A Review of License Plate Localization Methods

Chanatip Chuenmanus
Defence Technology Institute
Nonthaburi, Thailand
chanatip.c@dti.or.th

Abstract—License Plate Recognition (LPR) is the process of locating and extracting the license plate information of the vehicle from captured images. This technology is widely used in various applications such as finding stolen vehicles, parking lot access control, toll payment, and traffic monitoring system. License Plate Localization is the first phase of license plate recognition to find the location of the license plate from the image. This phase is important for the accuracy of license plate recognition because the performance of the extracting process has depended on the accuracy of locating the license plate. In this paper, we have categorized existing methods of license plate localization based on the applied features. We review the methods in terms of techniques, pros, cons, and limitations. Trends for future development are given at the end.

Keywords—*Image processing, license plate recognition (LPR), license plate localization.*

I. INTRODUCTION

Intelligent Transport Systems (ITS) is very important nowadays that used technology for process data and communication to traffic management, transport and security on the road. License Plate Recognition (LPR) is an important part of Intelligent Transport Systems that use image processing techniques for locating and extracting the vehicle license plate information from still images or video. Benefits of LPR to help instead people that can work all time and collect large data. Moreover, it can also be connected to other systems, such as traffic lights control system. The importance role of license plate recognition for security awareness like finding stolen vehicles, monitoring of unauthorized vehicles entering private areas, law enforcement and speed limit enforcement. Moreover, for manage traffic like parking lot access control, toll payment, traffic monitoring system and border crossings.

The purpose of this paper is to provide researchers with a review of license plate localization methods according to the applied features, review them in terms of techniques, analyzing the pros and cons of these methods and limitations of the existing localization methods. Rest of this paper is organized as follows: after introduction, we describe difficulties of LPR and LPR process. Section III present methods of license plate localization by categorized. Finally, section IV provides conclusion and trends for future development.

II. BACKGROUND

Difficulties of license plate recognition is accuracy to locating and extracting license plate information base on two variations: 1) Environment (illumination, weather, background, angle between the camera and license plate, resolution of the image) 2) Plate (location, color, character size, different font, dirt on the plate) So there are many methods try to make it

$$Gx = \begin{bmatrix} -1 & 0 & +1 \\ -2 & 0 & +2 \\ -1 & 0 & +1 \end{bmatrix} \quad Gy = \begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ +1 & +2 & +1 \end{bmatrix}$$

Fig. 1. 3x3 Mask of Sobel Operator.

more accuracy which each method may be appropriate in the different situation. The accuracy of detection license plate and extraction license plate information is important to the efficacy of license plate recognition system.

The process of license plate recognition (LPR) consists of three phase: The first phase is the license plate localization to find the location of the license plate from the image base on some feature, such as the boundary, the color, or texture feature. The second phase is the character segmentation for separated each character of the license plate. The last phase is the optical character recognition (OCR) to recognize the extracted license plate characters are identified by template matching or using classifiers.

III. LICENSE PLATE LOCALIZATION METHODS

A. Edge Detection

Edge is points at which intensity changes from one point to another point. This method identifies the edges of the license plate because the boundary of the license plate is rectangle shape and they have the same aspect ratio. A common disadvantage of these methods is their sensitivity to complex backgrounds. In addition, these methods often fail if the plate appears rotated in the image. Low-resolution images are another issue for these methods as they lead to identifying many false edges.

1) Sobel Operator: This is one of the most useful methods in image processing for edge detector. This method is found the edge by uses two 3x3 mask which is convolved with the input image. One mask used for the horizontal changes (Gx) and one mask used for the vertical changes (Gy) show in Fig. 1. In [1], [2], [3], Sobel filter is used to detect edges. Due to the color transition between the license plate and the car body, the boundary of the license plate is represented by edges in the image. The edges are two horizontal lines when performing horizontal edge detection, two vertical lines when performing vertical edge detection, and a complete rectangle when performing both at the same time.

2) Laplacian Operator: Laplacian Operator is similar as the Sobel operator but the difference it is use one mask for both horizontal changes and vertical changes. Because the mask is approximating a second derivative of the image thus it is