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Car Plate Recognition Using the Template Matching Method

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***Abstract*— One of the most important topics of intelligent transportation system (ITS) is the License Plate Recognition (LPR). LPR systems have many potential applications in intelligent traffic systems, such as the payment of parking fee, highway toll fee, traffic data collection, traffic monitoring systems, traffic law enforcement, security control of restricted areas and so on. Generally, LPR was developed to identify vehicles by the contents of their license plates. The LPR system consists of four major modules: image acquisition, license plate extraction, segmentation and recognition of individual characters. This paper presents a study of applying the template matching approach for character image recognition. The new approach can be applied equally to Egyptian and Saudi Arabian cases and can be extended to cover more countries. It is based on keeping the names of these countries along with a list of Arabic characters as entries in a table and then matching these entries one by one with the car plate. The new approach is tested on 400 samples of extracted license plate images captured in outdoor environment. The result yield 90% recognition accuracy, the method takes 1.6 seconds to perform the car plate recognition.**

***Index Terms*—license plate recognition, template matching, moving window.**

I. Introduction

License Plate Recognition (LPR) is one kind of intelligent transport systems and is of considerable interest because of its potential applications to areas such as highway electronic toll collection, traffic monitoring systems and so on. It can be considered as a logical complement for automatic radar and red-light running systems. Such systems are developed to identify vehicles by the contents of their license plates. The fundamental issues in number plate recognition are high accuracy and high recognition speed [1-5]. Due to the rapidly increase in number of vehicles across the world's big cities and one of them is Cairo, license plate recognition system has become one of the most important digital image processing systems to be used. The field of LPR and its application has attracted many researchers to search and develop systems which can process images and get useful information from them. Most previous researches and applications have faced some kind of poor performance due to the diversity of plate formats, the non uniform outdoor illumination conditions during image acquisition, noisy patterns connecting characters and poor edge enhancement. Accordingly, these researches and applications have in some way restricted their working conditions, such as limiting them to indoor scenes, stationary backgrounds, fixed illumination, fixed type of license plate, limited vehicle speeds and designated ranges of the distance between camera and vehicle. Several techniques have been developed to achieve this job. The artificial neural network method has shown good accuracy but long processing time and a need for periodical training for better accuracy. Template matching theorem has been used widely for recognizing the segmented characters and numbers. Template matching method has shown high accuracy but requires efficient searching method and needs a large storage to save all the numbers and character templates. Fuzzy logic technique has been used to recognize the plate's segmented elements showing high performance, accuracy and short processing time. However, it is sensitive to the noise and distortion. Generally, the LPR system consists of four modules: image acquisition, license plate extraction, segmentation and recognition of individual characters. The structure of such systems is shown in Fig.1.

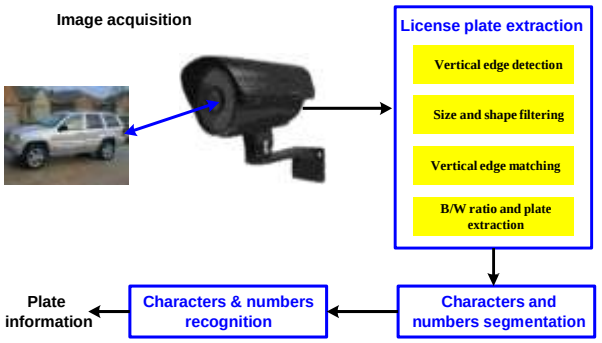

Fig.1 License plate recognition system

The image acquisition is the first phase in the LPR system where the image is acquired through digital camera, video camera or analog camera and scanner. The acquired image may be converted to a grayscale image to facilitate the extraction of the license plate. The first step of license plate extraction process is locating the plate within the car image. This step is achieved through four steps: vertical edge detection, size and shape filtering, vertical edge matching and B/W ratio and plate extraction. For the transformed grayscale image, its corresponding vertical edges are detected using Sobel or Prewitt edge detectors. Sobel edge detector shows better results. The threshold used by the edge detector is dynamic because the system takes an automatic value from the algorithm. The Sobel edge detector uses a 3×3 mask, which is applied on the input image to give the resultant edged image. It is observed that most of the vehicles usually have more horizontal lines than vertical lines. To reduce the complexity of the algorithm, the vertical edges are detected. If two of the vertical edges are detected correctly, the four

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