

**TRAFFIC LIGHT FOR CONSTRUCTION SAFETY SYSTEM**

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I dedicate this to both of my beloved parents, Mohd Yusoff bin Abdullah and Rohanim binti Amat, my family and electronic engineering education.

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## ABSTRACT

This project is an about intelligent Traffic Lights system which is proposal to replace the flagmen on road construction site. The intelligent traffic light can be best utilized in traffic flow control for long-term or short term. Application for the intelligent traffic light system to control two traffic lights in a single line which ensure safety of workers on a certain road construction site. The purpose new technologies in automating traffic flow in road construction site could possibly eliminate the usage of a conventional flagman. The automated portable traffic light system can reduce costs and increase safety for the road users by eliminating the need human flagman. This system is practical for public or privately funded road construction projects that require overnight or 24 hour traffic control as well as in various weather conditions.

## ABSTRAK

Projek ini mengenai sistem lampu isyarat pintar bagi menggantikan orang yang mengawal lalu lintas ketika berada di kawasan baik pulih jalan. Lampu isyarat pintar ini juga memberi manfaat yang sepenuhnya dijangka masa panjang mahupun pendek. Lampu isyarat ini digunakan dengan mengawal dua unit lampu isyarat di dalam jalan sehalu dengan memastikan keselamatan pekerja semasa melakukan kerja-kerja di kawasan yang berisiko tinggi. Dengan adanya teknologi terbaru, lampu isyarat ini berfungsi secara automatik boleh menghapuskan dari menggunakan pengawal lalu lintas. Lampu isyarat yang senang diubah kedudukan ini juga boleh mengurangkan kos serta meningkatkan keselamatan pengguna jalan raya lalu menghapuskan penggunaan pengawal jalan raya. System ini lebih praktikal oleh orang awam malahan kontraktor projek persendirian yang memerlukan sepanjang masa atau 24 jam kawalan trafik di semua keadaan cuaca.



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## LIST OF ABBREVIATIONS

PCB	-	Printed Circuit Board
AC	-	Alternate Current (Arus Ulang Alik)
DC	-	Direct Current (Arus Terus)
IC	-	Integrated Circuit
PIR	-	Passive infrared sensor
LED	-	Light Emitting Diode
PLC	-	Programable Logic Controller
TX	-	Transmitter
RX	-	Receiver
PSM	-	Projek Sarjana Muda
RF	-	Radio Frequency
IR	-	Infrared

## **CHAPTER I**

### **INTRODUCTION**

#### **1.1 Introduction of the Project**

The intelligent construction safety traffic light system is designed to be an intelligent system for smooth traffic operation in a typical system for construction site with high frequency of vehicles. The automated system which high operates without human intervention at all time regardless of weather conditions enables the system to work efficiently for long working durations. The system has many features which empowers the users on dangers at a road construction site. The automatic vehicle presence detection and control system enables the road users to be informed an the traffic flow ahead.

Traffic flow control in road construction site is difficult to be monitored and controlled in both directions especially during rainy seasons. The intelligent



constructions for effective, safe and in ensuring smoothness in the traffic flow in a dangerous road construction site.

The most important factor in a road construction site is the hazard warning sign for the road users. If a system is capable to indicate the road users without human intervention and regardless of weather, it will help the contractors and their workers doing their work without worries.

## 1.2 Objectives

- a) To design intelligent traffic light system for smooth traffic operation in typical road construction site with high frequency of vehicles.
- b) To change an alternative system by operates without human intervention at all time regardless of weather conditions.
- c) To implement an automated traffic light system for long term or short term lane closure on construction site, it is suitable to control two-way traffic in single lane.

## 1.3 Scope of Work

For this project there are 4 steps to be developed

1. Researched about the traffic light
  - a. Find information from books, internet and the supervisor point of view
  - b. Do analysis about the project
  - c. Study about PLC programming
2. Design software programming
  - a. Design PLC programming using the Grafcet

- b. Test run and troubleshoot the program
  - c. Request the components for this project
- 3. Design and build the hardware part
  - a. Start building traffic light model
  - b. Make some adjustment and troubleshoot the device if needed
- 4. Test run and troubleshoot
  - a. Interface the hardware and the software
  - b. Test run the project and troubleshoot if needed

#### **1.4 Problem Statement**

During construction activity, there are various problems that can face which more than 70% of accidents occurred at the flagman on the work at the construction site. The possibilities of workers, user and flagman involve in an accident is high. Traffic flow control in road construction site is difficult to be monitored and controlled in both directions especially during rainy session. Thus, the road is very dangerous area for the user and flagmen when cross the road construction site.

## CHAPTER II

### LITERATURE REVIEW

#### 2.1 Traffic guard

A traffic guard, "traffic controller", "flagman", or "flagger" is a person who directs traffic through a construction site or other temporary traffic control zone past an area using signs or flags. They are responsible for maintaining the safety and efficiency of traffic, as well as the safety of road workers, while allowing construction, accident recovery or other tasks to proceed. Flaggers are commonly used to control traffic when two way roads are reduced to one lane, and traffic must alternate in direction.

Their duties are to direct traffic to safer areas where construction, accidents, and severe traffic are taking place. In addition they have to moderate the traffic density to not cause traffic jams. They guide motorists to follow the traffic laws; but may not be able to enforce the law. Most traffic guards are seen as construction workers; but in Figure 2.1 shown some nations they dress or perform as security guards and police officers.



Figure 2.1: Flagman work at area

### 2.1.1 Equipment

For this work, the flagman needs some material that control flow traffic like:

1. Signal flags; a small or large flag in colors such as white, red, and orange.
2. Signal hand sign; called stop/slow paddles in the United States, based on Figure 2.2 these are a sign that has 'stop' on one side and 'slow' or 'go' on the other side.



Figure 2.2: Uniform for flagman

3. Signal baton (or marshalling wand); a baton that lights up or reflects light.
4. Traffic vest; a brightly colored vest shown Figure 2.3 that is made to reflect headlights light or has built in LED lights.
5. Helmet (or a hard hat); protecting the head from hazards.
6. Signal flares; flares for night or bad weather.
7. Traffic cones and warning signs; a warning and barrier used to slow down traffic and alert drivers.



Figure 2.3: Flagman control traffic flow

## 2.2 Contractor

Some contractor does not care road safety regulations during construction. These regulations are created by responsible authorities and agencies such as The Department of Occupational Safety and Health (DOSH) which contains legal requirements to ensure safety of the workers at work zone and public. Besides that, there are certain contractors neglect the rules such as listed by the Ministry of Works.

With reference to the Ministry of Works, during a road construction there should be a minimum of 10 safety alert sign boards that must be placed on specific locations at

the construction area. In most cases the contractors overlook the safety regulations and take it lightly. Indirectly, this irresponsible attitude causes problem to numerous parties.

Therefore, a flagman must appointed by the contractors might not poor trained by their employment. These untrained flagmen could be harmful for the road users and themselves. At times the flagman's concentration on controlling the traffic flow also can result in various miseries not only to his life but also to the public. For an example, when the flagman works under the hot sun, they get tired easily and lose their concentration on work. Nevertheless, miscommunications also occur when these flagmen uses improper method to communicate among themselves in order to control the traffic.

### **2.3 Road user**

Statistic published by DOSH, shown that reckless road users are the main cause of an accident on a road construction site. Usually flagman who direct traffic around a road construction site are highly visible in their bright orange vests, as they hold up their "Stop" and "Go" signs or their flags to inform drivers what they must do to get through a single lane bypass. Some reckless driver tends to ignore these directions and causes accidents.

In many countries, disobeying the flagman and speeding in road construction sites is serious a punishable which is finable or imprisonment if it results in a bodily injury accident. Other than that, when knowledgeable driver enters a bypass lane, they know the pavement may not be as smooth as the expressway. In fact, it is likely to be rough and uneven, possibly full of potholes and also muddy and slippery. The good driver enters the bypass slowly and carefully. But when the irresponsible drivers enter the bypass at higher speed than as posted speed limits, it could cause the loss of control. This irresponsible attitude will drift the construction workers and other road user into fatal zone.

Drivers must be sensitive with traffic regulations, as well as security and safety standards for their own safety, other road users' safety and road construction workers' safety as well.

## 2.4 Critical Zones in the Road Construction Site

A road construction site can be categorized into zones and risk level as shown in Table 1.0. Referring to Figure 2.4 and 2.5, the risk factor for both the public users and the flagman is high in zone A and zone C. This zone is defined as a critical or high risk zone due to the stopping point of the oncoming vehicles. The risk factor here involves the road users and also the traffic controller which is the flagman. The next zone is zone B where the construction or road maintenance job is done. The risk in this zone is moderate if the work zone is not close to the road allocated for the users. The contractor should study on possible space for all types of vehicles to pass through all zones especially between zones as shown in Figure 2.4 and 2.5.

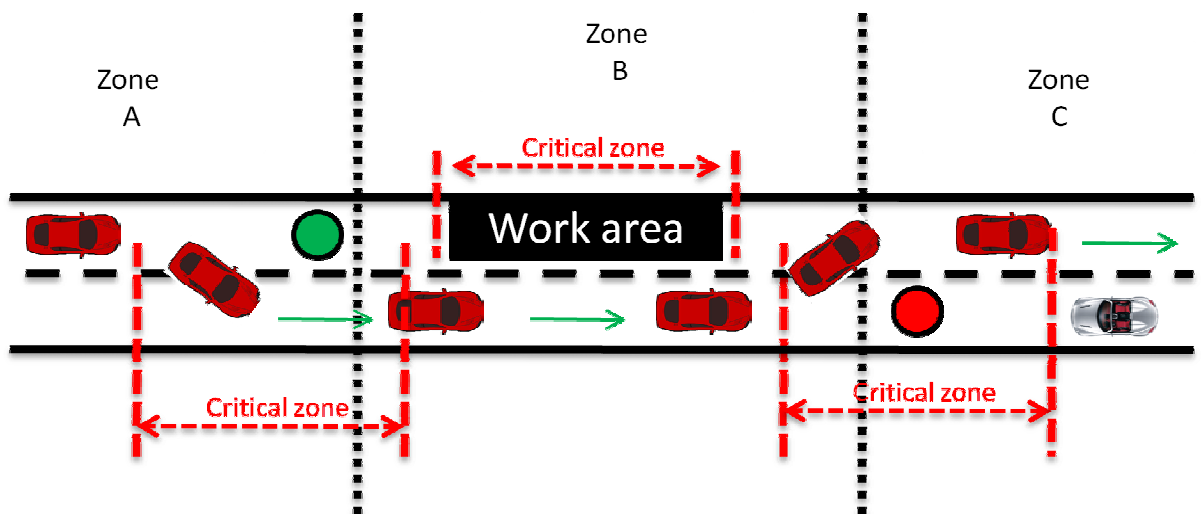


Figure 2.4: Straight lane road construction scenario 1

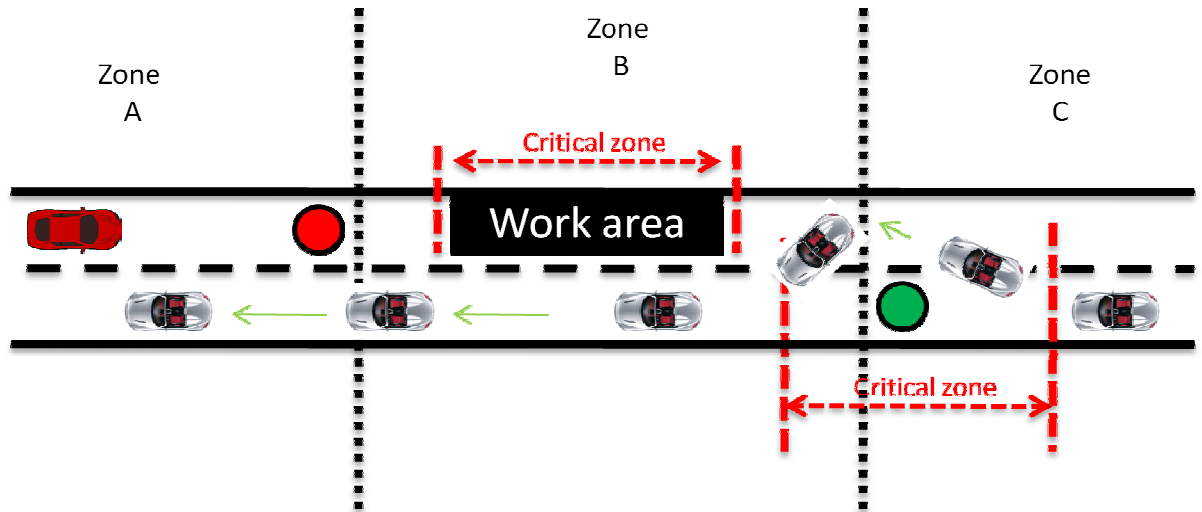


Figure 2.5: Straight lane road construction scenario 2

Table 1.0: Critical zone and risk level in straight lane

Zones	Scenario 1	Scenario 2
A	High	High
B	Moderate	Moderate
C	High	High

There are many types of road construction site and possible danger if safety measures are not taken into account. Figure 2.6, shows another scenario of a road structure which is similar to the scenario in Figure 2.7. The risk level for this scenario is as shown in Table 2. The risk factor for both the public users and the flagman is high in zone A and zone C. This zone is defined as a critical or high risk zone due to the stopping point of the oncoming vehicles. The risk factor here involves the road users and also the traffic controller which is the flagman. The next zone is zone B where the construction or road maintenance job is done. The risk in this zone is moderate if the work zone is not close to the road allocated for the users. The contractor should define on possible space for all types of vehicles to pass through all zones especially between zones.