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JUDUL: “MODELING OF TRAFFIC LIGHT CONTROL SYSTEM USING VISUAL BASIC”

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## **ABSTRACT**

Traffic light is one of the instrument which is used to control the traffic congestion, especially in the urban city. Based on the incremental of population and development of automotive industry, traffic congestion will be more critical. This project will produce traffic light system which used Visual Basic programming. This traffic light system is combination of two main components which is hardware and software. Basically, this traffic light system is programmed by Visual Basic 6.0 and controlled by personal computer. Then it will be connected to the traffic light through serial port or parallel port as the interface. Beside, this project used sensor to detect the vehicle which is come from any direction. Through this project, an efficient traffic light system will be produced.

## **ABSTRAK**

Lampu isyarat adalah suatu alat yang digunakan untuk mengawal kesesakan lalulintas yang berlaku terutama di bandaraya besar. Dengan pertambahan penduduk yang semakin meningkat dan perkembangan di dalam industri automotif, sudah tentu kesesakan lalulintas yang berlaku semakin kritikal. Projek ini adalah untuk membina satu sistem lampu isyarat menggunakan satu program yang dikenali sebagai 'Visual Basic'. Secara amnya, projek ini adalah kombinasi antara komponen perkakasan dan perisian. Pada asasnya sistem lampu isyarat yang telah diprogram menggunakan 'Visual Basic' dikawal oleh komputer peribadi dan komputer ini disambungkan terus kepada lampu isyarat melalui 'serial port' atau 'parallel port' sebagai satu pengantara di antara komputer peribadi dengan lampu isyarat. Selain itu, dalam projek ini juga penderia digunakan untuk mengesan kenderaan yang datang dari sesuatu arah. Hasil daripada projek ini, satu sistem lampu isyarat yang lebih cekap dan berkesan dapat dihasilkan.

## **DEDICATION**

*Specially dedicated to  
my beloved parents who have encouraged, guided and inspired me  
throughout my journey of education*

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## **LIST OF ABBREVIATIONS, SYMBOLS, NOMENCLATURES**

PC	-	Personal Computer
PLC	-	Programmable Logical Controller
VB	-	Visual Basic
LDR	-	Light Dependent Resistor

# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 Background**

Traffic light is a signaling device that positioned at intersection. The purpose of building the traffic light is to control the traffic movement on the road in urban area especially at intersection. Generally, traffic light contains three lamps namely red, yellow and green. Each lamp has their own signal for example red light means the driver must stop driving, yellow light means ready to stop and green light means go or continue their journey.

A few advantages of generating traffic light on the road such are to reduce congestion in urban areas especially during peak hour; reduce and avoid accident; and make human more discipline to follow road rule.

Traffic light has existed since several years ago and controlled by Programmable Logical Controller (PLC). However, the purpose of this research is to create a new type of controller for the traffic light system so than an efficient system can be achieved by using a programming language called, Visual Basic.

### **1.2 Problem Statement**

Nowadays, traffic congestion has been causing many critical problems and challenges in most cities of modern countries.

A traffic signal is typically controlled by a controller inside a control panel box. The controller that used in control panel box is called Programmable Logical Controller (PLC) (Wikipedia, 2007).

However PLC has a disadvantage when used to control traffic light. When using PLC programming to control traffic light at four intersections, the ladder diagram for the program are too long and it becomes more complex and difficult to understand and troubleshoot (Lin *et al.* 2003).

This project will implement Visual Basic (VB) to control the traffic light. Visual Basic is development tools that can be used to build application that perform useful work. The most important advantage of Visual Basic is that it has been designed to increase productivity (Petroustos, 1998).

### **1.3 Objectives**

The objectives of the project are:

1. To develop a model of traffic lights at three intersection.
2. To develop programming of controlling the traffic lights using Visual Basic software.

### **1.4 Scope of project**

This project will focus on programming to control the traffic light via personal computer (PC). The program can be done using programming language such as Visual Basic 6.0.

Basically, the idea is to connect the output to PC via parallel port. Then, the output is controlled using program written in VB language. To implement this project,

the software will be connected to traffic light model using parallel port cable between PC and a model.

This project is developed using LEDs as output; parallel port; sensor as a switching element to detect when car arrive at the intersection and Visual Basic software to make a program of traffic light to control the system. Sensor that used in this project is light dependent resistor (LDR). Sensor is used in this traffic light model so that an efficient traffic light system can be achieved. Efficient traffic light system means by using LDR sensor, the sequence of light have been change when the sensor is trigger. Thus, by using VB, a traffic light system can be created by integrating the hardware and software component used in this project.

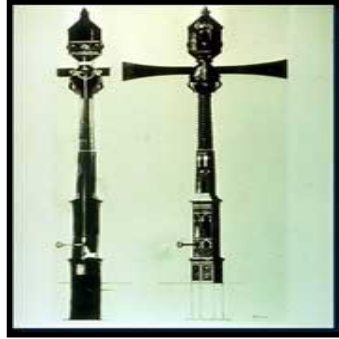


## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 HISTORY**

According to the history of traffic light, the first light was installed in London on 10 December 1868, near the houses of parliament to control so much horse-drawn traffic at that time motorized vehicle were still in the future. This traffic signal using a colored light called a semaphore. The purpose is to provide a safe crossing for pedestrians, especially members of Parliament. A semaphore is a tall post with moveable arms. Figure 2.1 shows a semaphore that used as a traffic signal. A semaphore has an arm and if the arms stuck straight out sideways, it means stop. While at night a gas light at the top of semaphore was lit. The light had a red lens for stop and a green lens means go. In 1910 and 1920, many cities in the United States started using traffic towers. Figure 2.2 shows the traffic tower that was installed at Detroit in 1917. This tower is small and locates in the middle of a street or intersection. Inside the tower has an officer that operated the color light or semaphore. In 1920, Detroit becomes the first city to use three color of light red, green and yellow to control traffic. Once automated signal were invented, no more officer inside the tower and traffic tower operate automatically (Regenold, 2007).



**Figure 2.1:** A semaphore (Regenold, 2007)



**Figure 2.2:** Traffic tower (Regenold, 2007)

From year to year, technologies have changed so fast. From the advanced technology, Charles Adler, Jr and Henry A. Haugh as a new designer have improved the system of traffic light from manually to automate especially in traffic detector. According to Charles Adler, Jr, sonic vibration can made the mechanism to shift electrical circuit and changed the light. The signal comes from a vehicle horn. The drivers have to honk their horn and the horn have detected by microphone that mounted at intersection. After that, sonic vibration will be produced. Another type of detector is pressure detector. Detector has sensed the pressure of passing vehicles and the pressure caused by two metal strips touch each other then sent electrical impulses to the controller. Controller will produce the output (signal light) (Regenold, 2007).

Uniform Traffic Control Device is one of the organization, that standardized the manual of traffic signal device. This organization standardized the colored lights for traffic light that consist three colors namely red, yellow and green. If colored light same at all country, the drivers did not have to figure out unfamiliar signal. For old version, LED that used for traffic signal also use 10-25 watts but today to make an efficient traffic signal, LED is changed to incandescent light bulbs which used 175 watts (Regenold, 2007).

The first automatic traffic light was installed at Princes Square in Wolverhampton. Nowadays, traffic lights are often operated by Complex Computer Software to optimise traffic flow (BBC, 2006).

Currently, traffic light is operated by using programmable logical controller. The basic component of traffic light still same have three signal lamp; red, yellow and green and a controller. Some traffic light has additional equipment, for example digital counter that mounted at the traffic light itself. Figure 2.3 shows the present traffic light that use in the road and Figure 2.4 shows traffic light with timer .



**Figure 2.3:** Present traffic light (Maikschroeer, 2006)



**Figure 2.4:** Traffic light with counter (Maikschroeer, 2006)

## **2.2 CONTROLLER**

### **2.2.1 PROGRAMMABLE LOGICAL CONTROLLER (PLC)**

According to Blacharski (2008), programmable logical controller is a control device that consists of a programmable microprocessor and it is programmed using a specialized computer language. Programmable logical controller contains a variable number of input/output (I/O) ports called I/O modules and typically PLC also can reduced instruction set computer (RISC) based. PLC applications are found in both process industries and discrete manufacturing. In discrete manufacturing industries, PLC can control individual machines, machine cells, transfer lines, material handling equipment and automated storage system (Groover, 2008). However, PLC also can be applied to control traffic light system. For the recent controller for traffic light, they have use PLC to control the traffic flow. Figure 2.5 shows the control panel box and generally all the component include PLC are stored in the control panel box and this panel box is connected to the traffic light.



**Figure 2.5:** Control panel box (Samsudin, 2007)

The first controller that use in control the traffic light by using time relay system (TRS).The major components of this system are Timer and Relay. This controller usually use at the small junction or at the non-busy junction and also compatible for pedestrian crossing. The advantages of this system are at their cost which is less than ITS Controller, and easy in maintenance. Besides that, to wiring the TRS system is more easily and need less time compare to the ITS Controller. For the recent system, Intelligent Traffic System (ITS) controller is a traffic controller using the Programmable Logic Control (PLC) as a processor and the Malaysian Area Traffic Control System (MATC) software as an interface to control the flow of the traffic light system. This controller has more capability compare to the Time Relay System (TRS). In other word, it is an upgraded or the backward compatibility for the Time Relay System (TRS) controller. The Programmable Logic Controller (PLC) is the main part of the ITS controller. Figure 2.6 shows the PLC unit that use in traffic light control system. Its operation depends on the software installed inside its memory card according to the ladder diagram. The ITS controller are totally controlled by the PLC; the traffic light operations. Usually, the OMRON CQM 1H with CPU51 for its central processing unit (CPU) is used where its input and output depends on the condition of the junction; such

as the number of phase, loop sensor (detector card) connected to (ID212), the usage of the countdown system (OD 212), and others (Samsudin, 2007).

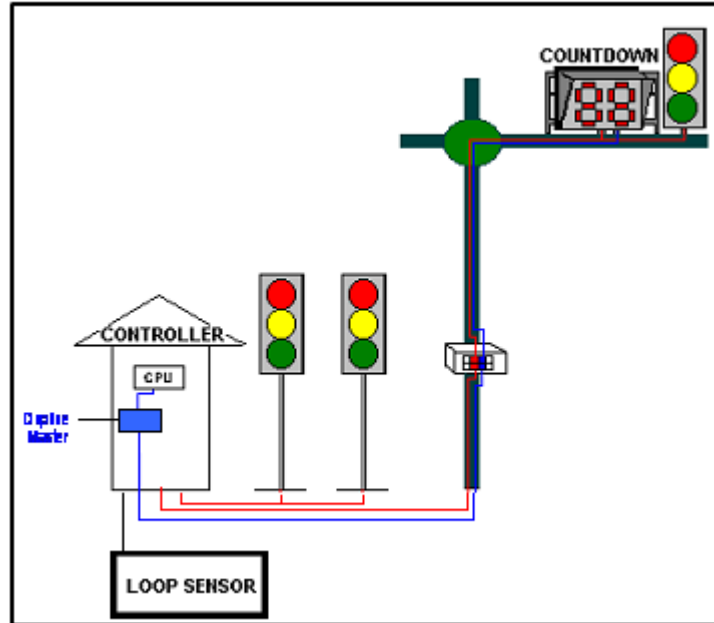


**Figure 2.6:** PLC unit (Samsudin, 2007)



**Figure 2.7:** Completed controller wiring (Samsudin, 2007)

To build the complete controller using PLC, there are a few component that must be used such as PLC unit, PCB-D plate (terminal plate), green conflict detector and lamp detector, connector (termination plate), detector card, relay and solid state relay (SSR) card. Each component has their own function itself. Figure 2.7 shows the completed controller wiring and Figure 2.8 shows overview of traffic light system. (Samsudin, 2007)



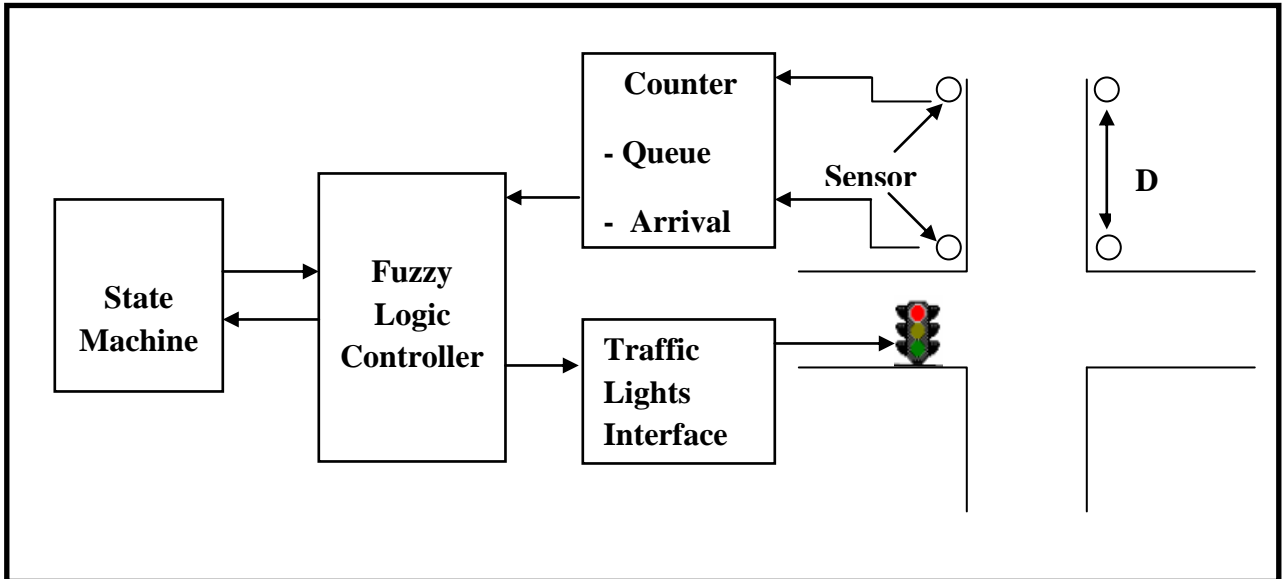
**Figure 2.8:** Overview of traffic light system (Samsudin, 2007)

## 2.2.2 INTELLIGENT TRAFFIC LIGHTS CONTROL BY FUZZY LOGIC

According to Kok *et.al* (1996), they have designed and implemented of an intelligent traffic light controller based on fuzzy logic technology. They used software based on Visual Basic to simulate an isolated traffic junction. Basically, there are two types of conventional traffic light control system. One type of control uses a preset cycle time to change the light and another type is combination between preset cycle times with proximity sensors. By using software that they developed, both conventional preset cycle time and fuzzy logic controller can be simulated in the software. Analysis can be done such as waiting time, density and cost.

A fuzzy logic controlled traffic light used sensors and this sensor will count cars instead of proximity sensor which only indicate the presence of cars. Figure 2.9 shows the structure of a fuzzy logic traffic light control system. In this system, they used two electromagnetic sensor that placed on the road at each line. First sensor count the number of cars passing the traffic light and the second sensor count the number of cars

coming to the intersection at distance  $D$  from the light. The number of cars between two sensor will be determined by the different of reading. Fuzzy logic controller is responsible for controlling the length of green time. The purpose of state machine is to control the sequence of state fuzzy traffic controller.



**Figure 2.9:** Structure of fuzzy logic traffic light control system (Kok *et.al*, 1996)

### 2.2.3 SOFTWARE BASED VISUAL BASIC (VB)

For the beginning, to understand basic of programming is more important. Generally, computer program is an organized list of instruction, when executed the computer can predetermined manner. Therefore, programming means designing a set of instruction to ask computer to do certain jobs (Liew, 2008).

In this project, traffic light control is achieved by using software based. In the programming world, there have a lot of programming language such as Visual Basic, Fortran, Cobol, Java, C++, Turbo Pascal, Assembly language and etc. Each of these programming languages has their own criteria such as the concept of programming, advantages and disadvantages of using that language. Mainly, in this project, software based that will be use to control the traffic light is Visual Basic (Liew, 2008).