



## **Intelligent Traffic Control (i-TC) for Road Construction**

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### **ABSTRACT**

Work operation in heavy construction site requires high safety level, which includes the management of the traffic congestion near the constructed road. Nowadays, many roads require maintenance or newly built construction thus disturb the road traffic, especially near the narrow road. This problem will cause traffic congestion from two opposite directions and hence the user should wait longer. To cater such problems, Intelligent Traffic Control (i-TC) was innovated for mitigating the purpose. With an improved characteristic, i.e. portable and easy operation, the product can be used at shuttle working sites with restricted road condition of one-directional road route. Our aims to construct a smart portable traffic light that can control the flow of the car at an affordable cost comprises of microcontroller, RF receiver and transmitter, and I/O accessories of the button and LED arrays. As results, this invention could increase productivity, shorten the required time and human intervention for traffic patrolling, and ultimately reduce the operating costs. The better coordination between two roadsides ensures a smoother traffic flow.

**KEYWORDS:** intelligent system, smart traffic control, safety, road construction

## **1 INTRODUCTION**

According to the statistic that has been issued by Road Safety Department (Malaysia), the number of accidents that caused by road defects is increase over years. On average, 11.25% of the total number of road traffic death is related to these road defects [1]. Moreover, it has identified that road construction can cause congestion which leads to car accidents as well. The only way to lower this percentage by repairing the road damage back to the original condition. Current operation of managing the road traffic during road construction was either conducted by manual intervention or operated by stagnant indicator. However, existing approach was inefficient due to driver's limited eyesight, hence may cause accident to occur [2]. Considering the factors which drives the accident, new approach by innovating the existing method at low cost product development in order to handle the traffic congestion during construction has necessary to be developed.

## 2 OBJECTIVE

The objective of this work aims:

- i. To design an intelligent and low-cost traffic control system for road construction.
- ii. To develop an algorithm mechanism capable to automatically control the traffic congestion without human intervention.
- iii. To compare the system performance before and after the technology implementation.

## 3 SIGNIFICANCE

The significance of the intelligent-Traffic Control (i-TC) [3-4] for road construction seems important to cater the issue of manpower utilization known as flagman to control the traffic queue that might pose the probability of accident. This portable traffic light system is more effective to be used for two-way road where one way is under construction or maintenance and the other ways is used for vehicles traffic. Moreover, this i-TC is very useful in construction area such as road construction. It can help with the traffic flow as it will manage the traffic to flow smoothly compared to use a flagman to control the traffic. To solve all this problem, i-TC has been built to increase productivity, shorten the time for the road works to complete as the construction workers can only focus on repairing the road and it also can reduce the costs of construction works. This is because, Portable Traffic Light is built using a low-cost component [5-6]. This project will assist to improve our industry and economy. With this project, the communities are aware about the importance to keep the safety at the road that under construction. This to keep away the communities from any accident that may happen at the construction area. Thus, by using i-TC is the simple way to communicate directly with the drivers compared by using flaggers. Besides, the innovation allows flagger to do other works that is needed within the area which means more works can be accomplished at a faster rate. Other than this i-TC can keep the safety of the flagman, by keeping away from exposed to vehicle conflicts or to deal with angry motorist and there is no longer a need to rotate flagman works every two hours.

## 4 METHODOLOGY/TECHNIQUE

The project has been developed by using Arduino Uno microcontroller, radio frequency HC12, push button, LED and relay [7-9]. Besides, the programming wise using the microcontroller with RF connectivity module was developed in order to light up the LED based on the three designated of light sequence. Once the first circuit (TL1) turns red, it will transmit the data through the radio frequency to another circuit (TL2). The TL2 would receive the data and then turns green. This will continuously be repeated since this circuit involves relay at both sides. The designed system also incorporates the safety measure which is equipped by a reset button. Each time the reset button is pressed, it will transmit the signal to the TL1 and the red led will light up before the sequence started. Furthermore, the connectivity module using HC12 as radio frequency to transmit and received signal capable of transmitting signal up to 1km, which is considerable sufficient for this kind of application. The function of this LED is to check the sequence of the right LED. As we all know this portable traffic light are putting opposite to each other, so it is difficult to check either the other side of the traffic light is running the correct

sequence. Therefore, this LED that is connected directly to the left traffic light is used to display the TL1 light.

## 5 RESULT

Experiments were conducted in the lab scale environment to examine the product functionality. This is the condition when the TL1 turns green while TL2 turns red. Radio frequency is used to transmit and receive the data. While the delay time is needed to prevent both traffic light from being overlapped. According to the coding, it mentioned about yellow LED, but this project only used red and green led so the yellow LED command can be ignored. Since this Portable Traffic Light is not using yellow LED it will cause danger to the user as yellow light on the traffic light means the user need to be caution as it will chance the colour to red, so the time delay is increase at red LED and this is to make sure at both side of the road is clear to proceed turning into green light. Fig. 3 demonstrates several conditions examined according to its sequence of the i-TC; Firstly, TL1 at red light condition while TL2 is at green light condition. Secondly, both TL1 and TL2 are at red light condition and this show the delay time at set A for red led is increasing. Thirdly, the condition for TL1 in green light condition while TL2 at red light condition. Finally, both TL1 and TL2 are at red light condition and demonstrates that the delay time at TL2 for red led is increasing. Meanwhile the performance of the i-TC was measured by varying the distance and examine the button functionality as tabulated in Table 1.



Fig. 1 Verification of results for the traffic sequence

Table 1 Delay timing experiments on different button functionality

Traffic Light (TL) sequence	Button 1 (below 10m)	Button 2 (between 10m to 90m)	Button 3 (greater than 100m)
TL1: Green, TL2: Red			
TL1: Red, TL2: Red			
TL1: Red, TL2: Green	10 sec	20 sec	40 sec
TL1: Red, TL2: Red			

## 6 CONCLUSIONS AND FUTURE RECOMMENDATION

In conclusion, this i-TC is built to design a smart traffic control for road construction. It assists with the traffic flow and manage the traffic smoothly as compared to manual control using manpower. The i-TC has been built to increase productivity with low-cost product development, shorten time for the road construction works to complete as the construction workers can only focus on repairing the road and it also can reduce the costs of construction works. As suggestion for future recommendation, the improvement on the product can be improved by adding counter clock which able to avoid an increased in delay time. Another feature improvement by adding the warning alarm. An additional alarm in this system can alert the user if the traffic light is not working. The alarm will turn on and send to user so the user could respond faster. Finally, this project can be further improved by adding a sensor to detect the car. This sensor supports to control the i-TC based on the density of the vehicles beneficial to avoid traffic congestion.

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