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PROPOSAL

Automatic Vehicle Identification System using Indonesian License Plate

1. Introduction

License plates are used for identification of vehicles all over the nations so it is illegal for two vehicles to have the same license number. Vehicles are identify either manual or automatically. Automatic vehicle identification is an image processing technique of identify vehicles by their license plates. Automatic vehicle identification systems are used for the purpose of effective traffic control and security applications such as access control to restricted areas and tracking of wanted vehicles. Real –time automatic vehicle identification based on Digital Video Recorder (DVR) play a major role in maintaining law enforcement on roads [1][2]. Extraction of license plate from vehicle image and

classification of extracted features into different classes are difficult problem in Automatic Vehicle Identification System. The accuracy of the system depends mainly on the effectiveness of the extracted features and the pattern classifier. Many researchers have used different technique to extract or segment license plate character for different classifiers.

Automatic Vehicle Identification (AVI) has many applications in traffic systems (highway electronic toll collection, red light violation enforcement, border and customs checkpoints, police radar systems etc.). License Plate Recognition is an effective form of AVI systems. In this phase, a smart and approach algorithm is presented for vehicle's license plate recognition system. The proposed algorithm consists of three major parts: Extraction of plate region, segmentation of characters and recognition of plate characters. For extracting the plate region, edge detection algorithms and smearing algorithms are used. In segmentation part, smearing algorithms, filtering and some morphological algorithms are used. And finally statistical based template matching is used for recognition of plate characters. The performance of the proposed algorithm will be tested on offline mode images.

2. Problem Statement

A growing demand for traffic data concerning traffic flow and automatic vehicle identification, led researchers around the world to adopt advanced electronic and computer vision technologies to monitor and control traffic. Increasing levels of road traffic ask for real time analysis of a moving car in order to extract important data, in this case the vehicle registration number. Automatic vehicle license plate detection and recognition is a key technique in most of traffic related applications and is an active research topic in the image processing domain. Different methods, techniques and algorithms have been developed for license plate detection and recognitions. Due to the varying characteristics of the license plate from country to country like numbering system, colors , language of characters, style (font) and sizes of license plate, further research is still needed in this area. Therefore, this work targeted to develop and describes a system based on image processing technology to meet the increasing needs of efficient traffic management. System detects and recognizes a license plate of the car registered in Malaysia. It performs the recognition in almost offline or real-time, watching cars slowing down in front of video recording device. Beauty of the system lies in a fact that it is using very low cost devices to accomplish this task even in real time.

3. Objectives

To achieve the above stated, the following objectives are required

1- Data Collection of Input Vehicle Image
2- License Plate Area Location Module
3- The pre-processing phase consists of conventional techniques for enhancement in images.
4- Text and Number Recognition
5- Authentication

4. Related Works

Othman Khalifa el al [3] proposed Indonesian vehicle license plate recognition system, texture based edge information is used to locate license plate and segmentation of characters is performed by using connected component analysis. Multi-layer perceptron neural network is used to classify the characters. Also S. Hamidreza Kasaei el al [4] proposed Iranian car plate detection and recognition system. Car license plate is localized using morphology operation and template matching scheme is used to recognize the digit and character within the plate. Serkan Ozbay et al [5] proposed Automatic Vehicle Identification by plate recognition. Edge detection algorithms and smearing algorithm are used for extraction of plate region, filtering and morphological algorithm are used for character segmentation and recognition of plate characters is based on template matching. And Xinfan et al [6] proposed vehicle licenses plate character recognition based on

Chinese license characters. Neutral network is used to segment and recognize characters simultaneously.

Most of the previous vehicle license plate recognition systems perform classification of license plates based on segmented characters [3], [6], [7], [8]. The new approach presents in this work is different from the method presented in previous systems. In the proposed system, a new license plate feature extraction technique, training and classification algorithm based on HMM is presented. Features are extracted from license plate without segmentation of plate to individual characters notwithstanding the position, font of the numbers and characters. The extracted feature is the input observation of the HMM for effective modelling and recognition of license plate. HMMs have proven very effective in modelling both dynamic and static signals [9]. The application of HMMs in this work is motivated by its successes in speech, signature and character recognition [9] [11].

5. Proposed System

5.1 System Overview

The system is used to identify vehicles by their license plates and provides automatic detection of car license plates within real view camera scene. It uses a camera to take the image of the front of the vehicle, and then image processing algorithms are applied

to analyse the images and extract the plate information. Later on this data can be used for various applications. [5][6] Data can used for (1) Automated entry in parking against prepaid membership, (2) Road-toll calculation between check-in and check-out points, (3) Authentication while crossing countries boarders, (4) Stolen cars tracking by alarming the un-identified vehicles, (5) Detection of charged vehicles, and for various other purposes.

The main tasks of the proposed system are recognition of location of the license plate area in the image after capturing the image through ordinary video recording device, the segmentation of the characters and their identification[7][8]. These tasks are strongly inter-related, mainly because the way to check if the license plate has been correctly located is based on the result of the character identification process. For the location of the license plate area in the image, the method takes advantage of the "signature" of the license plate area in a horizontal and vertical cross-section of the image. The research is made to make low cost system, for that ordinary video recording device and image processing approach is used to deploy a system [1][2]. The working of proposed system is comprised of four modules corresponding to the four main computational phases as shown in the Figure 1, (1) License plate area location module, (2) Pre-processing module, (3) Text recognition module and (4) Authentication module.

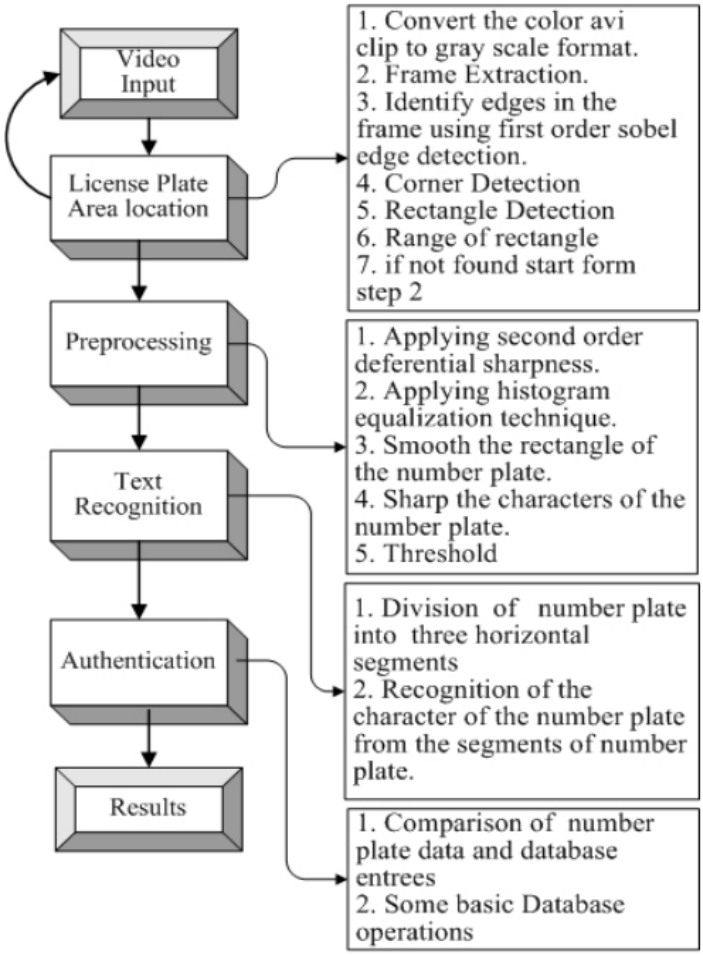

Figure 1: Block diagram

5.2 System Structure

Input Vehicle Image

The input data to the proposed system are moving vehicle images collected from surveillance cameras and a device are installed at Indonesian road or highways. The surveillance camera is synchronized with a device to record videos image of cars moving in roads. The captured still snapshots are then used as input into

the proposed system. Example of 24-bit colour bitmap input vehicle images to the proposed system is shown in Figure 2.

Figure 2 Samples of Input car Plates Images

Phase 1: License Plate Area Location Module

In this section a brief description of the Indonesian license plates is given and the technique to locate license plates in the given input video is also proposed. First of all the issue needed to be handle is when to start the camera to take the video, for this

purposes some sensors should be placed on road side at a forefront, that send signals to the system to “switch on” the camera for taking video as shown in Figure 3. The video of the car from the front is captured now we focus our discussion, to locate the plate from video clip being captured through video recording device. In order to achieve this task, we need the outer body line of the rectangle outline plate.

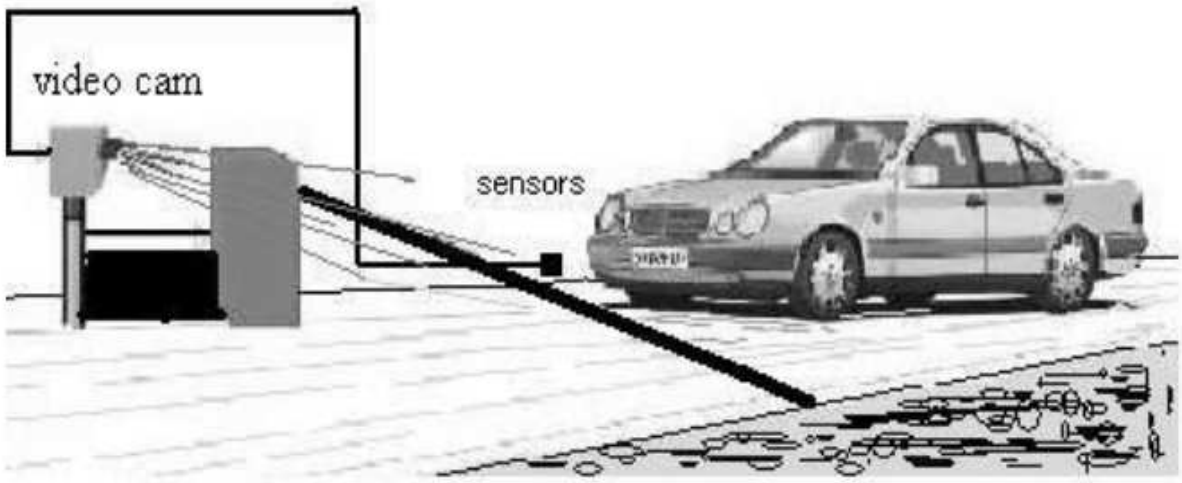

Figure 3 System to switch on the camera for taking video

To find out this rectangle outline that is basically a license plate boundary encompasses the license plate, some steps are needed to be performed on video being captured

Gray Scale Conversion: The video is converted to gray scale format [9], to get rid from difficulties of colours management.

Frame Extraction: The image processing will be performed on a single image that is why frames are extracted from the video. For efficiency of the system and to have some change in next frame every N^{th} frame of the video is taken for the processing. Then a particular frame is extracted and copied, that is used to perform image-processing operations to extract the required information.

E**dge Detection :**For the edge detection in the frames, first order (Sobel or Canny) edge detection filter will be investigated and applied on the each frame. It is applied in four directions; horizontal, vertical, diagonal edges at – 45 degree and diagonal edges at 45 degree. [9][11] [12]

Plate Corner Detection : The corners of the plate are detected through edges. In this concern an algorithm is designed for detection of license number plate in a frame. In order to find the corners in a frame some pre-processing is also required

Edge Linking: In practice this set of pixels seldom characterizes an edge completely because of noise; breaks in the edge form no uniform illumination, and other effects that introduce spurious intensity discontinuities. Thus edge detection algorithms typically are followed by linking procedures to assemble edge pixels into meaningful edges [9]

Segmentation: Through edge linking, we will determining different edges in image, the techniques that are used to find the objects of interest are usually referred to as segmentation techniques. [9] Our objects of interest are horizontal and vertical lines

Rectangle Detection: To achieve the rectangle detection, different calculations and algorithms are needed to be investigated and implemented

Phase 2: Pre-processing

The pre-processing phase consists of conventional techniques for example image filtering, improving the visibility of the image and some enhancement in image. Some of the basic filters are applied on the area of number plate that is Histogram Equalization, Median filter and Morphological filters to enhance the particular area for next phase 3

Phase 3: Text Recognition

This phase relates to the simple OCR (Optical Character Recognitions) operations [15][16][17]. The information is of different types on license plate and has different size, which creates some difficulties in text recognition

Phase 4 : Authentication

The authentication phase is the simple comparison of the values obtained from number plate and the values which are available in database tables. What kind of data should be stored in database, It all depends on the application for which the system is being used. For example if the system is deployed on the entrance gate of any organization then only the employs vehicle record is entered in database and whenever the vehicles arrive on gate the number plate data is collected through above mentioned phases and compared if the values are same then the gate is opened for the vehicle and if not the non-authentic vehicle massage is displayed, and the entry time is saved. So many algorithms such Artificial Neural Network (ANN) Model can be used for action and recognition. ANN is a probabilistic pattern matching technique that has ability to absorb both the variability and the similarity between image samples.

5.3 Conclusions

In this proposal an investigating approach is introduced that is very cost effective solution of license plate recognition. We focused on performance factor as well to make this system efficient. This system targeted to be capable to recognize the

license plates with in short time. The specialty of the system is the use of very low cost devices to achieve this critical and cumbersome task. Instead of using very costly cameras normally recommended by other such application, we used video recording device, easily available in market at very low cost that is capable to perform same task with same quality level. For the extraction of image of interest own designed algorithm is used that is very simple and able to perform the task of image extraction through simple steps that also enrich the performance factor of this system. This off line car recognition software has many applications in the market. It can be used for (1) automated entry in parking against prepaid membership, (2) Road-toll calculation between check I and check out points, (3) Authentication while crossing countries boarders, (4) Stolen cars tracking by alarming the un-identified vehicles, (5) Detection of charged vehicles as mentioned in section one.

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