Traffic Light Control System Design Using Omron PLC With Ladder Diagram Method

Azpadli Rozali

Universitas Imelda, Indonesia
Email: Azpadli@gmail.com

Received: 14 April 2020
Revised: 25 Mei 2020
Accepted: 29 Mei 2020

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Abstract
At this time, traffic congestion is a problem that many big cities face, especially at intersections. Traffic jams at intersections occur a lot because they are caused by the traffic light regulation system that is not in accordance with the traffic light settings which can be changed at any time. The design of the traffic light simulation control program is deviated by four. The program is made with 4 models, namely the all-light flashing model, the flashing yellow light model, and a different one-way model. The current traffic light regulation mostly uses a fixed time setting system where the lights are set to work on a fixed time basis, regardless of the ups and downs of traffic flow. Therefore, offered a detector system (traffic actuated) by utilizing PLC (programmable logic controller) as a controller. This research is made a simulation tool with PLC Omron. The working process of this tool is in the form of sending input from sensors installed on the road, where this sensor detects the presence or absence of vehicles.

Keywords: Detector System, PLC Omron, Traffic Light Simulation.

INTRODUCTION

Automation is needed in this life. Along with the progress of the times that require human work to be more effective and efficient, an automation system is needed[1]. This technology has led to improvements in terms of communication and information technology[2]. Along with the problem of traffic flow / congestion on the highway, especially in big cities in Indonesia, the author tries to design a traffic signal simulation system based on PLC Omron CPM1A using density sensors or often called Traffic Actuated Signals, to reduce traffic density in big cities in Indonesia. Simulation process of traffic light signs based on PLC Omron CPM1A uses two working systems, namely: manual system and automatic system. Where the manual system works by using a predetermined time (timer), while the automatic system works by using sensors, the sensor works when a vehicle crosses the sensor with an interval of 40 seconds. In the design of the Omron CPM1A PLC-based traffic light simulator, the simulation results are either input or output voltage measurements and input or output current measurements according to the tool system made. This traffic light control system uses a Programmable Logic Controller (PLC) based control system. The PLC used is Omron brand, with type CP1E - N20DR - A programmed by CX-Programmer in the form of ladder diagram[3]. Operationally, the performance of the equipment components is regulated through the CP1E Programmable Logic Controller (PLC).[4]. In making ladder diagram programs, researchers use the state
diagram method because this method can arrange ladder programs well[5]. The traffic light system establishes priority rules at junctions in order to improve user safety. Once linked, it takes into consideration all available data in order to fit real-time traffic, vehicle priority hierarchy, and other events that may have an influence on traffic.

METHODS

Detector System
The simulation section shows that the signal detector performance analytically has similar results to the Monte Carlo simulation[6]. The development process consists of requirements analysis, tool design creation, tool performance simulation using software and prototyping[7]. This prototype uses an OMRON PLC as a controller and monitors connected devices[8]. In the prototype there is a level switch sensor that is able to detect movement[9].

Omron PLC
PLC (Programmable Logic Control) is an equipment system that is used to control an equipment or other system by using a logic circuit that can be programmed as needed.[10]. Programmable Logic Controller is an electronic device that works digitally has a programmable memory, stores commands to perform special functions such as logic, timing, and counting to control various types of machines through analog or digital input-output modules.[11]. PLC (programmable logic controller) is basically a computer specifically designed to replace relay-based systems. By using a PLC, each system design has a different amount, generally the ratio of input and output to a PLC is 60 percent versus 40 (18 input terminals and 12 output terminals)[12]. PLC is connected to components consisting of push buttons to activate or deactivate the circuit, switch selector functions as a regulator of the circuit to function manually or automatically, indicator lights as an information provider for the circuit in active or inactive conditions, sensors[13] as a traffic jam detector. The system has been tested using a timer to determine the movement of the motors[14].

Traffic Light Simulation
The traffic light control system is an activity to regulate the turn of traffic lights on each road section at the intersection with the aim of reducing congestion at each intersection. The Q1614 axis camera is used to record violations that occur at a fork in the road[15]. Arrangement the traffic light control system can only be done by the company by programming the traffic time with a computer which is done directly. The current time setting procedure is as follows:
1. Sehas monitoring is carried out if there is a change in the level of vehicle congestion and road conditions, then the traffic light control system is set up by first looking at the control system used.
2. ifa the control system used uses a manual system, the traffic officer calls a technician to adjust the time for changing traffic lights.
3. Fork don settingsn system traffic light controlu lints listenn how to program an application by changing the time.

See procedures for setting up traffic control systems and monitoring road conditions are a problem of the level of vehicle congestion at intersections, so to facilitate a smooth journey a new system is needed for monitoring and regulating the traffic light control system. Directly controlling the traffic light control system requires a computer that can adjust the turn of the traffic light by setting the computer's parallel port output as a digital switch
input.

The following are the requirements for hardware and software to support this system running:

a. Minimum Processor Pentium IV
b. 120GB Hard Drive
c. 1GB RAM
d. And other standard computer devices
e. Windows XP Professional Operating System
f. Microsoft Visual Basic 6.0
g. InOut.DLL

RESULTS & DISCUSSION

Testing Data With VB 6.0

In this simulation problem will be solved using the Ladder Diagram method which does use a rule that makes the traffic light simulation system easier to develop. The priority in this system is how to set the time for the green and yellow light positions, the red color does not need to be set because the system will automatically activate the red light if the green light condition is up. In this simulation, to make it easier to determine the waiting time, a constant value is made, namely the respective values for each green and red light, following the form.

![Traffic Light Simulation Display](image)

Figure 1: Traffic Light Simulation Display

The problem of traffic light is how to adjust the speed of the lights based on dynamic time which can be adjusted based on the density of the car, for this simulation it takes the same principle, the only difference is that the time can be entered manually. The above method can be seen in the explanation below and the program listing:

```
Input
Initialize time for green and yellow lights
Automatic red light set.

Process
Count the green light time
```
If the green light runs out, turn on the yellow light
If it runs out, turn on the green light in the other corner and do it
Rotation for each angle
Output
The output is if the light is green then the car is moving
Done.
Dim ctl As Control

Out &H378, 256
Out &H37A, 11

For Each ctl In Me.Controls
  If TypeOf ctl Is Shape Then
    If ctl.Name = "shpLampRed" Then ctl.BackColor = RGB(70, 0, 0)
    If ctl.Name = "shpLampYellow" Then ctl.BackColor = RGB(70, 70, 0)
    If ctl.Name = "shpLampGreen" Then ctl.BackColor = RGB(0, 70, 0)
  End If
Next

Select Case Index
  Case 0
    Out &H378, 1 + Val(Inp(&H378))
  Case 1
    Out &H378, 2 + Val(Inp(&H378))
  Case 2
    Out &H378, 4 + Val(Inp(&H378))
  Case 3
    Out &H378, 8 + Val(Inp(&H378))
End Select

Simulation Program
For the implementation of this system required specifications of a standard computer. And those who follow the rules and regulations so that there are no errors and are expected to first understand the meaning and understanding of the traffic light queue.
The steps in implementing the system are as follows:
a. Simulation Main Menu Display
Figure 2: Simulation Display
This display is to see a traffic light simulation from 4 street corners, with different time settings, pay attention to the simulation results in the image below:

Figure 3: First Simulation Display
Figure 4: Second Simulation Display

For convenience, it can be illustrated with the following flowchart:

![Flowchart Image]

**Figure 5: Simulation Main Flowchart**

The flowchart above describes the overall process of the designed simulation system, from the splash screen to the about form.
CONCLUSION

Based on the results of the discussion and design of the Traffic Light Control System simulation, it can be concluded that: In making this simulation using the Visual Basic 6.0 programming language as a software controller circuit of the Traffic Control System. This series of traffic light simulation systems (hardware) is designed using Visual Basic 6.0, a microcontroller, and as an interface (relationship) between the circuit and a computer using a serial port communication channel. This system simulation is to make it easier to create a traffic light program so that it can run the Traffic Light Control System. The simulation work process of the Traffic Light Control System in this system will automatically control the road in congested conditions or not the traffic flow.

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