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Intelligent Traffic Light Based on PLC Control

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Intelligent Traffic Light Based on PLC Control

Lin Mei [1, a], Zhang Lijian[2,b], Wang Lingling[3,c]

[1,2,3] Binzhou Polytechnic No.919, Huanghe 12 Road,Binzhou, Shandong Province
E-mail:[a]Linq_0324@163.com, [b]41350992@qq.com, [c]1041436154@qq.com

Abstract. The traditional traffic light system with a fixed control mode and single control function is contradicted with the current traffic section.The traditional one has been unable to meet the functional requirements of the existing flexible traffic control system.This paper research and develop an intelligent traffic light called PLC control system.It uses PLC as control core,using a sensor module for receiving real-time information of vehicles, traffic control mode for information to select the traffic lights. Of which control mode is flexible and changeable,and it also set the countdown reminder to improve the effectiveness of traffic lights,which can realize the goal of intelligent traffic diversion.intelligent traffic diversion.

1. Introduction

With the development of urbanization, the problem of urban traffic congestion has attracted more and more attention, and the traffic congestion has become a major problem restricting urban development.

Cities have built high-speed road, main road, the subway to play its expected role, and the same sections in different periods of the traffic condition, how to adopt the suitable control method, the maximum advantage of one city road, reduce traffic congestion in peak road, has become a problem to be solved in the traffic control.It can be seen that improving traffic light control system and improving its flexibility and adaptability to realize intelligent traffic guidance is the trend of future development.

With the development of industry 4.0 and intelligent automation, programmable control module PLC is widely used in various fields due to its control of simple, flexible, intelligent and stable feature.PLC has higher reliability and better stability relative to embedded controller, and it can collect and extract external signals quickly.Using PLC to realize traffic lights control also gradually become the mainstream of traffic intelligent control, on this basis, we discuss PLC to realize a variety of mode conversion control with intelligent counting control traffic lights.

2. Function Description

According to the actual situation,this paper select the main road traffic signal model of travel through Binzhou Polytechnic as the research object. The location is a comprehensive business district of schools, kindergartens and large shopping malls. The road is spacious and the planning of transportation facilities is in line with the latest traffic construction standards.However, due to the existence of schools and shopping malls , the traffic volume is large and the traffic jams are easy to occur,How to develop a set of traffic light control system which can effectively solve its traffic control,to realize intelligent traffic guidance function of peak time, improve the efficiency of transportation, become the research problem in this paper.
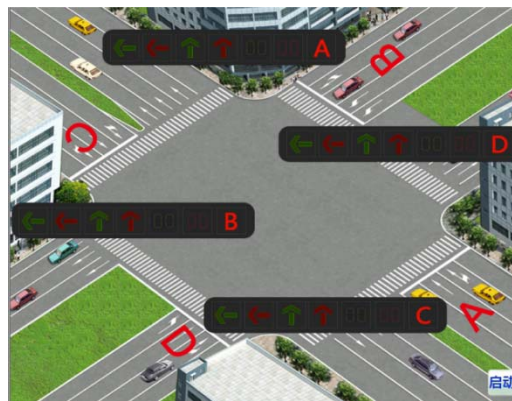
Figure1. traffic light simulation diagram

The scenes are shown as follows: the road not only has the conventional control function: such as AD road and BD road lights display cycle: On the basis of the original signal light, it is optimized to use direct line and left-turn sections, while adding countdown alarm and flashing warning.

In this paper, a kind of automatic switching mode based on time period and traffic ratio is adopted.In intelligent working mode, the traffic light time can be adjusted according to the traffic flow of AC and BD.The design control system has the advantages of high reliability and real time.As shown in figure 1, the traffic light simulation diagram.

3. Design ideas

The whole system adopts Siemens PLC as the control core, and uses the dual laser photoelectric sensor to collect the traffic signals.The PLC uses comparison operation instruction to realize the output of traffic signals and the intelligent selection of working mode based on the comparison of traffic flow.The work mode is divided into intelligent working mode, routine work mode and night work mode.The overall design idea is shown in figure 2: the whole system is calibrated by the internal clock of PLC.The system function is divided into daytime and evening hours.
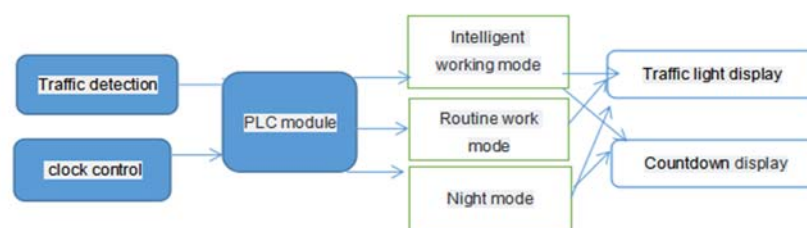
Figure 2. Overall Design Diagram

During the day time, according to the road travel condition and internal clock, we subdivide it into the peak segment and the normal section,The sensor module is used to collect the traffic signal of the vehicle, and the signal acquisition frequency is set in the peak segment for every 10 minutes.The normal segment is a cycle every 20 minutes, and then according to the traffic flow of the road according to the traffic lights, the traffic light work mode is calculated and selected.The normal period of detection is 20 minutes.The system then calculates and selects the traffic light work mode according to the traffic flow of the road according to the traffic lights.For each test, the work cycle was 40 minutes.In the evening, the sensor module stops working, and the traffic light realizes the signal output of traffic lights and the countdown display function in the night working mode.

4. PLC Hardware Design

PLC selection, according to the requirements of control, the system needs to one start switch and a stop switch, four vehicle detection sensors in AD and BC road, due to AD road the vehicle detection

sensor can share one input point, BC road vehicle detection sensor can share one input point too, Therefore, the system requires a total of four input points.The output part includes the signal lamp and the countdown time, which includes four light signals a red light straight, a red light turn left, a green light straight, a green light turn left. The countdown module needs to have a red light countdown display,The green light countdown shows,Each of the countdown requires two digital tubes to display, and a total of 16 output points are required.Considering the cost factor, the system of Siemens S7-200 PLC host adopted CPU226 (16 input point, 24 dots), plus two EM222 8-way output extension module, can provide a total of 26 input and 16output points, meet the needs of system control.According to the control requirement for input and output allocation, the distribution table is shown in table 1:

Table 1. I/O assignment table

Input		Output			
SB1	Repeater switch	Q0.0	A/C the green light	Q1.0	A/C digital red tens
SB2	Stop switch	Q0.1	A/C goes straight to the red light	Q1.1	A/C digital green tens
S3	Photoelectric switch	Q0.2	A/C left green light	Q1.2	A/C digital red ones
S4	Photoelectric switch	Q0.3	A/C left red light	Q1.3	A/C digital green ones
		Q0.4	B/D direct green	Q1.4	B/D digital red tens
		Q0.5	B/D goes straight red	Q1.5	B/D digital green tens
		Q0.6	B/D left green light	Q1.6	B/D digital red ones
		Q0.7	B/D left red light	Q1.7	B/D digital green ones

In practical application, traffic light control needs to consider the function of remote monitoring and operation in the process of electric power consumption.In hardware design, it is necessary to separate the power supply and control line, and it must be used safely.Therefore, in this design, short circuit protection is introduced in the power supply end, which can be controlled by the starting switch to control the intermediate relay, and the regular contact point of the intermediate relay is used as the PLC to connect the signal.

5. PLC software programming

On the system, load the initialization data, press the remote start button, the system starts to work normally, the relay closes the acquisition system time, and the time is used to check the module in real time.Its PLC ladder diagram is shown below Fig.3:
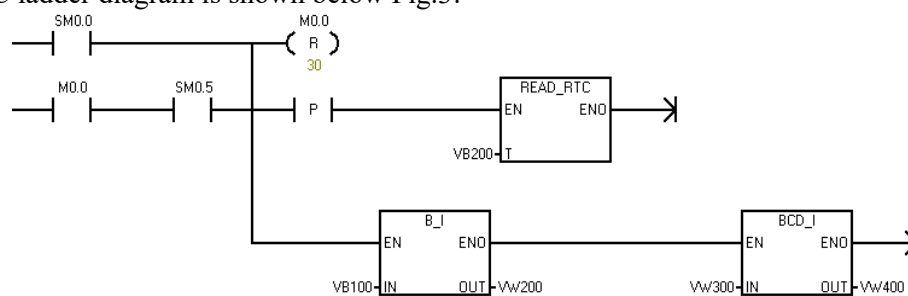
Figure3. ladder diagram

5.1 main program design

System based on PLC internal clock, judge the current time is in a period during the day or at night, if in the day time again for judgment, whether at the peak stage, if in the peak stage into intelligence work mode.

Set up vehicle detection time period AC0 to AC1, It's period can be adjusted.

In a vehicle testing cycle, testing AC to and BD to traffic, respectively in the C1 and C2 counter cycle one C1 for vehicle detection in AC to traffic, C2 is a BD to traffic vehicle detection period.

C1 and C2 flow, calculating the ratio of the relationship between in the AC4: if AC4 integer value is greater than 1, the said AC to AC4 times that of BD to traffic, traffic, set the AC show green light time to 33 s, finally to the countdown 3 s flashing reminder.

If the total value of AC4 is zero, then the AC is less than BD to the traffic flow, and the AC to the green signal time is 13s, and the final 3S can be used to remind of the countdown flicker.Red light show time for 33 s, BD to red light show time for 13 s, green light shows that time is 33 s, so repeatedly, each test time interval for AC1 - AC0 cycles, the life cycle for an hour after the test cycle, the life cycle time once again to the test vehicle.Among them, the traffic collection and trunk road of AC road is shown in the following Fig 4.
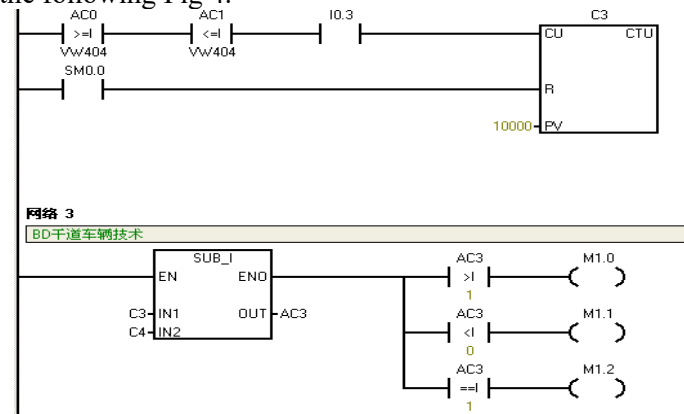
Figure 4. traffic comparison ladder diagram

5.2 Normal working mode
The programming idea of this work mode is similar to that of the intelligent work mode.In this mode, the signal light display time is set by the system, and the time that AC is illuminated for the green light is the same as that of BD, which is not intelligent.

5.3 Countdown program design
Respectively set two groups countdown digital display, turn left at AC went to the green light, green light, BD went to the green light, green light left bottom 3 s, according to the digital display is composed of bits with 10 in each group, digital tube display by multiple combination to realize the countdown timer function.

6. Conclusion
The intelligent traffic light control system developed in this research is built and programmed by the network teaching software of JINGYI. Through the debugging of the later simulation,the function has reached the development and design requirements,which can alleviate the traffic jam. The main features of this control are: to fit the actual situation and analyze the problems of the traffic light control system, to promote a way of improving. Its function is flexible.It can simulate a variety of real work condition of traffic light control .and it is maintained conveniently, installed simply.

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