DEVELOPMENT OF ALGORITHMS FOR VEHICLE AND SPEED DETECTION BY MOBILIZE CAMERA USING IMAGE AND VIDEO PROCESSING

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"I hereby declare that this report is the result of my own work except for quotes as cited in the references"

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ABSTRACT

Nowaday, the road accidents contribute amongs the highest rate of the death in Malaysia. The main causes of accident are form careless of driver and drive in over speed limits. However, the existing camera speed detection is based on static camera which is high cost of operation. Therefore, this project proposed new algorithms to detect and measure the speed of vehicle based on mobile camera using image and video processing techniques. In this project, there two algorithms are developed, vehicle detection and speed detection. The data is collected by our own camera which record the real situation of road. This video footages are used in development of algorithm including test and evaluate the performance. The algorithm are developed in Matlab platform which image processing tool is utilized. Based on conducted experiments, the developed algorthms show the promising result

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ABSTRAK

Pada masa kini, kemalangan jalanraya menyumbang kepada kadar kematian yang tinggi di Malaysia. Punca utama kemalanagan jalanraya adalah akibat daripada kecuaian pemandu itu sendiri dan pemandu seringkali memandu melebihi had laju yang ditetapkan. Namun, kamera perangkap had laju sedia ada adalah beradasarkan kamera setempat yang menelan kos belanja yang tinggi. Oleh itu, fokus projek ini adalah untuk menghasilkan algoritma untuk mengesan dan mengenalpasti kelajuan kenderaan berdasarkan kamera yang di pasang di dalam kenderaan dengan menganalisis rakaman menggunakan teknik proses gambar dan video. Projek ini menghasilkan dua algoritma iaitu pengesanan kenderaan dan pengesanan kelajuan kenderaan. Data dikumpul dengan menggunakan kamera yang di pasang di dalam kenderaan yang merakam keadaan sebenar pemanduan di jalanaraya. Rakaman video yang di kumpul akan digunakan untuk menghasilkan algoritma dan menilai prestasi algoritma itu sendiri. Algoritma ini dihasilkan dengan menggunakan perisian Matlab di mana alat video proses digunakan. Berdasarkan eksperimen yang dijalankan penghasilan algoritma ini menunjukkan hasil yang di janjikan.

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LIST OF ABBREVATION

PSM	-	Projek Sarjana Muda
ANC	-	Adaptive Noise Cancellation
Ip	-	Previous Temporal Images
In	-	Next Temporal Images
Ic	-	Current Images
DetectionIdx	-	Detection Identification
TrackIdx	-	Track Identification

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CHAPTER I

INTRODUCTION

1.1 Project introduction

Nowadays, technology are wide developed, traffic analysis have gained a step up by providing a technology to capture whose violate the traffic law. Traffic control is an essential way to avoiding an accidental event and a smooth flow of traffic operation. Most of traffic light and certain road had been installed with CCTV and sensor operation to caught who violate the law but recently, a few cases about car accidental are shocking the community such as (Duke accidents), *it is said crash was victims faults claims by Myvi driver*. The incident occur and it hard to determine how the incidence happens. The approach of video processing should be implemented since nowadays many people installed camera while on-board and caught road rage issues, unethical driving and accidents. The video records can be used as an evidence to determine of any incidence

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occur while driving and the speed detection will be an important things on analysis of the evidence to determine the real incidence situation.

The latest technology which is being implemented in the traffic control is Automated Enforcement System (AES), it‘s capable to capture over limit speed image with high resolutions. The system consists of hardware and software application. The problem with this type of technology was static placement of the system. The system only manages to catch the offender that violates the law at certain place that were installed with the speed trap. In this project, the technology is developed beyond the traditional technology.

Vehicle detection and vehicle speed detection algorithms by mobilize camera are expected to be developed by using a conventional camera that can be place on the car while on-board. The algorithm is developed to be able the conventional camera to detect the vehicle and detect vehicle speed by mobilize camera by compliant certain parameter setup. This vehicle detection and vehicle speed detection by mobilize camera method can improve the enforcement of law by providing mobilize speed measurement. The algorithms analysed the vehicle detection and vehicle speed detection by deal with recording road traffic image using mobilize camera. The pre-processing should be able to detect the current object in the images, map the object or vehicle that enter and left the scene. The algorithm will be able to calculate other vehicle speed varies with current speed.

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1.2 Objective of study

The objectives of this project are:

i. To develop an algorithms for vehicle detection by mobilize camera using video processing

ii. To develop an algorithm to detect the speed of vehicle by mobilize camera using video processing.

1.3 Problem Statement

Recently, a few cases involve with road accidents are frightening to the road user. The Unethical attitude of certain driver is a challenging problem since there tend to speed up & contribute to an accident in the area that there is no speed trap camera installed. Other than that, most of the incidence involves others driver as a victim of that acted. Since that, nowadays more driver installing a camera on their vehicles for safety and evidence purpose in order to convict a driver that abuse the road law, an evidences is the main things that need to be proved. Sometimes incidence occurs on a place that no speed trap or camera installs and it hard to determine the real incidence. The analysis of the footage captured while vehicle on-board will helps to analyze and determine the real incidence occur.

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1.4 Scope of Project

The projects only focus on software algorithms development. The algorithm developed using MATLAB software that may provide excellent application with their powerful video processing toolbox. The algorithm developed are for daylight purpose and offline application only. The detection of vehicle is without classifying the type of vehicle. The GUI is designed to perform the functionality of the algorithms.

1.5 Organization of report

The report consists of 5 chapters organized as follow:

i. Chapter 1 discuss about the introduction of this project. It consists of background, objective, problem statement, scope and methodology.
ii. Chapter 2 contains literature review on past studies about vehicle detection, speed estimation and relevant information related to traffic analysis form the researches around the world.
iii. Chapter 3 will describe on the implementation of the project. What are the methods that will be used in every stage and how it work.
iv. Chapter 4 is about the progress result in this project and its discussion of findings.
v. Finally, Chapter 5 is the conclusion for final year project 2 that describe about the tasks that have been done during this project.

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CHAPTER II

LITERATURE REVIEW

This chapter will explain and discuss about the literature reading which is related to develop an algorithm to detect the vehicle and speed of vehicle on mobilize camera by using video processing and the implementation method that has been studied from different resources to perform this project.

2.1 Vehicle Detection Overview

Basically, vehicle detection algorithms can be gained by implementing the object detection algorithms which is the vehicle are the object of detection. The object detection can be separated to two methods which are by implementing static camera methods and mobilize camera. The difference between the two methods is the installation or the applications of the camera itself. The static camera usually installed or record on static place or the background of the image are not moving and can be refer as reference. The mobilize camera is slightly different from the static camera. The camera

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is installed on moving object or the background of the video record is also moving and difficult to gain the reference point.

According to Elham Kermani and Davud Asemani, [1], the goal of the motion detection system is to divide each image frame into moving and still segments. The algorithms proposed are involved the techniques of Bayesian change detection algorithm and adaptive noise cancellation. The Bayesian techniques focus on generating a mask of the frame that is consist of binary images. The gray scale images are converted first and find the change of the difference between two consecutive frames for a change of mask. Then, the adaptive noise cancellations are performed. It is a method to estimating corrupted signals by noise and interference. The original signals is obtained by adaptive filtered and subtract from input to removing the noise. The output produced the error signal and be the feedback to adjust the adaptive filter.

According to Ttripty Singh and Sanju S, [2], the offline mode algorithms process is proposed to produce better efficiency in the algorithms. The algorithms consist of video acquisition, pre-processing or noise removal, segmentation and feature extraction. The image is converted to the gray scale images that consist of ‗0' for black and ‗1' for white. By converted it, it helps in reduce the complexity. The segmentation is performed by background subtraction that is frame difference between 2 frames. Then the difference is stored on the new image at the same position. After the background subtractions the feature extraction is used to identify the objects. The moving object is marked by drawing a rectangle box to generate the coordinates of the bounding box. Through the bounding box in the center of the box which is centroid can be detected and tracked through the frames.

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2.1.1 Vehicle Detection Study Research

The study research regarding the vehicle detection is widely explored by a researcher around the worlds, the research are by taking consider of a few techniques and methods to be performed. Mostly the research field explored are for enhancing the analysis of video processing such as traffic analysis. There are a few techniques that are suitable to be implemented in this project specially to deal with the mobilize camera factors.

2.1.1.1 Background Subtraction

Background subtraction is one of the method is used to extract moving objects in a video frames. The methods are performed by estimate background images and subtract it with each frame. Ttripty Singh and Sanju S, [2]. The major drawbacks of using adaptive background subtraction only, it makes no allowances when the stationary objects start to move. Eventhough it is usually detected, ―holes" are leaving when new exposed background is different from the background model as shown in figure 1.1. The error will provide a false alarm for a short period of time. In order to overcome this problem, a hybrid model is present which is combined the adaptive background subtraction with three frames differencing algorithms. Osman Ibrahim, Hazem ElGendy, and Ahmed M. ElShafee [4].

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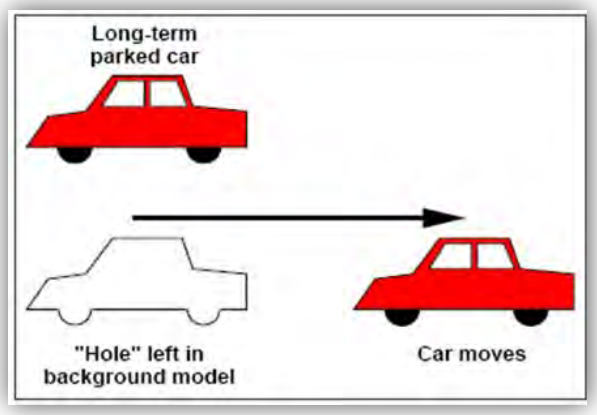

Figure 1.1: background subtraction leaves holes

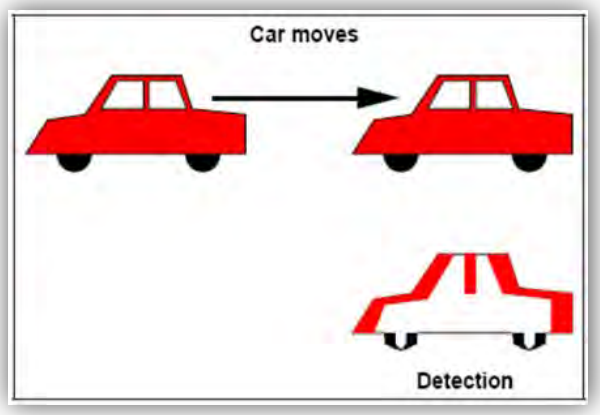

Figure 2.2: Frames differencing do not detect entire objects

Combination inter-differencing frames with sobel images methods also can be used to extract moving edges. To get an accurate detection the uses of three sequential images and process each image according to its previous and sub sequence images. By perform this method, the movement from the static background can be separate in order to overcome gain reference images in the background frames. D.J. Dailey and L. Li [3]. Three images uses, the previous temporal (*Ip*), current images of interest (*Ic*), next temporal images (*In*).

$$Edge\ image = Sobel\ (Ip\text{-}Ic) \cap Sobel\ (In\text{-}Ic) \qquad (2.1)$$

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2.1.1.2 Adaptive Noise Cancellation Algorithm

Adaptive cancellation noise technique used in Bayesian framework to detect moving parts of objects in each frame in the video sequenced. The static camera methods provide a fixed location position of camera that enables to make stationary background as reference. The background is separated from foreground by applying adaptive method using correlation threshold. There are two methods in Adaptive Noise Cancellation which is one background frame and one original frame, the second methods is two successive original frames without any processing. The best practice is by implementing the second method due to no need of background extraction. The normalized gray level of these two frames is put into column vectors X and Y and setup as the input. The vectors X and Y are represent as reference N1 and N0 +s[n] signals. S[n] is change caused by motion in the second frame. Figure 3.3 show the illustrations of the ANC techniques..

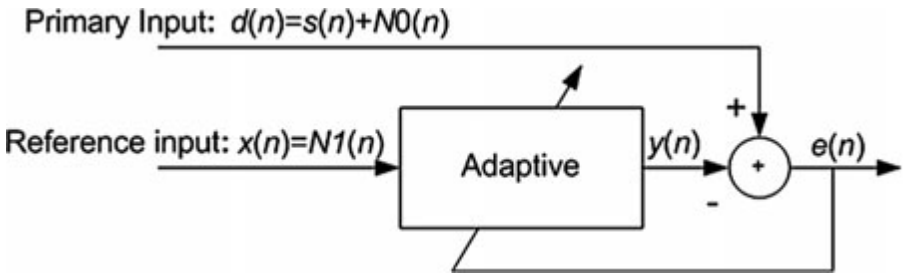

Figure 3.3: General block diagram of ANC

2.2 Speed Detection Overview

According to D.J. Dailey and L. Li, [3], it is important to extract moving edges and process the resulting edge information to obtain quantitative geometric measurements of vehicles because the algorithms develop use simple geometric relations

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