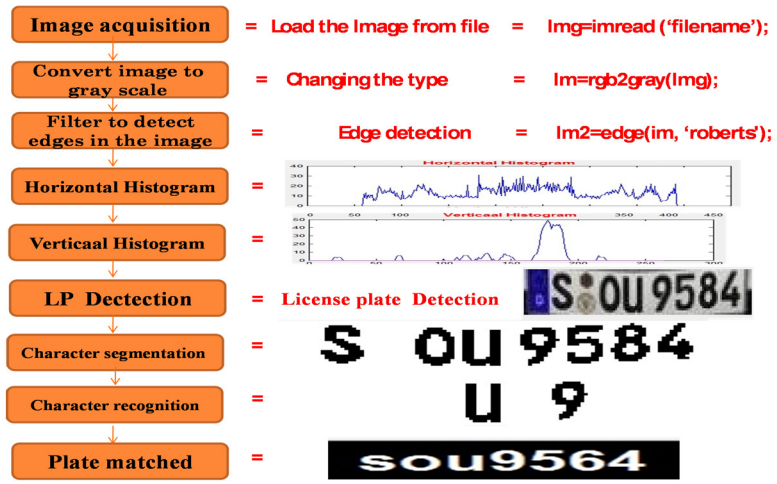

Figure 6. Flow Chart of Localization in Matlab

4.2 Experimental result

1-(Image Enhancement)

It is natural that images which are input to the system be a few quality even the accuracy of used cameras was good increased such as rain or a reflection of the sun, these factors is reduced the image quality , and at this stage improving image will be illustrated. These are examples of improvement:

- Noise Removal.
- Get rid of the details, which are not useful.
- Reduce the details that are resulted from finding the edges of the image.

In the beginning the image is converted from a colored image to image with grey gradation, and then applied the filter to the image to get rid of details that may cause an impediment in the next stage (identify edges).

2- Locating plate.

Consist of two steps:

A- Extracted edges by (Prewitt Edge Detection)

It is a filter used to determine the edges in the image. The edges are the transformation from a degree of a color to another degree in image. This done by scan the image horizontally and vertically using a filter for each coordinate. After the scanning done, the final image is produced, and the result be a binary image with white color edges [10,11]. Figure 7 shows the Prewitt Edge Detection.

1 1 1
0 0 0 Horizontal filter
1 1 1

1 0 1
1 0 1 Vertical filter
1 0 1

Figure 7. Prewitt Edge Detection

B- Located the plate
(Depends on Features-Based Detection)
Each object has the possibility to be a plate location, so these objects are filtered at this stage depending on their characteristics by two steps:
In the first step get rid of every object does not have the most important plate feature which the length of object is greater than the height. Every object that does not conform this requirement are disposed. In the second step each object are processed separately. Assuming each object that dealing with is a plate of the vehicle, and at the end of the operation if the number of objects within larger than 7 object (less number of symbols that the plate consist of is 7 characters) will be considered as a plate location [12]. Figure 8 shows the plate location.

Figure 8. Plate Site

3- (Plate Segmentation):-
At this stage the parts that need to identified it will kept to send them to the next stage which is the recognize stage. Number of plate, state code and number of office are cutting by using (imcrop) function. This operation done by giving it the coordinates of the location for each part. Figure 9 shows the plate segmentation process.

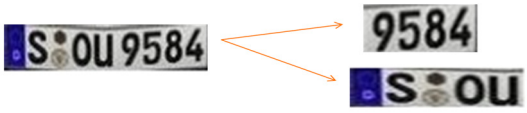

Figure 9. Plate Segmentation Process

4- (Character Recognition):-
A- Enhancement phase mean histogram equalization
It is one of ways of improvement imaged, usually used to increase the contrast of the image. Through this amendment, the intensity can be distributed better in the graph .This allows the area with little contrast to get a higher contrast. This method used to increase the visibility of letters and separated them as much as possible from the background [13]. Figure 10 shows the character recognition process.

Figure 10. Character Recognition Process

The Enhancement process is followed by other processes beginning from converts the image to binary image. The result, as in the following figure. Figure 11 shows the enhancement process.

Figure 11. Enhancement Process

B- Segmentation phase

After improving the entered image, each character will separated, this done by considering every object as a character [14]. Figure 12 shows the segmentation phase process.

Figure 12. Segmentation Phase Process

C- Recognition phase (template matching)

Store a set of templates or prototypes for each type or code the plate can afford it in the computer and in classification stage the comparison process for the (Input pattern) is done with (templates). Example if the result of the comparing with Class (A) is greater than the result of comparing with the Class (B), they will classified within Class (A) and so on. Figure 13 shows the template matching process

Figure 13. Template Matching Process

Figure 14 shows the detecting license plate in the Matlab Program

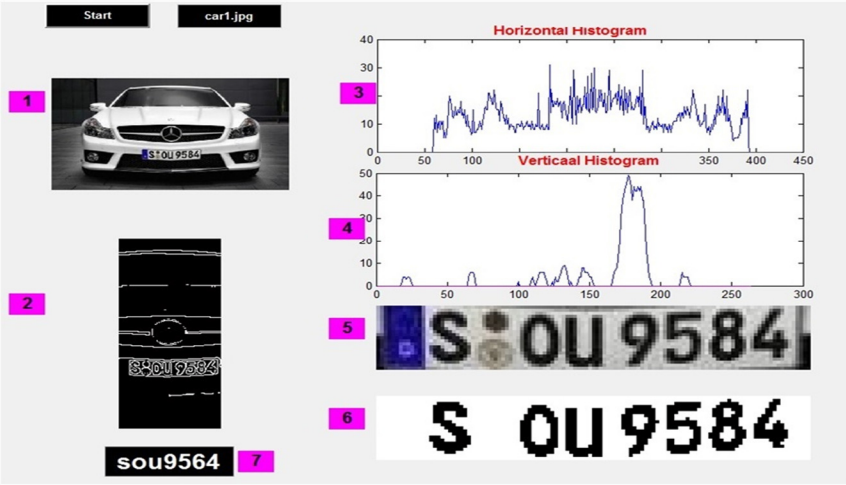

Figure 14. Detecting License Plate in the Matlab Program

5- Results

In this part the results in locate the plate and identifying the size of the plate will be illustrated.

5.1 plate location

Total images that got will making the system to locate the plate in all images with 100% present.

5.2 Identifying plate content

The percent that the system reach it was more than 85% .The table below illustrate the number of images which have been tested and results in each stage.

The system can extraction-identifying result in average time between 4-6 second if the device has the mentioned specification in the system hardware. The average time is reduced whenever the device specification increased that the system working on.

6- Conclusion

This system aims to identify the content of the plate in captured image but it will be developed more in future and these are some notes that can applicable on the system:

1. Apply such systems in reality.
2. Expand the system use domain such as control gates in institutions or entryway garages.
3. Link the system with the traffic database and using short message service (SMS) technology to inform the violator that commit the violation.
4. Develop a spatial system for vehicles that comes from other countries or if the system developed more, make it able to dealing with these vehicles' plate.

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