Faculty of Electrical and Electronic Engineering Technology

PORTABLE WIRELESS TRAFFIC LIGHT

MOHAMAD SYAHMEZAN BIN AMAT

Bachelor of Electronics Engineering Technology with Honours

2021

PORTABLE WIRELESS TRAFFIC LIGHT

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**A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology with Honours**

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2023

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI TEKNOLOGI KEJUTERAAN ELEKTRIK DAN ELEKTRONIK

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : Portable Wireless Traffic Light

Sesi Pengajian : 2022/2023

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DEDICATION

First of all, I would like to express my gratitude to Allah for providing me with the strength necessary to complete this research and see my thesis become reality. This study and research are dedicated to my beloved parents, Amat bin Ibrahim as well as Hazlin binti Sarip, who have always supported and encouraged me in completing my study. Not forget to mention my siblings, supervisor Dr.Vigneswara Rao A/L Gannapathy, and my friends who have supported me throughout my education journey. Thank you for all your assistance, which I will always appreciate and will never forget.

ABSTRACT

Reconstruction and maintenance of road is unavoidable and has always been a safety hazard if there is no safety system during the process. Therefore, humans or traffic light were normally used to control the safety system of a road lane. However those method pose some flaws in term of effectiveness, reliability and cost. For example, common problem faced when using labourers are regarding to their safety, careless and selfish driver often cause injury and accidents to this labourers. Besides that, cost also is a major factor where company often try to avoid using labourers to increase profit margin and prefer to use automated system. This paper presents a new design and development of Portable wireless Traffic Light to replace labourers and improve the existing traffic light system. . An Arduino UNO board, sensors and lights were used to command the entire control system and perform the automatic functions of the PWTL machine. Software development and testing were conducted to determine which hardware components could be utilized for this project. Based on the analysis and result, this machine is able to save motorist delay by a little amount and also low the risk of vehicle accident in the work zone. In conclusion, PWTL machine is able to cut cost by reducing the amount of labourers required to manage the safety system. Moreover, less workers and labourer are less likely to involved in an accident or injury thanks to the automated PWTL system that eliminates the risk of using humans.

ABSTRAK

Pembinaan semula dan penyelenggaraan jalan tidak dapat dielakkan dan sentiasa menjadi bahaya keselamatan jika tiada sistem keselamatan semasa proses tersebut. Oleh itu, manusia atau lampu isyarat biasanya digunakan untuk mengawal sistem keselamatan lorong jalan raya. Bagaimanapun kaedah tersebut menimbulkan beberapa kelemahan dari segi keberkesanan, kebolehpercayaan dan kos. Sebagai contoh, masalah biasa yang dihadapi semasa menggunakan buruh adalah mengenai keselamatan mereka, pemandu yang cuai dan mementingkan diri sering menyebabkan kecederaan dan kemalangan kepada buruh ini. Selain itu, kos juga merupakan faktor utama di mana syarikat sering cuba mengelak daripada menggunakan buruh untuk meningkatkan margin keuntungan dan lebih suka menggunakan sistem automatik. Kertas kerja ini membentangkan reka bentuk baru dan pembangunan Lampu Isyarat wayarles Mudah Alih untuk menggantikan buruh dan menambah baik sistem lampu isyarat sedia ada. . Papan Arduino UNO, penderia dan lampu digunakan untuk mengawal keseluruhan sistem kawalan dan melaksanakan fungsi automatik mesin PWTL. Pembangunan perisian dan ujian telah dijalankan untuk menentukan komponen perkakasan yang boleh digunakan untuk projek ini. Berdasarkan analisis dan keputusan, jentera ini mampu menjimatkan kelewatan pemandu dengan jumlah yang sedikit dan juga mengurangkan risiko kemalangan kenderaan di zon kerja. Kesimpulannya, mesin PWTL mampu mengurangkan kos dengan mengurangkan jumlah buruh yang diperlukan untuk menguruskan sistem keselamatan. Lebih-lebih lagi, kurang pekerja dan buruh kurang berkemungkinan terlibat dalam kemalangan atau kecederaan berkat sistem PWTL automatik yang menghapuskan risiko menggunakan manusia.

ACKNOWLEDGEMENTS

First of all, Alhamdulillah thanks to Allah S.W.T for giving me a chance and helping me in completing this final year project report. In addition, I would like to give my full credit to all my family members for their continued encouragement throughout the preparation of this report.

I would like to share my excitement and acknowledgment to anyone that has helped and assisted me to finalize this report. Besides that, I would like to express my feeling and gratitude to my supervisor Vigneswara Rao A/L Gannapathy for his guidance and advice that is related to the project "Wireless Portable Traffic Light" and manage to complete the project smoothly.

I am very thankful for all my lecturers and friends that commit to the preparation of completing the report and always supported me in completing my work and provide me with undivided moral support so that I could prepare a comprehensive report within a set time.

Finally, I would like to thank all my fellow colleagues and classmates, the faculty members, as well as other individuals who are not listed here for being cooperative and helpful.

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LIST OF ABBREVIATIONS

PWTL	-	Portable Wireless Traffic Light
LED	-	Light Emitting Diode
DSD	-	Decision Sight Distance
PIR	-	Proximity Infrared
PVC	-	Polyvinyl Chloride
PTS		Portable Traffic Signal

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background

Work zones are an unavoidable part of our society's efforts to maintain and develop our transportation infrastructure[1]. As a result, we must recognise that four elements are always in tension in the design and execution of a work zone: minimising the delay and disruption to the travelling public, maintaining the safety of both the public travelling through and the workers within the work zone, containing the costs to the public, and maintaining a profit margin for the contractor doing the work[1]. All of these elements are directly affected by traffic control within the work zone.

There are numerous sorts of work zones and traffic control within work zones. For an example, pavement repair, roadside maintenance, bridge maintenance and far more than this page can completely explain[2]. As a general rule, lane closures in work zones on two-lane, two-way highways necessitate some manner of coordinating opposing traffic flows in the remaining open lane[3]. This road closure is improtant for safety measurement for both construction workers during their working period and road user.

Traffic accidents [4], on road building sites are a persistent issue. Authorities change safety regulations on a regular basis in an effort to provide a safer working environment on a road building site, with the primary concern being the safety of road users and construction workers. According to the acts indicated in the road construction safety regulation, adequate safety measures have always been considered in all means, particularly those endangering human life. DOSH produced statistics on road construction accidents[3].

In the effort to maintain safety and smoothness in traffic flow on the road construction site, the usage of a traffic controller or so called “flagman” is essential[4]. Such a practise was developed some time ago, and it has since spread throughout the world. The best way to stop traffic is to put the flagman's life in danger. Contractors, unbeknownst to them, have put the flagman's life in high risk, with the majority of tragic cases among them. Flaggers have been stationed at each end of the lane closure in order to control the traffic flow as smooth as intended. During road construction, the motorist must obey the flagman's instructions in order to avoid an accident involving the flagman, workers, and road users [5]. Sometime, little tolerance for error on the part of either the flagger or the driver occured. Flagging is such a time-consuming and dangerous activity. They need to monitor the approaching vehicle all the time during the repairement by standing at both end of the construction. This will consume so much energy to maintain untill the end.

1.2 Problem Statement

Construction work on roads can take place everywhere. As a direct consequence of this, traffic must be carefully managed and regulated. The passage of traffic is regulated and controlled by this flagman who stands at the intersection. The use of labourers comes with a hefty price tag attached to it. Because training sessions are so expensive, the vast majority of flagmen currently in use lack the necessary level of education and experience. During the time that the road is being constructed, the flagman, the employees, and the drivers on the road are all susceptible to a number of risks. In addition, there is a significant risk that a flagman will become injured or killed when working on a road that is currently under construction.

The Department of Occupational Safety and Health found that careless drivers were the leading cause of accidents that occurred on road construction sites. Flagmen are typically quite visible in their bright orange vests as they monitor traffic around a road construction site. They hold up "Stop" and "Go" signs or flags to notify cars what they need to do to get through a one-lane bypass. Accidents occurred as a direct result of the decision made by some careless drivers to disregard these warnings. In many countries, disobeying the flagman and speeding in road construction zones is considered a serious offence that can result in penalties or even jail time if it leads to an accident that results in physical damage.

Aside from that, veteran motorists are aware that the pavement in a bypass lane is likely not to be as smooth as the pavement on the highway. In all likelihood, it will be rough and uneven, riddled with potholes, as well as muddy and treacherous to navigate. The skilled driver approaches the on-ramp to the bypass with caution and ease. On the other hand, careless drivers who enter the bypass at speeds that are higher than the posted speed limitations risk losing control of their vehicles. This reckless attitude will result in fatalities among those working on the construction project as well as other users of the road. Drivers are responsible for adhering to traffic laws as well as security and safety requirements for not only their personal safety but also the safety of other people who use the road and employees who are engaged in road construction [2].

1.3 Project Objective

The main aim of this project is to propose a systematic and effective methodology to control traffic during any construction which also to avoid flaggers becoming involved in an accident. Specifically, the objectives are as follows:

a) To investigate the safety of flagman and road users at road construction side.

b) To design a new portable traffic lights that able to control traffic automatically at road construction side.

c) To test and validate the developed portable traffic light system at road construction side.

1.4 Scope of Project

To avoid any uncertainty of this project due to some limitations and constraints, the scope of the project are defined as follows:

a) Range of transmitter covered a 100 meter(maximum length) of construction.

b) The equipment is used a minimum of one to three working days per used.

c) The Traffic light can work under several weather condition.

1.5 Summary

In conclusion, Background, problem statement, and objectives are essential for determining the path of the investigation and focusing the importance of generating the study. The following chapter will conduct research on past studies, relevant methodologies, related components, and ways to design a prototype based on the issue description and purpose. The project scope secures the bounds of a project in order to simply fulfil the objectives.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter covers design concepts, requirements, and other project-related information. This is established through researching prior similar projects as well as researching portable traffic lights that are currently in development and on the market. This chapter also describes the theory underpinning the system that will be utilised to build the machine.

2.2 Portable Traffic Light

In this system design, portable traffic lights played an important role. Between these two sets of traffic lights, there is a wireless communication system in place. The portable nature of the traffic signal can be attributed to the absence of wires. In addition to this, this may eliminate the usage limit that the traffic signal has, and it may be installed anywhere. The traffic light system is fully automated, meaning that it may function at any moment without the assistance of a human operator. The Intelligent Traffic Light is one of the best devices in work zone traffic control systems. This system can replace one or both flaggers during the lane closures for the construction[4]. In a normal situation, it is difficult to monitor and manage the flow of traffic, particularly on a two-way road, when it is raining, or when the temperature is really high. As a direct consequence of this, the traffic issue may be resolved by utilising the solution that was offered. Beside, the system is designed to help in the effort to control the traffic and decrease the number of accident without having a flagman during the road construction[5]. This idea has been used for many years to replace flagmen in various constructions. As a result, there are numerous of previous designs or systems in controlling traffic that may be addressed to make this project more efficient and advanced. For an example;

i. Controlling System
ii. Hardware Component
iii. Model Design
iv. Routine Maintenance

2.2.1 Controlling System

Some of the old systems are still using outdated algorithms that use local knowledge. Majority Traditional traffic lights use a delay method to operate the traffic signal. Calculation and prediction of traffic levels are required in order to set the timer for green and red traffic lights. Therefore, it is possible to see the various timing components of portable traffic signals setting for work zones[6]. There are many factor need to consider when developing the timing of PTS include:

I. Length of the work zone.
II. Number and variability of vehicles expected to approach each side of the work zone.
III. Speed of traffic approaching each side of the zone
IV. Amount of buffer time used to separate departing traffic from entering traffic

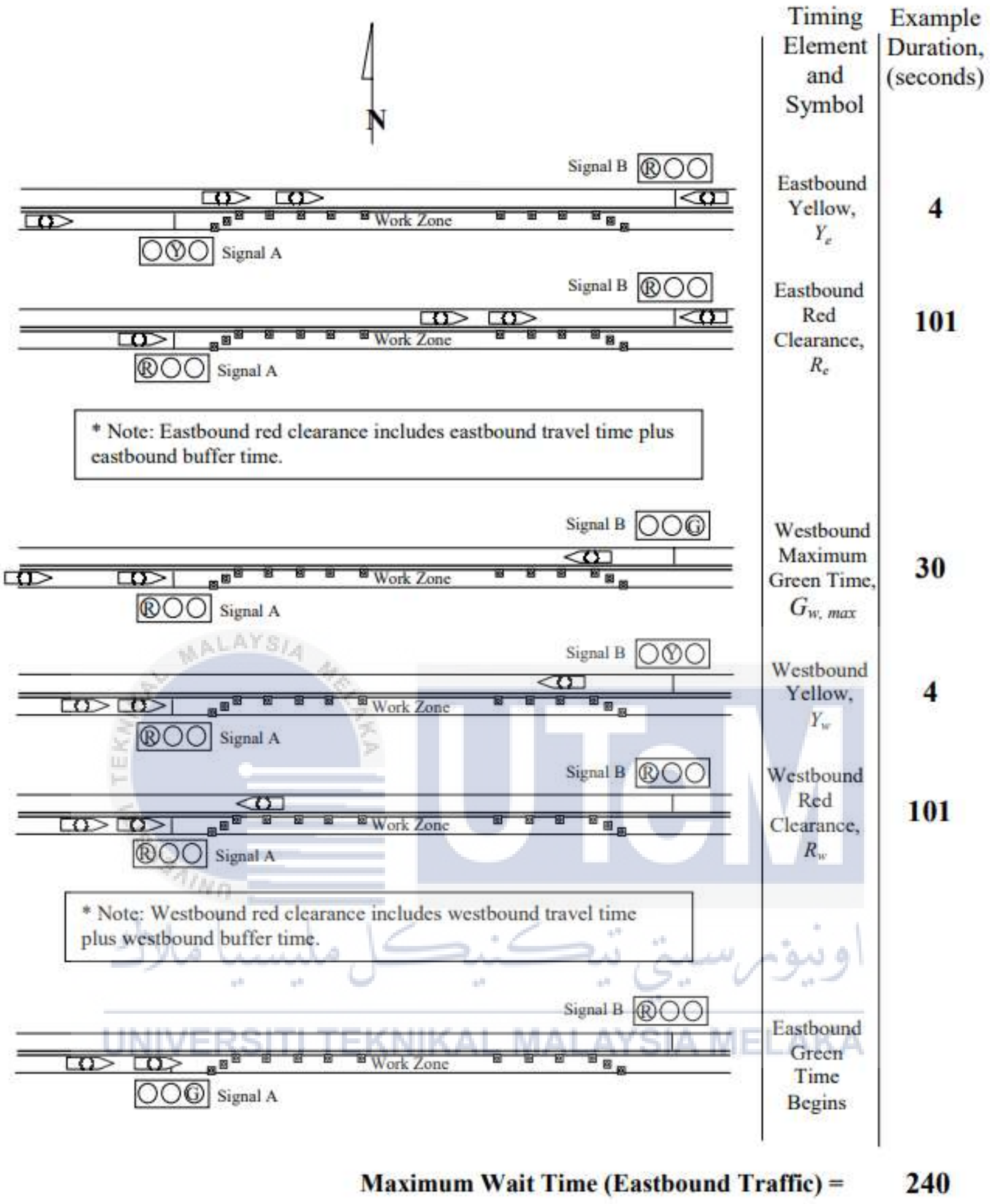

Figure 2.1 Complete Traffic Signal Cycle for Previous Portable Traffic Signals[6]

Figure 2.1 shows a step-by-step illustration of the various signal timing aspects that contribute to the longest possible waiting time[6]. If the work zone were any longer than 336 meter, motorists in the eastbound direction (and probably the westbound direction also) would have a wait time longer than the upper limit of 240 seconds. All timings shown in Figure 2.1 are for example purposes only; actual signal timing will be based on work zone