IMPLEMENTATION OF OBJECT RECOGNITION BASED ON TYPE OF VEHICLE ENTERING MAIN GATE

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Bachelor of Electrical Engineering

July 2012

"I hereby declared that I have read through this report and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Control, Instrumentation and Automation)"

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This Report Is Submitted In Partial Fulfillment Of Requirements For The Degree of Bachelor In Electrical Engineering (Control, Instrumentation and Automation)

Faculty of Electrical Engineering

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"I declare that this report entitle "Implementation of Object Recognition Based on Type of Vehicle Entering Main Gate" is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree."

Signature : .....

Name : **ZALINA BINTI KAMIS**

Date : 25 JUNE 2012

I dedicated this report to my beloved father and mother

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ABSTRACT

This project related to develop and implementation of object recognition based on type of vehicle entering the main gate. This project seeks to facilitate the employment data of vehicles entering according to the types of vehicles. Data for the number of vehicles in accordance with the types recorded. In completing this project, there are two algorithms used, the detection algorithm and classification algorithm. Vehicles will be classified by comparison in terms of it front light area and will be stored in three types of vehicles; sedan, multipurpose van or van, and four wheel drive. Wireless camera are mounted with 1.6 metres high on the pipe rod at the guard house as input for the processing algorithm. Vehicle image will be captured by a wireless camera and then processed to identify its type. Data for the type of vehicle and number of vehicles by type is shown through the Graphical User Interface (GUI). Inflow and outflow of vehicles can be monitored via the control unit (GUI) without human monitoring at the entrance.

ABSTRAK

Projek ini adalah untuk membangunkan dan melaksanakan pengiktirafan objek berdasarkan jenis kenderaan yang masuk ke pintu pagar utama. Projek ini bertujuan untuk memudahkan pengambilan data masuk kenderaan mengikut jenis-jenisnya. Data bagi bilangan kenderaan mengikut jenis juga akan direkodkan. Bagi menyiapkan projek ini, terdapat dua algoritma yang digunakan, algoritma pengesanan dan algoritma klasifikasi. Kenderaan akan diklasifikasikan berdasarkan kepada perbandingan dari segi luas lampu depan dan akan disimpan di dalam tiga jenis kenderaan iaitu sedan, van pelbagai guna atau van, dan pacuan empat roda. Kamera tanpa wayar telah dipasang pada ketinggian 1.6 meter pada sebatang batang paip dan diletakkan di pondok pengawal sebagai input untuk algoritma pemprosesan. Imej kenderaan akan ditangkap oleh kamera tanpa wayar dan kemudian diproses untuk mengenal pasti jenis kenderaan. Data bagi jenis kenderaan dan bilangan kenderaan mengikut jenis yang ditunjukkan melalui "Graphical User Interface" (GUI). Aliran masuk kenderaan boleh dipantau melalui unit kawalan (GUI) tanpa perlu pemantauan penjaga di pintu masuk.

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CHAPTER 1

INTRODUCTION

Vehicle classification systems is important for traffic management. For example, automatic toll collection requires different types of vehicles to determine the different rates. Well be applied to traffic management, vehicle classification systems can also be applied to security systems for housing areas. Most of the current housing security systems are using the services of guard. Therefore, other than using the guard service, the system can be used discretion to replace the existing system.

1.1 Problem Statement

Continuous monitoring at the main entrance gate are very important to ensure the safety of housing areas is assured. However, most of the main gate monitoring system are controlled by humans. As for the more technology system used, such as the use of CCTV but it only can be recorded inflows vehicle without a clear idea of how much the total number of the incoming vehicles. Still requires the use of CCTV to record the data controller for vehicle entry. Guard on duty will have to guard consistently to avoid errors and to record data or overlooked in some vehicles. In addition, usually there are two main gate of a housing area. Thus, the data records are likely not the same between the two gates. Therefore, a system created to facilitate the acquisition and recording of data.

1.2 Objectives

The main objective of this project is to implement object recognition based on type of vehicles entering main gate. To make this project successful, some objectives had been listed down. These objectives must be achieved in order to complete this vehicle classification project. The objectives are as below:

1. To implement and develop the classification and detection algorithm.
2. To display data for type of vehicle by using Graphical User Interface (GUI) at the control unit room.
3. To integrate between hardware (wireless camera) and software (classification and detection algorithm).

1.3 Scopes

In an effort to achieve the goal of this project, some scope was outlined. The main scope of this project is to create a system that can implement the object recognition based on the types of vehicles. System can only identify the type of vehicles entering main gate with the number only. To identify the type of vehicle, classification algorithm must be develop by analyze image viewing. Image must be captured by using wireless camera and displayed on Graphical User Interface before classification algorithm execute. Classification and detection algorithms are designed using MATLAB programming. Vehicle type is determined using the comparative method. Vehicles will be compared in terms of it area of front light.

1.4 Expected Results

1.4.1 System can identify the type of vehicle through the comparison of the shape or size.

1.4.2 The number of vehicles in accordance with the types can also be recorded.

1.4.3 Data for type of vehicle will be diplayed through the GUI.

1.4.4 Data for the number of vehicles in accordance with the types will be displayed through the GUI.

CHAPTER 2

LITERATURE REVIEW

The complex nature and the large number of combinations of all features surrounding the vehicle makes the object detection and recognition are difficult. There are two types of sensor that are widely used including passive sensors such as video camera and actives sensors such as radar. Different types of sensors may be appropriate for different sensing tasks. As example an active sensor are depends on echoes from objects in the field of view. The most important factor is the reflectivity of the object. To detect the conductor such as metal, radar can detect it very well, however it has very poor performance on detecting dielectric such as wood and brick. By using radar, the relative speed and distance between the host vehicle and the preceding object can be determined directly in a single time interval.

Objects must be distinguished from the background in the image for the passive sensors such as video camera. It usually used pattern recognition in order to analyzing images and identifying objects. Detailed analysis of multiple continuous frames are required for determination of the distance and the closing speed of objects. Image analysis need to be conduct at the object level and not on pixel by pixel basis to detect and recognize the objects. Therefore, passive detection computational cost is higher than the active detection. However, there is advantage of using passive sensor, the objects in the field can be identified and the host vehicle can exactly know what is in the field view.

Vision-based detection has a problem in the identification of objects under strong sunlight, especially the glare of the sun. A shadow created by the intense light is difficult to be recognized by the vision-based sensors, because there is no clear boundary between objects and shadows. That is the lack of vision and needs based on complementary sensors

such as radar, laser or infrared sensors. Unfortunately, without a vision-based detection, active detection can meet the challenges in recognizing an object and its moving path.

Long-range detection tool are using vision-based detection. Short-range detection is enabled and the security threats object identified. To overcome the lack of vision-based recognition, short-range detection devices such as radar will be called. Compared with other detection approaches, the use of vision-based technologies are more suitable for detecting long-distance because the object can be identified. Detection of short range is to be activated when an imminent danger of being observed by long-range detection to confirm the information. Thus, this proves that the use of short-range sensor with a limited scope can obtain the relative distance and relative speed with respect to the target object.

In this section, the existing models that attempt to detect and recognize objects from image sequences will be discuss. Automatic object recognition from an image is very difficult and unreliable even though the identification of the surface boundaries or the detection of relevant features of the scene is quite natural to human driver. In recent years, there are various approaches have been proposed to perform this task. Koller et al. [1] was proposed a binocular sterepsis for vision based vehicle control. The vehicles that are occluded and asymmetrical can be detect by the binocular vision, but the computational cost is very expensive.

Graefe [2], was proposed a vision based recognition and tracking system named BVV3 for autonomous vehicle driving. The multiple parallel processors, a bus for interprocessor communications and a separate video bus for digital data transmission are includes in the system architecture. Image is continuously scan by an obstacle module to search for a feature that may represent the first sign of possible obstacle like another vehicle. Smaller vehicles like car are detected at a distances at about 350 m while for a larger objects like trucks are detected at very long distances up to 700m. Since the 2-D object models used, the system can reaches good performances in the object detection and tracking task, but yet presents some limitations in the recognition phase.

Sobel Edge detection is used to recognize the type of vehicle [3]. There are three main steps for vehicle classification. Sobel Edge detection used to create minimum

number of edges and bring it to a proper shape. Figure 2.0 below shows the designing steps of the vehicle classification algorithm. A series of thresholding in gray scale conversion is applied one after the other on the reference and the current image. Each of pixels of color sample presents the color by three 8-bit numbers. Filter is used to improve present noise on the generated image.

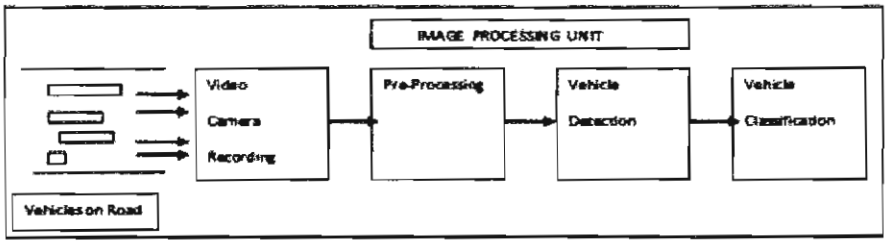

Figure 2.0: Designing Steps of the Algorithm.[Ishan Jain & Babita Rani, 2010]

A variety of grey scale image sequence taken from a moving vehicle is used in vision-based approach to detect and identify vehicles by taking into the parameters of their motion calculation and track vehicles [4]. Vision-based system consists of four models; object detection model, object recognition model, object information model and object track model. The features of the object are investigated in order to find the potential object in the object detection model. In recognition model, it consists of a neural network to recognize different vehicles. Next, the information model is used to analyze the relationship between the host vehicle and the object. To track multiple objects, a recursive method is used in the tracking model. Figure 2.1 below shows preprocessing, vehicle detection and classification algorithm.

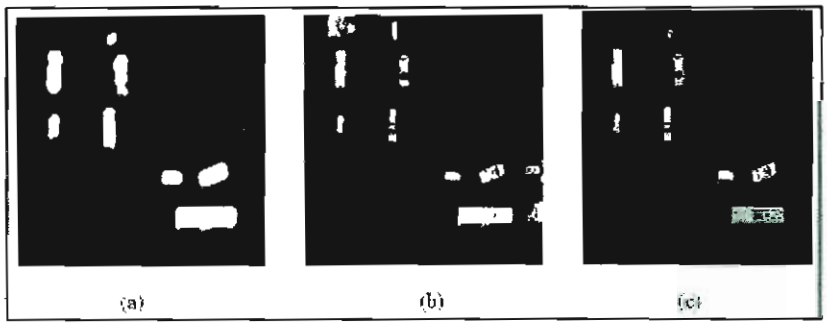

Figure 2.1: (a) Preprocessing. (b) Vehicle Detection Algorithm. (c) Vehicle Classification. [Ishan Jain & Babita Rani, 2010]

Since vehicles vehicles have different colors, rather than traditional methods which use motion features to detect vehicles, a new color transform model method is introduced [5]. A novel detection method is propose to detect vehicles from still images using colors and edges. It also make vehicle colors be more compact and sufficiently concentrated on a smaller area. It still owns very nice properties to describe objects even though the color of an object is quite different under different lighting conditions. Results for vehicle color detection both in original image and detection result are shown in Figure 2.2 below.

Figure 2.2: Result of Vehicle Color Detection. (a) Original Image. (b) Detection Result. [Luo-Wei Tsai, 2005]

In this paper, a vision-based approach to detect and recognize vehicles, calculate their motion parameters, and track multiple vehicles by using a sequence of gray-scale images taken from a moving vehicle are presents. Because the vehicle is the most common objects in the driving environment, so the emphasis is on the vehicle. Several features of a vehicle are investigated, which include symmetrical shape and aspect ratio of a vehicle in order to detect potential objects on the road. Recognition and tracking are accomplished by combining the analysis of single image frame with the analysis of consecutive image frames. In the analysis of single image frame, the system detects potential objects by using their shape features and recognizes the objects.

Daniel Marcus[12] was proposed a Car –Rec system. This Car-Rec is an approach to car recognition. It is use to creaye a real-time car recognition system by building on recent technological advances in object recognition with a strong recognition performance. A smart security camera is stationed at the entrance of an office bulding parking lot in order to illustrate the usefulness of a car-recognirion. It can be used for an employee car

database. Car-rec building consists of three stage; feature descriptor extraction, word quantization and structural matching.

Feature descriptor extraction is a Speed-Up Robust Features(SURF) that used to localize interest points in an image and the features as a vector of value can be described. Word quantization ia an effective converter that can converted high-demensional vectors to single value words. While Structural matching is the top results that returned from the image database search are scored using a structurtural verification algorithm. As a results, the top matches are returned as a ranked list.

CHAPTER 3

METHODOLOGY

For this project, to develop a vehicle classification method used is to use wireless cameras and image processing to process the data. Wireless camera is used because it is easy to install and affordable prices. In order to determine the vehicle type, size and shape data for different vehicles and recorded in advance.

There are several steps taken in order to completing this implementation object recognition based on types of vehicle entering main gate. Figure 3.0 below shows the overall flow chart in this project.

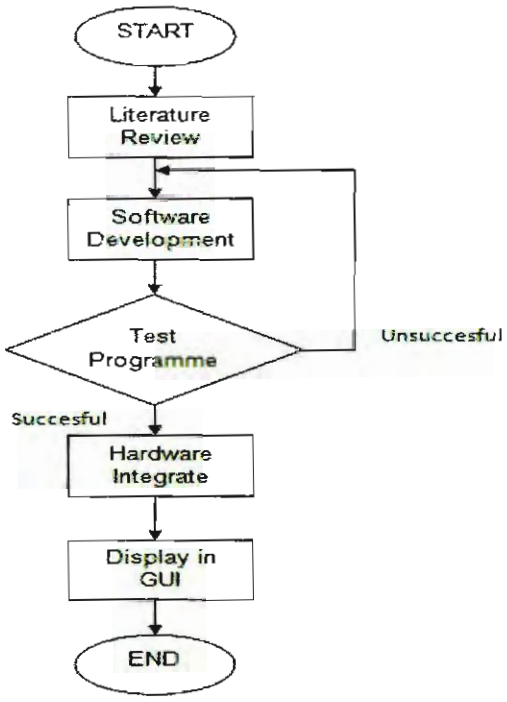

Figure 3.0: Overall Flow Chart

3.1 Flow chart Explanation

3.1.1 Literature Review

This is a report evaluating about the information obtained in the selected study area. This review will summarize, evaluate and explain this literature. It should provide a theoretical basis for research and help to determine the nature of this research. Through the literature review for this project, it can identify and assess the technical issues of the sorting system reliability.

3.1.2 Software Development

There are two algorithms used for this project; detection algorithms and classification algorithms. Detection algorithm is used to detect the presence of the vehicle and classification algorithms are used to determine and classify vehicles according to the type specified with the number of vehicles. Figure 3.1 shows detection algorithm flow chart and Figure 3.2 shows a flow chart of classification algorithm.