UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF VEHICLE DETECTION AND COUNTER FOR TRAFFIC SURVEILLANCE SYSTEM USING RASPBERRY PI

This report is submitted in accordance with the requirement of The Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Computer Engineering Technology (Computer Systems) with Honours.

by

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TAJUK: **DEVELOPMENT OF VEHICLE DETECTION AND COUNTER FOR TRAFFIC SURVEILLANCE SYSTEM USING RASPBERRY PI**

SESI PENGAJIAN: **2019/2020**

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I hereby declare this report titled "*Development of Vehicle Detection and Counter for Traffic Surveillance System Using Raspberry Pi*" is the result of my own research except as cited in the references. The report has not been accepted for any bachelor and is not concurrently submitted in candidature of any other bachelor.

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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Computer Engineering Technology (Computer Systems) with Honours. The member of the supervisory is as follow:

Signature: …….

Supervisor: TS. Shamsul Fakhar Bin Abd Gani

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ABSTRAK

Projek ini akan menggabungkan pengetahuan bahagian elektronik dan sistem perisian seperti pengaturcaraan. Objektif projek ini untuk mengesan dan mengira kenderraan untuk sistem pengawasan trafik menggunakan Raspberry Pi dan mereka bentuk dan membangunkan produk berciri-ciri kos rendah yang untuk mengesan dan mengira kenderaan untuk sistem pengawasan trafik. Projek ini untuk tujuan pendidikan menggunakan mikropemproses Raspberry Pi 3 B + teknologi model, Rasbpberry Pi juga sebagai minikomputer untuk mengawal semua aktiviti. Input yang digunakan pada projek ini adalah kamera Pi dan video akan menghantar data kepada Raspberry Pi untuk menukar video ke “gray scale” dan mengesan kenderaan dan mula mengira dan akhirnya menyimpan data dalam bentuk video.

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ABSTRACT

The project will combine the knowledge of electronics part and software system such as programming coding. The objective of this project to detect and counter vehicles for traffic surveillance system Using Raspberry Pi and design and develop low cost feature which for tracking and counting the vehicles for traffic surveillance system. This project for education purpose uses Raspberry Pi microprocessor from Raspberry Pi 3 B+ model Technology as minicomputer to control all the activities. The input used on this project is Pi camera and videos will send a data to Raspberry Pi to convert the video to grayscale and detect the vehicle and start the counting and finally store the data as video.

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DEDICATION

To ALLAH SWT, RASULLAH SAW, my beloved parents who are always for me;

Muhammad Yunus Bin Abdullah

Rabeeyathul Pgeriyah Binti Mohamed Ghani

To my siblings;

Nur Syafiqah Binti Muhammad Yunus

Nur Atiqah Binti Muhammad Yunus

Nur Raaziqah Binti Muhammad Yunus

To my supervisor for their guidance and encouragement;

TS. Shamsul Fakhar Bin Abd Gani

And to my friends, for their unconditional support.

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I would like to express my gratitude to Universiti Teknikal Malaysia Melaka (UTeM) and for giving me the opportunity to pursue my Degree Bachelor of Computer Engineering Technology (Computer Systems) with Honours.

My fellow bachelor students should also be recognized for their support. My sincere appreciation also extends to all my colleagues and others who have provided assistance at various occasions. Their views and tips are useful indeed. Unfortunately, it is not possible to list all of them in this limited space. I am grateful to all my family members.

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LIST OF ABBREVIATIONS

WIM = Weigh in Motion

HSL = Hua saturation and lightness

UVC = Universal video class

UAV = Unmanned Aerial Vehicle

SD = Secure Digital

OS = Operating System

USB = Universal Serial Bus

LED = Light Emitting Diode

LCD = Liquid Crystal Display

HDMI = High Definition Multimedia Interface

CSI = Camera Serial Interface

HD = High Definition

SSD = Single Shot Detector

CPU = Central process unit

RAM = Random access me

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The vehicle detection and counter for traffic that can monitor by using surveillance webcam. The vehicle detection and counter for traffic especially helpful and important for the analysis the factor of roads stuck and road management. This project will helpful to many roads user but not for individuals in 'Malaysia'. The Development, objectives, criticality and project degrees will be discussed in this section.

1.2 Background

The fast expansion of population increases number of vehicles annually. Hence, growing number of vehicles contribute to traffic congestion and transport delay. Traffic congestion is the biggest problem in many countries, including Malaysia. Based on (Jonathan Lee, 2018) Malaysia has over 29 million vehicles according to Jun 2018 figures. Every year, the increase in traffic congestion causes air pollution, time loss and productivity. In addition, the charge of solving and decreasing this problem is also expensive. However, ignoring the traffic jam problem is not a solution but increases the problem in term of social among citizens.

The huge issue of causing congestion is poor timing of traffic light. One of the factors is because traffic signals timing is not consistent with vehicle number. Therefore, a method for diminishing the issue is by doing an examination on the number of vehicles going at that specific junction. By analysing vehicle number, an improvement can be made at the traffic signal, such as increasing the green light period. However, counting the objects manually guide to eye tiredness and influences the exactness of results and time-consuming. Development of Vehicle Detection and Counter for Traffic Surveillance System using Raspberry Pi assists to count vehicle

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number automatically. Ordinarily, the user obtains various results in each measurement while counting manually, but an accurate value can be obtained with this invention.

A lot of decisions were made for this project with the aim of optimized traffic problem. One of the decisions is by promoting public transport in more exciting way using IoT. This paper uses vehicle detection and counter to describe the outline and change of traffic system behaviour.

1.3 Problem Statement

Based on the situation at hand, traffic congestion often happens on busy road especially during peak hour. The public is affected by this problem most of them are working people, they approximately wasting their time about an hour on traffic jam every day. However, there is lack of solution and current system to solve this problem is inconvenient. These systems such as Manual count, Pneumatic road tube counting and Piezoelectric sensor not suitable have the function to analyse the traffic congestion in current situation. They can only monitor the traffic movement. Moreover, the systems use variety of hardware which is expansive to afford it. This problem causes continuous congestion and a lot of people depressed which produce lack of productivity and have a large impact on the economy. Based on a survey made by (Malay Mail, 2016) magazine one out five Malaysian studied state traffic is worst part of their day. Therefore, there should be an immediate solution toward this issue before it becomes critical.

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1.4 Objective

The main goal of this project is to:

1. Develop a Vehicle Detection and Counter for Traffic Surveillance System Using Raspberry Pi.
2. To analyse the number of vehicles in a particular traffic location.
3. Design and develop low cost feature which for tracking and counting the vehicles for traffic surveillance system.

1.5 Scope

In order there are two scopes to achieve in this project which is:

1. Raspbian is used to optimized Raspberry Pi. Python is used as programming language for program the Raspberry Pi because Python is more convenience to use.
2. Raspberry Pi camera to capture the movement of vehicle and Raspberry Pi will analyse the input video consist of car develop by OpenCV software. Then it provides the vehicle count and save the as videos. From the data collected, statistic of vehicle will be created. So that users can make decision.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will talk about the past projects and some project-related journals. These reviews and articles have been analysed carefully for improve this project's effectiveness and quality. By analysing previous journals and research, it is possible to analyse and review the potential affecting the quality of their projects. This idea also can implement from the pasts project and the project can be improved. Therefore, the literature review process begins from project beginning to project end. In addition to analysing the previous project, internet reviews and very effective books are done for this project.

2.2 Overview

The purpose of this chapter is to discover technical knowledge and important research findings as well the concept of 'Development of Vehicle Detection and Counter for Traffic Surveillance System using Raspberry Pi. Other than that, hypothetical and methodological proper researches about the past research in traffic congestion optimization the evaluated and analysed. This project is based on optimizing traffic, signal performances measure, analysis, vehicle detection and counting is related to this chapter.

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2.3 Related Research

(Andrew Nkaro, 2014) Was developed project name Traffic Data collection and analysis. The main objective of this project is collecting of traffic data. Based on the researcher, the concept of forecasting the future use of the road network as regards traffic loading and flow is generally a worldwide accepted approach. The validity of traffic information data collection and subsequent predictions is of primary importance in carrying out adequate road network planning, design, maintenance tracking and strategic planning.

Traffic track and counting is falling manually and automatically in two main categories. They are many methods to collecting data but the most widely used method for collecting traffic data by manual counting that is to allocate a person to track traffic as it goes through. This method of analysing data can be expensive in terms of manpower.

The second method that counts automatically. Since we know of the misuse of new electromagnetic spectra method and wireless communication media in the current year, traffic recognition has been allowed to occur in a non-intrusive manner, at locations above or on the side of the road. Currently relatively inexpensive traffic detection based on pavement will be met with fierce competition from detectors released from the road surface in the coming years.

There are many types of detector commonly used such as weigh-in-motion sensor type and pneumatic tubes. The Weigh In Motion (WIM) sensor systems are known as collection traffic sensors and loops used to count, weigh and classify vehicles in motion worldwide. On their own traffic speed and axle weighing equipment, sensor pads can be used, they are triggered by "leading" signalization placed on the roadbed before them. This scenario is adopted where axles speed and statistical data are required. Next is pneumatic tubes, these tubes are placed on top of road surfaces at the area which we want to count the vehicle. When a vehicle passed over

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the tube, it will send a compression result, which is a burst of air to an air switch. This can be connected in any way of traffic counting devices.

Figure 2. 1**:** Manual traffic counting(Andrew Nkaro, 2014)

Figure 2. 2: Axle detection pad(Andrew Nkaro, 2014)

(Zakaria, 2014) was developing project named target form detection for the application of machine vision. Proposed that computer technology vision method is process for use an image sensor to capture images, then use the computer technology for processor that analyse these images to extract information of interest. It can be simply defined as the emulation of the visualization capability of human beings using computer, and making computers see as we see. It involves the following steps: image acquisition, image manipulation, image understanding and decision making.

In this project the proposed method will follow like block diagram. This input image will take by input device and will convert to Hua, saturation and lightness (HSL).

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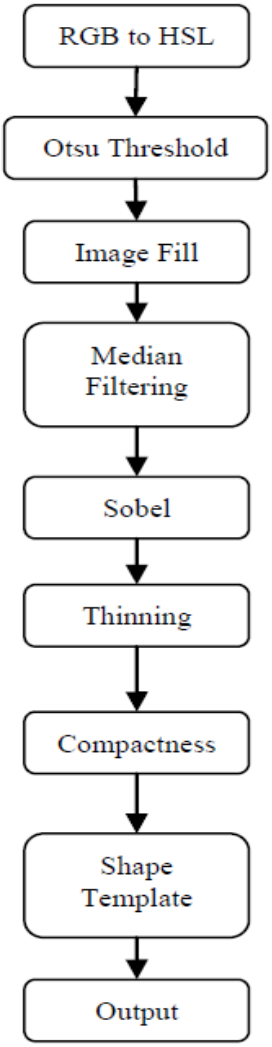

Figure 2. 3: Block diagram proposed method(Zakaria et al., 2014)

The main technologies that are driving this phenomenon are signal processing, multiple view geometry, optimisation, pattern recognition, machine learning, and hardware and algorithms. The method used is applies intensity variable number from the input, after that, the threshold by Otsu's method to obtain the binary input image. Next method is Median filtering is to eliminate noise. Then, Sable operator used to find the edges and thinning method is to remove unwanted edge pixels may be them counted in parameter estimation algorithm. The shape is chosen based on compactness of the region.

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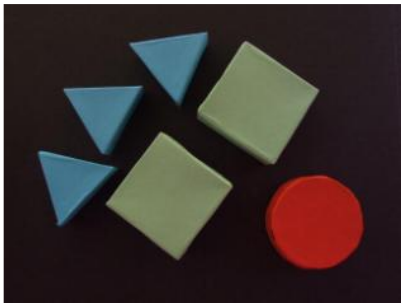

Figure 2. 4: Example of shape in RGB (Zakaria, 2014)

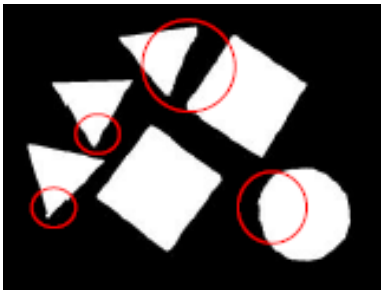

Figure 2. 5: 10 x 10 median filtering results(Zakaria, 2014)

According to (Crouzil, 2017) for traffic light monitoring with project automatic vehicle counting system. In addition, this study presents a vision-based system description for automatically obtaining data on traffic flow. This traffic light monitoring system operates in real time system and can proceed the operation with cameras, low illumination, and In the appearance of several shadows during challenging weather conditions scenarios. The system is also designed for operated at the cameras was already existing that for transmission operators have installed. The main cameras use for monitoring traffic, the incident detect such as counter flow, vehicles stopped, and others.

The main gaol of this system is for exist the cameras directly without cheated new existing parameters. This method shows where is originally allowing to count of vehicle and ring road classifying from a user personal needs documentation performed with the road transformation operated.

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They have to upgrade the system in this process can monitoring and counts vehicles automatically. Figure 2.6 shows the global process synopsis. The proposed system consists of five main functions: motion detection, removal of shadows, management of occlusion, monitoring of vehicles and counting of trajectories. For example, the process input is a video footage whereas the system output is an absolute number of vehicles.

Figure 2. 6: CCTV system and image shorting(Crouzil, 2017)

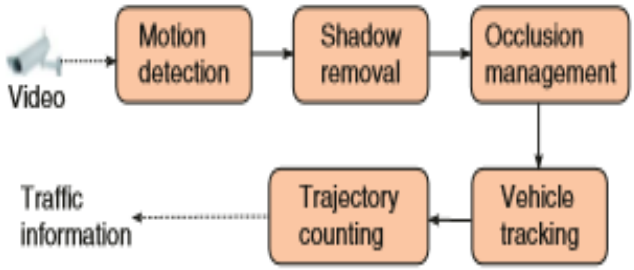

Figure 2. 7: Proposed system for vehicle counting(Crouzil, 2017)

(Kumar and Vasanth, 2015) come up with a system to detect and count dynamic vehicle efficiently. Component of hardware and software they use in this system is hardware implementation is Raspberry Pi and Universal video class (UVC) driver camera and for the software specification and framework are operator system Linux and QT for Embedded Linux.

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