Novel Approach for Single Display Traffic light with Real Time Fault Management System (Green Traffic Light)

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ABSTRACT

In the midst of energy escalating costs and the risk of global warming, government and NGOs are now recognizing the benefits of using green technology to reduce the environmental impact due to industrial or manufacturing process. Green technology achieves innovation and alternative technologies in various fields by taking in consideration on three main features which is recycle, reduce, reuse as core value in the design stage. “Novel Approach for Single Display Traffic light with Real time Fault Management System (Green Traffic Light)” is designed to implement the concept of green technology into traffic lights. The aim of this research is to introduce single display traffic light system as a revolution to the traditional three display traffic light system. As government and NGO’s encourage green technology and green innovation as a substitute to existing technology, the single display traffic light system could enhance the value of green in the respective technology. The single display traffic light system caters a few important features such as reduce manufacturing cost and maintenance cost, less quantity of component, less industrial process and this will make recyclability even better in the long run. The single display traffic light system also can be powered by using renewable solar energy. The single display traffic light system is designed to operate on full power (brightness) in day time and half power at night. By using such a method will further optimize the energy which is consumed by the system. The conventional traffic light system is a standalone system which is not efficient in tracking faults, maintenance issues and operation of traffic light in real time basis. The fault management system in Global System for Mobile (GSM) communication is designed to detect fault within traffic light system and report the faults via short message service (SMS) to monitoring station and respective authorities in real time basis. Such an approach, could be best utilized by the management in enhancing the efficiency of contractors, able to identify replaced components and directly save maintenance and operation cost.

ABSTRAK

Di tengah meningkatnya kos tenaga dan risiko pemanasan global, kerajaan dan badan bukan kerjaan menyeru pengunaan teknologi hijau dalam kehidupan harian untuk mengurangkan kesan persekitaran akibat proses industri. Teknologi hijau menjadi salah satu alternatif di pelbagai bidang, malah menitikberatkan pada tiga ciri utama teknologi hijau iaitu kitar semula, mengurangkan dan menggunakan semula. "Pendekatan baru untuk lampu lalu lintas dengan pengurusan kerosakna lampu lalu lintas dalam masa nyata" direka untuk merialisasikan konsep teknologi hijau dalam pengunaan lampu lalu lintas. Tujuan utama projek ini adalah untuk memperkenalkan satu paparan untuk tiga penunjuk lampu lalu lintas sebagai revolusi kepada system lampu lalu lintas yang sedia ada. Projek ini membawa beberapa cirri penting seperti mengurangkan kos pengeluaran, kos penyelenggaran, proses indusri dan juga boleh mengurangkan dari segi kuanti komponen. Sistem ini mampu beroperasi dan diaktifkan dengan mengunakan tenaga solar. Pengunaan tenaga boleh dioptimumkan dengan adanya dua mode sistem dalam lampu lalu lintas ini. Selain daripda itu, pengurusan kerosakan pada lampu lalu lintas dalam masa nyata diperkenalkan dalam projek ini. Dimana setiap kerosakan pada lampu lalu lintas akan dikesan dan melaporkan kepada pihak yang bertanggugjawab menerusi perkhidmatan mesej ringkas dalam masa yang cukup pantas dan cekap. Pendekatan seperti ini, boleh dimanfaatkan sebaik – baik oleh pihak pengurusan dalam meningakatkan kecekapan kontraktor dan secara langsung boleh mengurang kos penyelenggaran dan operasi.

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LIST OF ABREVIATION

AC	**-**	**Alternating current**
CCTV	**-**	**Closed circuit television**
DBMS	**-**	**Database management system**
DC	**-**	**Direct current**
DCE	**-**	**Data communication equipment**
DTE	**-**	**Data terminal equipment**
GSM	**-**	**Global system for mobile communication**
GUI	**-**	**Graphical user interface**
HTML	**-**	**Hyper text markup language**
LCD	**-**	**Liquid crystal display**
LDR	**-**	**Light dependent resistors**
LED	**-**	**Light emitting diode**
ODBC	**-**	**Open Database Connectivity**
PCB	-	**Printed circuit board**
PHP	**-**	**Hypertext preprocessor**
PLC	**-**	**Programmable logic controller**
RGB	**-**	**Red, Green, Blue**
SMD	**-**	**Surface mount diode**
SMS	**-**	**Short messaging service**
SMT	**-**	**Surface mount technologies**
SQL	**-**	**Structured Query Language**
USB	**-**	**Universal serial bus**
Vb.net	**-**	**Visual basic.net**

CHAPTER 1

INTRODUCTION

Traffic light is a road signal for directing vehicular traffic by means of coloured lights. Usually, red for stop, green for go and amber (yellow) for prepare to stop. These were standardized in 1935 in an early edition of the Manual on Uniform Traffic Control Devices [1]. Making traffic signals look basically the same all across the country meant that drivers didn't have to figure out an unfamiliar signal. They could recognize a standard signal and react appropriately, which made driving safer. Traffic lights have become a necessary and valuable tool all around world in order to reduce the number of accidents. Besides that it made the traffic flow smoothly and possibly could save people time. In addition it also works in conjunction with pedestrian display to assign pedestrian cross in right of way.

1.1 Background of traffic light

A modern traffic signal system consists of three basic subsystems: the signal lights in their housing, the supporting arms or poles, and the electric controller. The signal lights and housing are known as the signal light stack. A single stack usually consists of three lights: a green light on the, a yellow light in the middle, and a red light on the top.

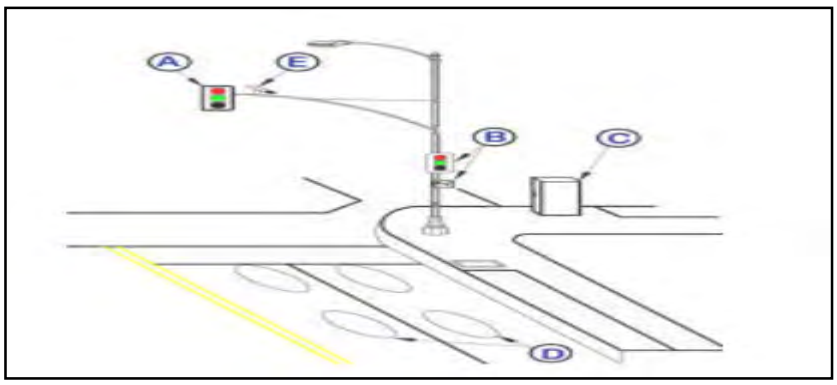

Figure 1.1: Traffic signal elements

A) Main display with Red, Green and Yellow lights
B) Pedestrian crossing light indication
C) Traffic Signal cabinet containing the traffic signal controller
D) Inductive loops or sensors
E) Video detection system

1.1.1 Traffic light display

Conventional traffic signal lighting utilizes a standard light bulb. Typically, a 67 watt, 69 watt, or 115 watt medium-base light bulb provides the illumination. Light then bounces off a mirrored glass or polished aluminum reflector bowl, and out through a polycarbonate plastic or glass signal lens.

Figure 1.2: Halogen bulb traffic light

Traffic light in Malaysia had pass through from halogen bulb to LED. However it is still common in some areas. The transformation from halogen bulb to LED is due to the disadvantages of halogen bulb traffic light. LED type's traffic light not only solved the shortcoming of halogen bulb traffic light but also provides more advantages compare to halogen types traffic light. The new traffic lights are made out of arrays of light emitting diodes (LEDs). These are tiny, purely electronic lights that are extremely energy efficient and have a very long life. Some other advantages are:

- LEDs are brighter. The LED arrays fill the entire "hole" and have equal brightness across the entire surface, making them brighter overall.
- LED bulbs last for years, while halogen bulbs last for months. Replacing bulbs costs money for the trucks and people who do the work and it also ties up traffic. Increasing the replacement interval can save a city big dollar.
- LED bulbs save a lot of energy.

Figure 1.3: Various types of LED traffic light display

1.1.2 Pedestrian crossing light indication

Figure 1.4 Pedestrian crossing light indication

Pedestrian crossing light indication is provided at crossings to guide or assist pedestrian in safe passage across the road. This is done when the main traffic light turns red, it will indicate pedestrian crossing light to turn green. Finally, pedestrian are able to cross using the zebra crossing line to reach the other side safely.

1.1.3 Traffic signal cabinet

Today's modern traffic signals and related systems are complex at the intersection level and system level. Micro – processor based and Program logic controllers are widely used for traffic light controller.

This kind of controller is normally placed at each junction in order to provide the communication to each traffic light at the junction.

1.1.4 Inductive loop and sensor

Figure 1.5: Inductive Loop Traffic Detector [2]

The primarily usage of Inductive loop is to detect the presence of cars and to alter the regular sequence of traffic light. If the presence of cars are not the in the area, the inductive-loop traffic detector will pick up this signal and will send to the controller and eventually adjust the timing of the traffic signal. In addition, it will reduce the congestion in areas installed with this device.

1.1.5 Video detection system

Video detection system is used to principally to monitor the total congestion area of the traffic. Besides that, this video detection system is a great way to curb over speeding in prominent area by capturing any moving vehicles passing after the traffic turns red.

1.2 Traffic light and Traffic Management System

1.2.1 Manual fault alert approach

Figure 1.6: Manual fault alert approach

Manual fault alert approach is the method widely used in many countries to detect faultiness in traffic light system. This method is fully depends on user's complain where authority person would take action once they received complaints from users. However, this approach is not so efficient in current practice system.

1.2.2 Online fault reporting

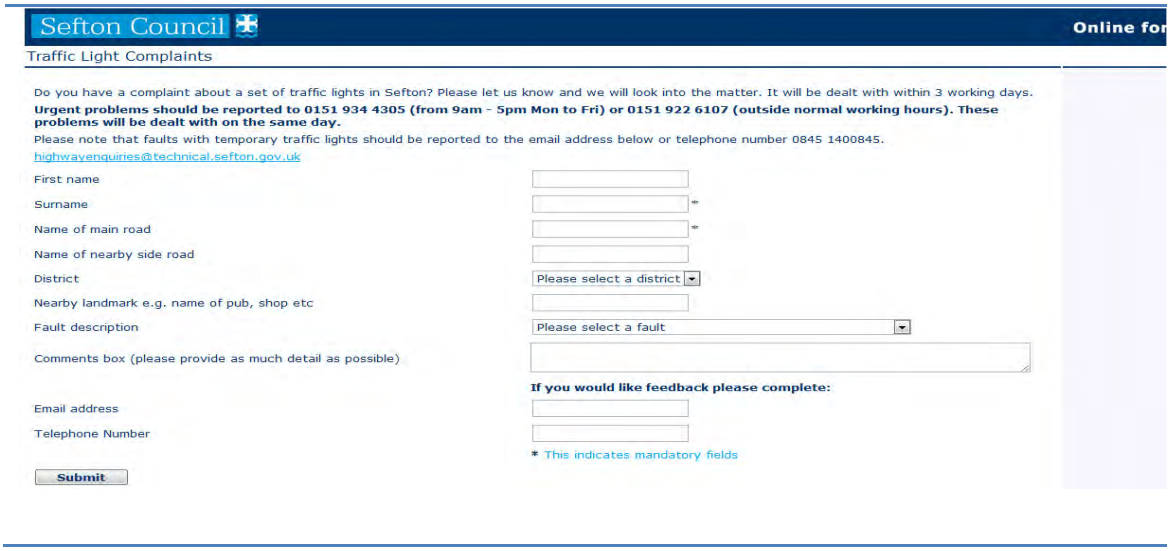

Figure 1.7: Online traffic light fault reporting [3]

Online fault reporting tools is one of the latest methods used by Europe countries. Where, users able to report the fault on traffic light and the timing problem via online. Faults report will be forwarded to the contractor and would be rectify according to the fault priority. Meanwhile, timing problems may require investigation over a few days to determine the exact cause but will generally be corrected quickly and any necessary adjustments to our traffic control computer system will be carried out accordingly.

1.2.3 Computerized traffic management

Figure 8: Computerized traffic management

Computer monitors the traffic signal 24 hours a day and traffic engineers use this information to make signal adjustments. All traffic signals are programmed with special timing plans to improve traffic flow. This system also include with closed circuit television (CCTV) cameras which are used to monitor traffic flow along major arterial segments to ensure that traffic synchronization is working properly. However this is not practical to implement such system at each junction since the cost of installation and maintenance are very high.

1.2.4 Red light enforcement

Figure 9: Red light enforcement camera

Red light cameras are located at critical intersections. The locations are based on safety needs, where collisions and the number of violations took place. A high – level security encrypted digital video camera system is installed at each approach of the intersection and records those motorists that violate the red light indication. Cameras take picture of the license plates of vehicles which run in red light. This information is used to automatically mail tickets to offenders [4].

1.3 Novel Approach for single display traffic light with real time fault management system (Green Traffic Light)

A new approach for single display unit for traffic light system is designed and developed based on problems unseen over the conventional three display unit. Traffic light is playing a major role in ensuring road user's safety at in and out of any junctions. For the day of traffic lights were invented till today, the three colour display unit is widely used and the only system available in the world.