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MOBILE TRAFFIC LIGHT FOR EMERGENCY VEHICLE

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“I hereby declared that this report is a result of my own work except for the excerpts that have been cited clearly in the references.”

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AKCNOWLEGDEMENT

Assalamuakaikum..

First and foremost, I would like to thank to my supervisor Pn. Ainain Nur Binti Hanafi who had taken a lot of efforts to meticulously go through my Final Year Project 1 and came up with helpful suggestion. Without helping from her, we surely came into deep problem in completing this report to fulfill the requirement in FYP II.

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ABSTRACT

Traffic congestion problem is the phenomena which contributed a huge impact to the transportation system in our country. This will cause many problems especially when there are emergency cases at four junctions' traffic light which is always busy and stuck with a lot of commuters. This situation becomes more crucial when special routing unprovided for the emergency vehicles such as ambulance, police and fireman when red sign light. To overcome this situation, a traffic light controller system for emergency vehicle will be designed. This system will operate based on Radio Frequency (RF) communication and Programmable Integrated Circuit (PIC) to help traffic control and also other road users when emergency situation occurs. When emergency vehicle approaches the traffic light junctions, the emergency vehicle driver send signal via special device to the receiver at traffic light control. Then the receiver or controller receives emergency signals, it changes the traffic red light to green light spontaneously. This system will help to reduce accidents which often happen at the four junctions traffic light because of other vehicle had to huddle for given route to emergency vehicle. In hope, this system will take control of traffic situation with better, in fact improving present traffic light systems technology.

ABSTRAK

Kesesakan lalu lintas fenomena yang memberi impak yang besar terhadap sistem pengangkutan negara kita. Hal ni menyebabkan pelbagai masalah timbul terutama bila berlakunya kes-kes kecemasan di kawasan simpang empat yang sentiasa sibuk dan padat dengan kenderaan. Tambah merumitkan apabila laluan khas tidak disediakan untuk kenderaan kecemasan contohnya ambulans, polis dan bomba untuk tujuan kecemasan ketika lampu isyarat merah (berhenti). Bagi mengatasi masalah ini, satu sistem kawalan lampu isyarat untuk kenderaan kecemasan direkabentuk. Dengan menggunakan kaedah komunikasi Frekuensi Radio (RF) dan *PIC*, sistem ini beroperasi untuk memudahkan kawalan trafik dan pengguna jalan raya yang lain apabila berlakunya kecemasan. Sekiranya kenderaan kecemasan mendekati simpang lampu isyarat, pemandu kenderaan kecemasan akan menghantar isyarat dengan menggunakan alat istimewa iaitu penghantar (*transmitter*) kepada penerima (*receiver*) di pengawal lampu isyarat. Setelah itu, penerima (*receiver*) atau pengawal (*controller*) lampu isyarat akan menerima isyarat kecemasan, lampu isyarat merah akan bertukar menjadi hijau. Di samping itu, sistem yang sempurna ini turut membantu mengurangkan kemalangan yang kerap berlaku di lampu isyarat simpang empat disebabkan kenderaan lain berhimpit-himpit untuk memberi laluan kepada kenderaan kecemasan. Di harap sistem ini dapat mengawal keadaan lalulintas di sesebuah negara dengan lebih baik malah meningkatkan teknologi sistem lampu isyarat yang sedia ada.

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LIST OF SYMBOLS AND ABBREVIATIONS

PIC	-	Peripheral Interface Controller
RF	-	Radio Frequency
PID	-	Proportional Integration Derivation
V	-	Voltage
A	-	Ampere
Ω	-	Ohm
SCADA	-	Supervisory Control and Data Acquisition
CAD	-	Computer Aided Design
ANSI	-	American National Standard Institute

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CHAPTER 1

INTRODUCTION

1.1 Project Overview

Malaysia is among developed country and also known as new industrial country. As we know, the term of development can be classified with improvement in every province. As an example, an improvement is need in prefect convolution of roadway convenience. This is because roadway is most important transportation element.

Moreover, with Malaysian level as a growing country in development, the land transportation system become dominant and the system are completely used to produce every activity regarding to human need. Meanwhile, roadways are the most efficient, faster and reduce transportation cost in domestic transportation system. With advance convolution of roadway convenience, Malaysia can compete with other developed countries such as Singapore, Hong Kong, Korea and Taiwan.

Referred to statistic information from Jabatan Pengangkutan Jalan (JPJ) Malaysia in 2003, number of registered vehicle increased to 8% every year. At 1996, total of registered vehicle are 7.7 million (7,686,684 vehicle) and that value increasing until 12 million in 2002. Now, the registered vehicle can be reach to 14.8 million (14,816,407 vehicle) until the end of year 2006. Regarding of this, road user are increasing day by day base on the increasing of vehicle. Beside that, Malaysian societies are move forward to self-improvement and development. Increasing of Malaysian population is also the factor of increasing of vehicle in Malaysia.

The extreme increasing number of vehicle will cause a difficulty among traffic movement in the country. Traffic jams are happening in city area especially in Kuala Lumpur, and different cities have different context of traffic jam problem. In Kuala Lumpur context, “Single Occupancy Vehicle” (SOV) is the number one factor in traffic jam problem. More than that still have other factor such as human behavior, traffic light system and other.

Miscellaneous of effect are recorded base to this traffic problem. Taking one of these problems than can be focused is emergency vehicle problem. An emergency vehicle can be categories as ambulance, police car, fire engine and VIP vehicle. As we all know, the emergency vehicle not really use the road compare to other private vehicle, this is because the emergency vehicle will needed when emergency case occur only. As an example, the ambulance vehicle will be very important in term of time because will be involved human life and need to rushing to hospital to get emergency treatment. In addition, with the normal traffic light system, more time will be wasted by the ambulance to arrive to the destination. To solve this problem, a continuous research and improvement of the system must be done.

1.3 Project objective

The objectives of the project are to apply the Radio Frequency Communication in traffic light control system for emergency vehicles. Beside that, to develop an algorithm for traffic light controller with emergency mode when the emergency vehicle switch ON the emergency system. Therefore, the developments of a prototype of the new junction’s traffic light system are needed to upgrade the traffic light system technology in Malaysia.

1.4 Problem statement

As we all know, traffic control system in Malaysia not been equipped with safe and easy method if emergency situation occurs. Therefore, more time are needed

to control the traffic jam when emergency situation occurs. The traffic becomes more worst because other vehicle had to huddle for given route to emergency vehicle. Moreover, an emergency vehicle has to avoid the traffic red light (stop) for emergency purpose. This situation will cause another accident between vehicles from the other junction. The following problem will be solving when this project applied to the real life soon. In hope it will reduce the difficulty for the emergency vehicle soon.

1.5 Project scope

Generally, every project or task have it own scope as a guideline for accomplish it. For this project, the scope is limited to certain selected fields, which are design a four junction's traffic light control system at main road using only timer controller. To specify the scope, the system will be implemented at four junction's traffic light where a main route to hospital or clinic. Beside that, this system will been prefer only in an emergency vehicles especially ambulance. In addition to improve this project control system, implementation of RF transmitting device [4] (to transmit signal up to 100 meters) and receiving device (receive RF signal from any 315MHz transmitter) via radio signal are very needed [3]. Beside that, design software coding using MicroC software to implement to the traffic light system and the system flow controlled by PIC microcontroller.

1.6 Executive Summary

This project was broken down into several chapters, Chapter 2: Literature Review. This chapter contains a review of previous work in traffic light emergency system applies in emergency vehicle. Chapter 3: Theoretical Background. This chapter contains an overview of the traffic light control system, Radio Frequency implemented in this project and operation of *PIC*. Chapter 4: Methodology. The flow of the project on how to develop the traffic light control system for emergency vehicle will be cover on this chapter. Chapter 5: Software development. This chapter

covers the outcome of the programming and software that help to develop the traffic light emergency system. Chapter 6: Hardware development. The development of basic design of the prototype and material selected. Chapter 7: Experiment & Analysis. All the experiment, test and run, Radio Frequency communication ability, and also the achievement of the emergency traffic light system will cover in this chapter. Chapter 6: Conclusion & Recommendation.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In every state along the globe are facing very large problem regarding to traffic light junction that cause accident between emergency vehicle and other public vehicle. Conducting literature review prior to undertaking research project is critical as this will provide much needed information on the technology available and methodologies used by other research counterparts around the world on the topic. This chapter provides the summary of literature reviews on key topics related to balancing a two-wheeled robot. Below are the several previous projects related to this project:

2.1.1 (Emergency traffic control system with security transmission coding by Levi L. Rose)

This traffic light system is the emergency traffic light control system designed especially for emergency vehicle only. Sensor that used transmitted signal system has been installed in every emergency vehicle, and then the receiver has been place at every traffic light. When emergency vehicle at the main road, the signal code will be sent inform of frequency modulation and receiver will receive the signal. The receiver will receive the signal and justified the code of the signal that sends from emergency vehicle, the traffic light will change to red sign (stop) at all junction. Thus, emergency vehicle will have special route from other vehicle to reach the destination.

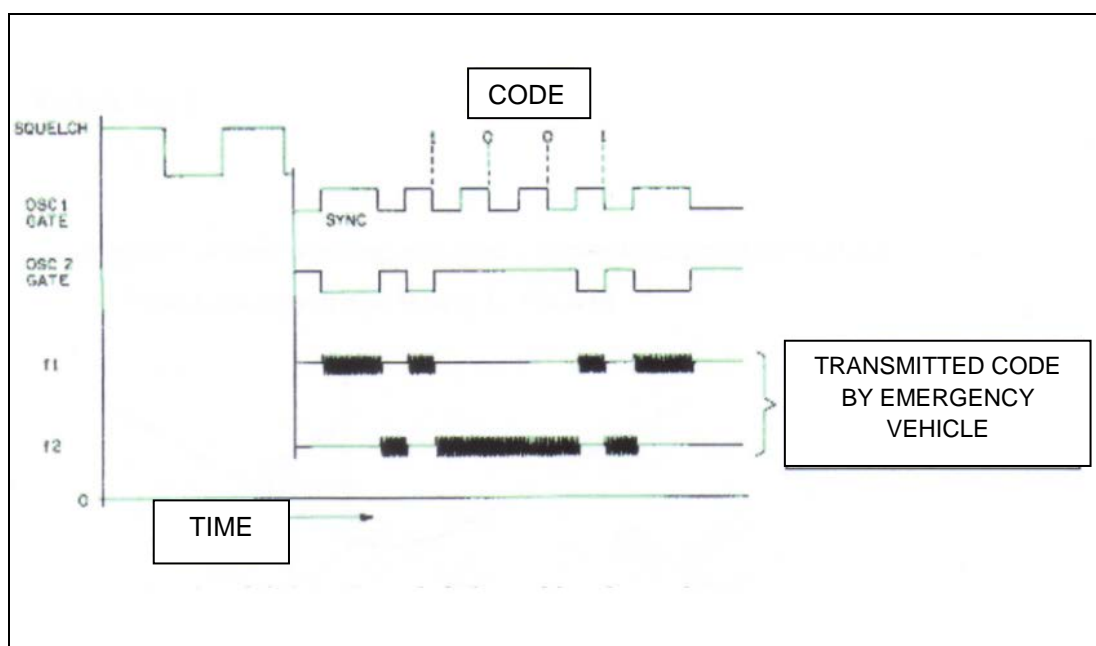


Figure 2.1: Emergency vehicle frequency waveform.

2.1.2 (Emergency vehicle warning and traffic control system by Michael R. Smith, Paul J. Davidson and Henry L. Pfister)

This traffic light system designed to give early warn to the emergency vehicle to find a way out from traffic jam and will easy the emergency vehicle reach to the destination more faster. This method, early emergency warn, will appeared to give direction where approaching of emergency vehicle. Beside that, it will be showed the traffic jam area at every junction.

The emergency vehicle transmitter device will transmit the emergency signal when any emergency situations occur. This signal will be received directly by receiver with infrared (I.R) interface. The receiver will be placed at every junction and operated to receive the signal from transmitter. The controller will process the transmitted data or signal from receiver and control all traffic light system operation and traffic movement where the junction that emergency vehicle located.

The controller also provides the output for display as a messages and symbol regarding to the path of emergency vehicle at every junction. In addition, the display system also displayed the emergency vehicle position where the emergency vehicle

has past trough the junction or not. After emergency vehicle past trough the junction, automatically system for emergency vehicle will deactivate and system turn to normal.

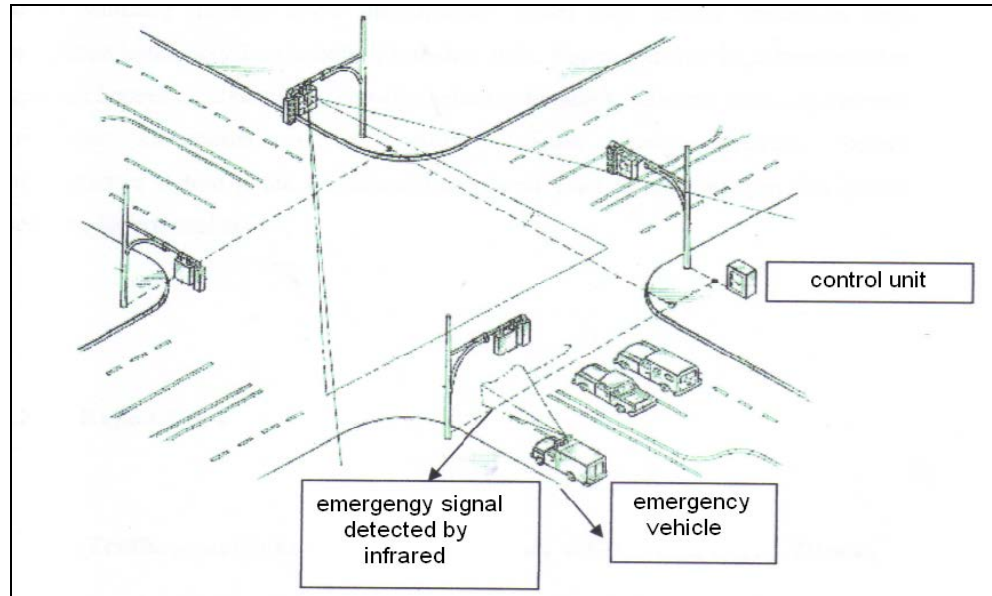


Figure 2.2: Four junction traffic light.

2.1.3 (Traffic light control for emergency vehicle by Wilbur L. Mitchell)

A traffic light control system for overcome the traffic jam problem and make easier to emergency vehicle obtain a emergency path where the radio transmitter and antenna provided in the emergency vehicle. The radio will transmit the signal to the other vehicle that nearby. The radio receiver had been placed at four junction traffic light to receive the emergency signal from emergency vehicle that passed by the junction. The first signal code contains a frequency for emergency vehicle but the second signal code contains a frequency for other vehicle.

The transmitted signals provide miscellaneous traffic light pole in normal condition or emergency. When the receiver receives the signal from emergency vehicle transmitter, traffic light system for emergency vehicle will activated.

2.1.4 (Emergency vehicle detection system by William E. Brill)

This system is the system to detect the emergency vehicle approaching. This system to alarm the other driver that emergency vehicle are approaching to have a way through. This system also equipped with a sound sensor to all vehicle and a device produce emergency sound to emergency vehicle (especially ambulance). The device at emergency vehicle will produce and transmit a sound signal. For the emergency vehicle attending a emergency situation, a switch will activate to produce sound signal and it will connected to siren. When the siren was activated, automatically the sound signal produces a waveform to alarm the driver in front of the emergency vehicle. The driver will received it trough a display panel in vehicle and the display panel will set the poles or waveform pattern of the emergency vehicle. When the emergency vehicle transmits the sound wave, the sound transduction will read this wave for get a confirmation about the vehicle type. If has a similarity of the emergency vehicle pole, other vehicle must give a way trough for the emergency vehicle.

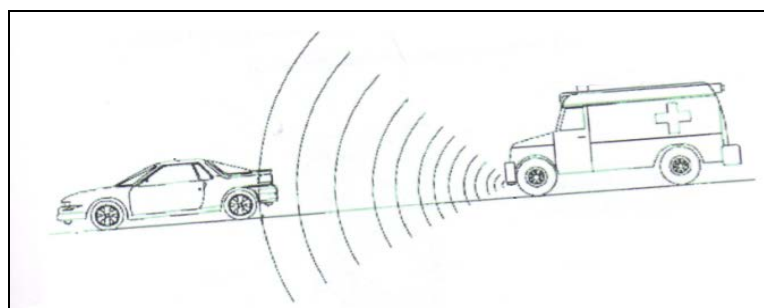


Figure 2.3: Side view between emergency vehicle and other vehicle

Figure 2.3 shows the wave produce by ambulance then the other vehicle in front will give a way trough. Ambulance will have an emergency path because other vehicles no need to huddle.

2.1.5 (Traffic signal light control for emergency vehicles by Carl J. Obeck)

This designed traffic light control system contains two way communications between emergency vehicle that past trough the busy road and a lot of traffic light

that must be through. The system was containing several poles and pattern about expected response that will be happen to control the traffic flow. That mean, this system has a very effective method to control traffic flow that always busy cause by a lot commuter.

This traffic light controller mechanism will receive the signal from emergency vehicle then it will find a pole to emergency situation and than give command to traffic light to give the emergency vehicle a way through. The poles storage system for controlling the traffic light will sent the response via all traffic flow situation to the controller. The system will stored much more pales and pattern about expected response of traffic light to control the traffic floe especially at four junction road. Although, this system still not perfect because it can't operated when there in certain situation doesn't satisfied before.

2.1.6 (Automated traffic control system having an interactive emergency vehicle warning therein by Jeremiah W. Pearson)

Traffic flow priority system define as the system that executed by emergency vehicle at four junction traffic light. A signal designed as a secondary electronic signal and an amplifier system, electronically as a source and it will be transmit to the traffic light controller as tricolors traffic light.

The system will replace the primary electronic signal to obtain a system that opposite with normal traffic light system. Either one of traffic light sign, usually yellow sign, will chosen as the secondary electronic signal. The signal will display an emergency icon. Figure 2.5 shows the emergency signal and displayed at yellow traffic light sign.