VEHICLE DETECTION AND TRACKING METHOD

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Bachelor of Computer Science
(Graphic and Multimedia Technology)

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Bachelor of Computer Science in Graphic and Multimedia Technology.

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Sistem pengawasan lalu lintas atau dikenali sebagai Sistem Pengangkutan Pintar (ITS) merupakan isu penting dalam pengurusan pemantauan lalu lintas. Teknik berasaskan penglihatan komputer adalah salah satu kaedah yang paling popular digunakan dalam aplikasi pengawasan video. Beberapa teknik pengesanan kenderaan, klasifikasi, pengiraan dan pengesanan telah dicadangkan oleh banyak penyelidik. Oleh itu, teknik sedia ada yang telah digunakan sekarang masih mempunyai masalah mengenai kualiti sistem pemantauan lalu lintas yang paling rendah dan kadang-kadang rendah terhadap keberkesanan dan ketepatan mereka. Tumpuan pada sistem pengesanan dan pengesanan kenderaan, aliran optik digunakan untuk mengesan dan menjejaki kenderaan. Penapis Kalman adalah kaedah pengesanan objek yang popular dalam sistem sedia ada yang sedia ada, bagaimanapun, kaedah berasaskan aliran optik memberikan hasil prestasi yang lebih baik daripada filter kalman berdasarkan analisis penyelidikan yang telah dilakukan. Walaupun, untuk kaedah pengesanan latar depan, kaedah yang sering digunakan ialah pendekatan kaedah penolakan Latar Belakang tetapi dalam kajian ini, lebih menumpukan kepada pengurangan Latar Belakang Adaptif. Objektif kajian ini adalah untuk membangunkan Sistem Pengesanan dan Penjejakan Kenderaan dan untuk meningkatkan ketepatannya dengan menggunakan pengurangan Latar Belakang Adaptif dengan Penapis Median Adaptif untuk menapis penyimpangan bunyi dalam video yang diperoleh. Kaedah yang dicadangkan ini datang dari analisis perbandingan kaedah sedia ada yang menumpukan pada penapisan hingar yang merupakan penapis Median dan penapis Median Adaptif yang akan memberi hasil yang memuaskan untuk ketepatan pengesanan kenderaan.

ABSTRACT

Traffic surveillance system or as known as Intelligent Transportation System (ITS) is an important issue in traffic monitoring management. A computer-vision based technique is the one of the most popular methods applied in video surveillance application. Several techniques of vehicle detection, classification, counting and tracking have been proposed by many researchers. Therefore, the existing techniques that have been used now still have an issue regarding to lowest quality of the traffic monitoring systems and sometimes low on their effectiveness and accuracy. Focus on vehicle detection and tracking system, Optical flow is used in order to detect and track vehicles. Kalman filter is the popular object tracking method implement in current existing system, however, Optical flow based method give better performance result rather than kalman filter based on the research analysis that have been done. While, for foreground detection method, the frequently used method is Background subtraction method approach but in this research, more focusing on Adaptive Background subtraction. This research objective is to develop Vehicle Detection and Tracking System and to enhance its accuracy using Adaptive Background subtraction with Adaptive Median Filter to filter the noise distortion in the acquired video. The proposed methods come from comparison analysis of existing method focusing on noise filtering which is Median filter and Adaptive Median filter that will give satisfied result for the vehicle's detection accuracy.

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LIST OF ABBREVIATIONS

ITS	Intelligent Transportation System
GMM	Gaussian Mixture Model
2D	Two Dimensional
DR	Detection Rate

CHAPTER 1

INTRODUCTION

1.0 Background of study

“Traffic congestion is a global issue, it is a matter of how we are going to solve it”(Andy,2017) shows that the problem related to traffic jam is a part of huge issues in our country. The development of economic growth and increases of human populations has increase the number of vehicles amount in a freeway. Related to that, some problem of traffic congestion has come out due to several factors such as the inefficiency and non-reliability of traffic management. Nowadays, there have many strategies that have been analysed to overcome that issue by the uses of technology and some logical approaches but, there is not enough solution to solve current issues with efficient management. According to that, vehicle detection and tracking plays an effective and significant role in the area of traffic surveillance system where efficient traffic management and safety is the main concern (Bhaskar, Yong, 2014) for better future of Intelligent Transportation System (ITS).

The object detection and tracking main target is vehicles. This approach will undergo the process to detect and tracking vehicles based on the video frames sequence. Back to the current system, the detection equipment has limited capabilities and reliability issues. Mostly, a current system use inductive loop which is placed in pavement surface that are unable to measure certain traffic parameters to accessing accurately traffic conditions. But, this method are no longer used because there have another way that more better to implement. Video surveillance and monitoring that use computer vision which lies on several image processing techniques as a strategy to produce more reliable and faster result. Most of the existing vehicle detection and tracking techniques use background subtraction and kalman filter as their method. There are many of

methods that can be used for object detection such as frame differencing, optical flow, background subtraction, blob analysis and feature – based method. The common use by researcher is background subtraction methods that produce the foreground and background frames that enable the methods to differentiate which pixels in the image represent a vehicle from the video sequence. Object tracking also widely used in many applications like video surveillance for traffic management and Pedestrian tracking purpose.

However, Adaptive Background Subtraction and Adaptive Median Filter are example of method that can be implementing in object detection and tracking process that can help in increasing the accuracy and effectiveness of vehicle detection and tracking system. Economic, more reliable and flexible detection method is needed to produce a better traffic surveillance to reduce traffic congestion problems. Therefore, research has been made to propose new method that can be used to enhance the effectiveness and accuracy of vehicle detection and tracking. The motion-based multiple object tracking method will be the main focus that will be implement in this research. This proposed method is to identify, analyse and implement combination of detecting and tracking method in order to achieve the objectives.

1.1 Research Problem

Nowadays, the amount of car that used on the roads increasing from time to time especially this days we need a transportation to go anywhere and transportation help us to go to the place faster and safe. But, the increases of vehicles have led to some problem such as traffic jammed. In order to help to reduce the number of traffic accidents and traffic jammed in urban area, video surveillance is one of the tools that have been widely used for the solution (Djalalov, Nisar, Salih, & Malek, 2010). However, the existing techniques that have been used now still have an issue regarding to lowest quality of the traffic monitoring systems (Zhang, Gao, Xue, Zhao, & Liu, 2018).

Traffic surveillance and monitoring approach are relies on several techniques of computer vision. There are various kind of techniques that can be used in vehicle detection and tracking system in order to increase accuracy and the effectiveness but until now there are still have another approaches have been studied by other researcher. Recent study shows commonly used method in vehicle detection and tracking is Kalman Filter. There are four types of Kalman Filter such as Kalman filter, Extended Kalman filter, Unscented Kalman filter and Complex Kalman filter (Mohanty & Kar, 2009). But, this extension of Kalman filter is not enough to ensure the accuracy for all type state systems. To locate and tracking object in low-contrast and high illumination are difficult (Wu, Kao, Jen, Li, Cheng, & Juang, 2014). Kalman also is not good enough to tracking motion object with non-linear state system. Therefore another tracking method needs to be design to increase the accuracy of vehicle detection and tracking system.

Object detection approaches exist in literature can classify into three categories which is frame differencing, optical flow and the background subtraction approaches (S. Parek, Thakore, & K. Jaliya, 2014). Background subtraction method is the famous used in motion object detection application, therefore there are various type of approach regarding background subtraction process. However, this method has many constraints like noise from image digitization and threshold selection from segmentation step (Elharrouss, Moujahid, Elkaitouni, & Tairi, 2016). The detection results still not give accurate detection. The error value for object classification and detection still high when misused of method applied. Therefore, Adaptive Background Subtraction approach can be introduced in order to enhance the accuracy detection of desired object in vehicles detection.

1.2 Research Questions

Q1: What is the suitable technique to use for applying in Vehicle Detection and Tracking System?

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