6way Traffic Control System Using PLC and HMI

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ABSTRACT

Traffic control systems are widely used to monitor and control the traffic flow through the junction of many roads. Conventional traffic systems do not handle variable flows approaching the junctions. We propose system based on PLC (programmable Logic Controller) that operates the traffic control using HMI (Human Machine Interface) to monitor this operation. In the system, the original relay wiring was replaced by the program, and the hardware and software resources of PLC were used reasonably. TIA(totally Integrated Automation) portal software is used to write the ladder diagram and this PLC ladder diagram is simulated with PLCSIM software and HMI is connected with it to monitor how to operate the traffic light control system.

Keyword: - *PLC, HMI, Traffic Control System.*

1. INRTODUCTION

As the rapid increase of the number of automobiles and the transportation growing, the world face serious road traffic congestion problem. The single interaction is one of the most important in cities traffic. Of course, people implement many methods to tackle traffic congestion problem. But it is the most direct and effective method to use traffic light control. To improve the planning time of signal method are very important and reducing the congestion. The signal control method, especially for the single intersection, is enough. Lately the research of control method mainly is concentrated on the technology of artificial intelligence (e.g. fuzzy control, expert system and neural network) [1].

However the traffic problem is very complicated due to the involvement of the diverse parameters. First, the traffic flow depends on the time of the day where the traffic crowing times are generally in the morning and in the evening. Secondly, the current traffic light system is implemented with fixed delay transition time slots and does not depend on the real time traffic movement. The third point is concerned with the state of one light at the interaction that influences the road traffic at adjacent interactions. Finally, the pedestrians that cross the lanes also alter the traffic system [2].

The conventional traffic system needs to be upgraded to solve the severe traffic congestion, reduce traffic volume and waiting time, minimize overall travel time [3][4]. This paper proposes real time traffic control system to improve the traffic management. The system based on the PLC that controls the various operations, monitor the traffic signal system with HMI and change the lighting transition. Moreover, 6way traffic control system is considered for the transportation needs.

2. SYSTEM DESIGN OF TRAFFIC CONTROL SYSTEM

The designed traffic light control system corresponds to a 6 bidirectional roads. We try to test the proposed design as software firstly. Next step will be extension of the suggested traffic light control system to bidirectional junction with various configurations.

The computer system has two main functions: one collected the output signals of the PLC and displayed real-time state of the traffic lights and trolled the traffic lights. This monitor and control system was designed with the TIA Portal software using HMI.

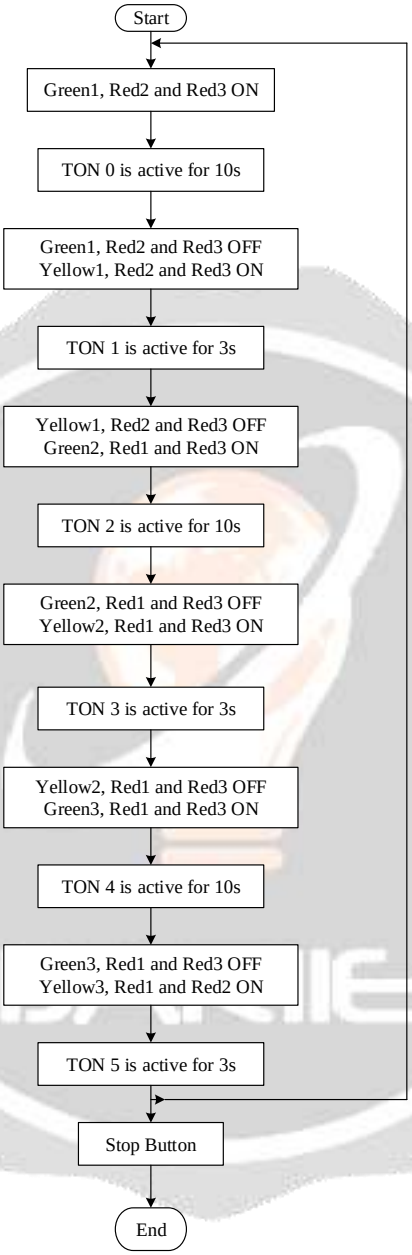

Fig -1: The program flowchart of the traffic control system

In this work, we write a program for 6way traffic light program and test this program using PLSIM software and TIA portal v13. When we create this program, we use global memory addresses for input of PLC because of PLSIM software only support global memory input. In addition, we use the device with hardware version 4.0 because of our PLCSIM v13 only support hardware version 4.0 or higher.

Our 6way traffic light program has nine rungs. In the first rung, we use %M0.0 is used as start push button of the system and output Q0.0 is used as Green1. When the start button is active, the process will start from giving output to Green1, Red2 and Red3 and then timer 0 will start counting the time and the process will run continuously.

After a successful connection between PLC and HMI, the controlling system was able to change the color of the analog signal light in the picture on the HMI by the collected data through the serial port.

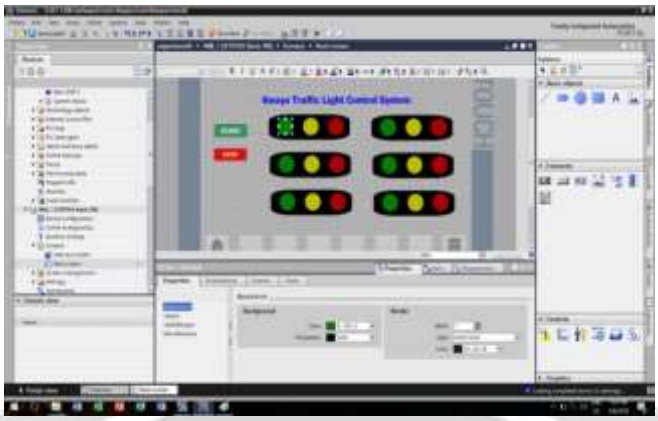

Fig -2: Creating the animations for output block

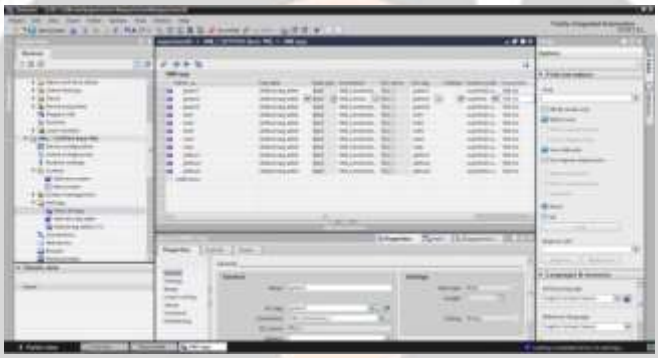

Fig -3: HMI tag table after defining all buttons and output blocks

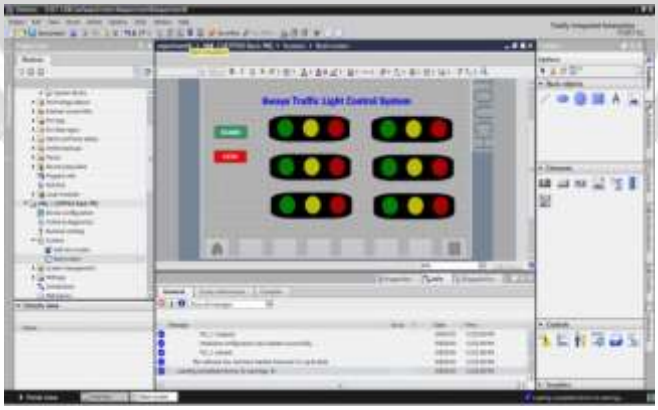

Fig -4: Ready to simulate the HMI panel for 6way traffic light PLC programs

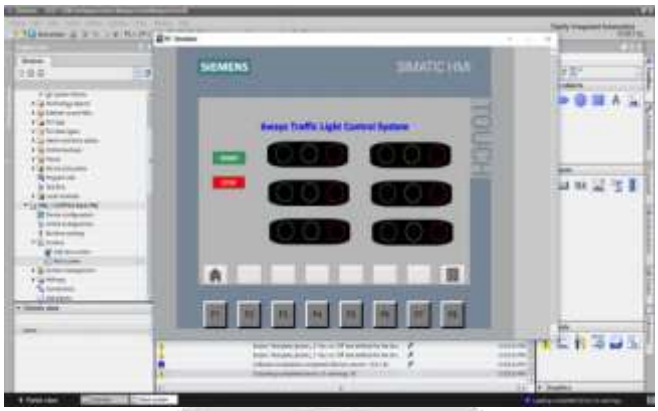

Fig -5: Screen of HMI panel for simulation

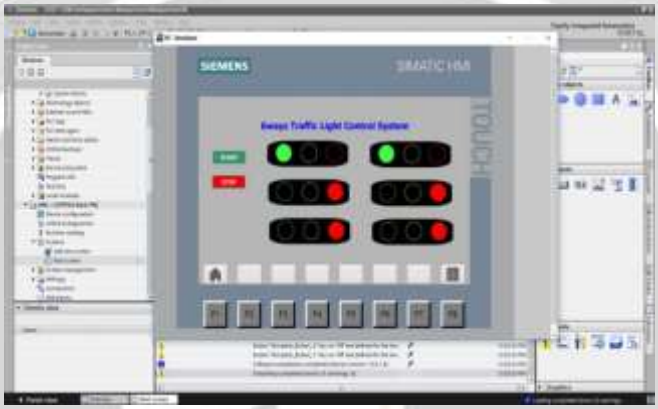

Fig -6: When press and release the start button, the Green1, Red2, Red3 and timer1 are on

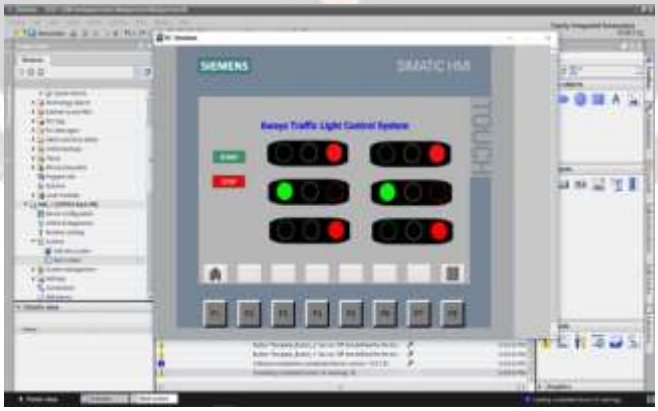

Fig -7: When timer2 is time up, the Red1, Green2, Red3 and timer3 are on

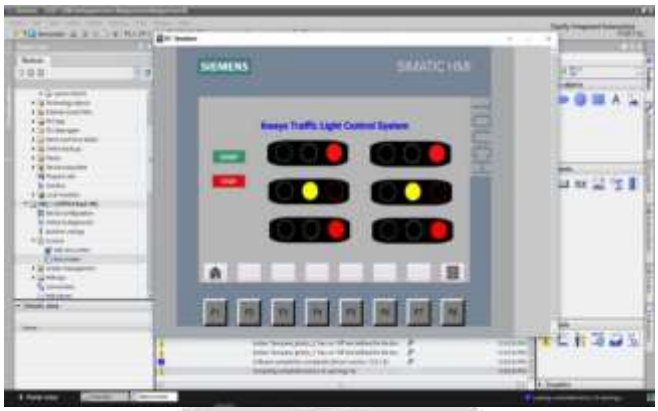

Fig -8: When timer3 is time up, the Red1, Yellow2, Red3 and timer4 are on

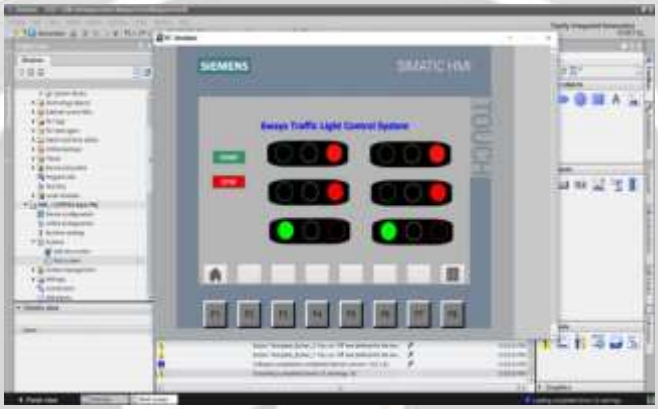

Fig -9: When timer4 is time up, the Red1, Red2, Green3 and timer5 are on

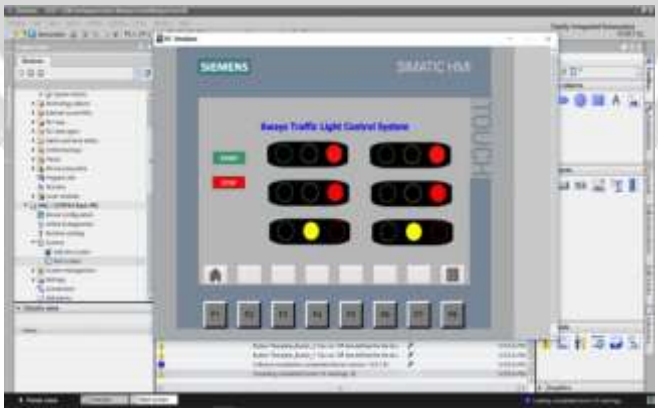

Fig -10: When timer5 is time up, the Red1, Red2, Yellow3 and timer6 are on

When we created the HMI panel in TIA portal software there were many steps. At the first, we added the new device that was 7 inches HMI panel with one PROFINET. When adding this HMI, the configuration screen appeared. We configured the connection between PLC and HMI panel, screen layouts, buttons and etc. After configuration, we drew the button form Element box to HMI panel. This button was changed in properties tap. It was changed its appearance and created two events. Two events are Press and Release. Press event was selected as

set bit which is under the bit edit. Release event was selected as reset bit which is also under bit edit. When defining these two events, we needed to define the bit address for tacking action. At this step, we wanted to create a START button for our program so we defined as start (%M0.0) which from PLC tags. After defining this tag, it was added in HMI tag table automatically. And then, we created the STOP button similar way. These steps are created input buttons of PLC in HMI panel. For the outputs, we drew some blocks and we created animations for each blocks. We changed their properties for appearance and created animations. When we created the animations, we defined the tag address for each block and creating the appearance that was the colors are changed according to its value. We created the block and its animations for each output that is desired for 6way Traffic Light PLC program.

After created the HMI panel in TIA portal, we simulated the 6way Traffic Light control system using TIA portal software for PLC program and HMI panel and using PLCSIM software for the virtual PLC device. The steps of tested and simulated results are described as the above figures.

3. CONCLUSIONS

The traffic control issue is noticeably a serious problem that worries citizens and governments. The influence of low efficient conventional traffic system affects the economic, financial and environmental domains. Our paper considered the simplest environment, however the actual situation will be more complex. The experimental results indicated that the system ran normally. We can control the traffic lights by PLC and HMI instead of the original relay control and an increase life expectancy of this system.

4. REFERENCES

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