

# Design and Research on Traffic Signal of Wireless Sensor Network Based on Labview

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**Abstract**—In order to solve the increasingly serious traffic problems in the city, how to achieve effective management and control of the traffic information has become an urgent problem that should be solved in transportation of our country. This paper proposes a design on traffic signal of wireless sensor network based on LabVIEW, including traffic signal controller, GPRS wireless modem and LabVIEW interface. It adopts GPRS wireless telecommunication as the method to transport the data of traffic signal control. This method could solve the problem of high costs and the difficult problems in using wired telecommunication cable system. Traffic signal device adopts Single Chip Microcomputer to control, introduces the information collection module by using the front-end of the HMC5883L Magnetoresistive Sensor. It describes the GPRS technology and relating properties. The traffic signal monitor interface designed by LabVIEW software, and achieves the control of traffic signal.

**Keywords**—GPRS; Traffic Signal; HMC5883L Magnetoresistive Sensor

## I. INTRODUCTION

Traffic is the lifeblood of city's economic. In recently years, taking advantage of advanced science and technology to improve urban traffic signal control system has become the consensus of traffic managers.

At present, installation and management of traffic light controller mainly is dedicated connection, the new management and installation. It need to excavate and string, which will cause great waste of resources unless wiring work is complete at the beginning of planning. In the management of traffic lights, using wireless sensor network (WSN)<sup>[1][4]</sup> has the following advantages:

- A. *Wireless sensor nodes is small size, flexible dispenser, less constrained and influenced by the monitored environment;*
- B. *It is convenient to installation and recycling the layout of wireless sensor network;*
- C. *Traffic information collection and road monitoring*

*management which based on wireless sensor network technology greatly improves the traffic condition;*

- D. *Wireless sensor network (WSN) improves the service standard of transportation and traffic operation management.*

## II. SYSTEM DESIGN

This system designs with single chip microcomputer as the core, LabVIEW interface to display, and using wireless to transfer data. According to the requirement of the design, we consider several designs about each function module. System design block diagram is shown in Figure. 1.

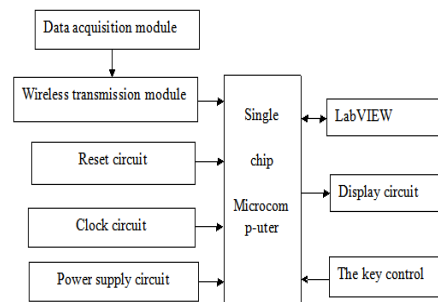


Figure 1. System design diagram

## III. COLLECTION TRAFFIC INFORMATION ALGORITHM

The Earth's magnetic field around vehicle passes place will be disturbance. According to the characteristics of disturbance signal, dynamic vehicle detection algorithm is designed. Not only consider the differences between disturbance signals in different magnetic field background environment, but also greatly reduces the complexity of the proposed algorithm which makes it implement on the limited resources of sensor nodes. A dynamic baseline measurement method, is proposed which effectively reduces time delay and improves the acquisition precision of system.



requires signal conversion circuit between the two lines, using A/D converter ADC0809<sup>[5]</sup>.

#### D. Design of Data Collection Module Circuit

In this paper, vehicle detection based on AMR<sup>[6]</sup> magnetic resistance sensor, it has good linear output in a certain linear region, using of this property can measure the variation of external magnetic field. Choosing Honeywell's magnetic resistance sensor HMC5883L, it is a three-axis AMR sensor, which has strong anti-jamming ability, good temperature characteristics, wide operating frequency, high-resolution, small size, easy to install, low price, etc.

#### E. Wireless Transmission Module

GPRS is short for General Packet Radio Service. Included in GSMPhase2.1 specification implementation, which could provide higher data rate than GSM 9.6 kb/s, the transmission rate up to 115 kb/s. Compared with the traditional circuit switching mode, GPRS introduces packet-switched transmission mode, which greatly improve the utilization rate of the wireless channel resources. Combined with the practical application environment and the requirements of the system, this paper chose to ETPro221AI GPRS module.

#### F. LED Display Circuit Design

According to the characteristics of this design, the display of red, yellow, green lights are indispensable, using ordinary emitting diode, setting up in each direction, a total of four groups. If the red is light in east-west direction, then green is light in the north-south direction, On the contrary, The result is also established. Designed K1, K2, K3, K4, K5, a total of five keys, respectively corresponding to the five kinds of traffic patterns, which corresponding to conventional traffic, north-south traffic, east-west traffic, night traffic, no thoroughfare traffic.

#### G. Filter

Electric equipment is often subject to (1000 HZ) power frequency interference, some electric equipment switch also could bring the strong electromagnetic interference. After rectifying, the DC power supply is still not ideal. It requires filter. Only a filter capacitor in parallel is needed to connect to the output of bridge rectifier. This paper designed a high-pass filter. The principle circuit design of high-pass filter is shown in Figure. 4.

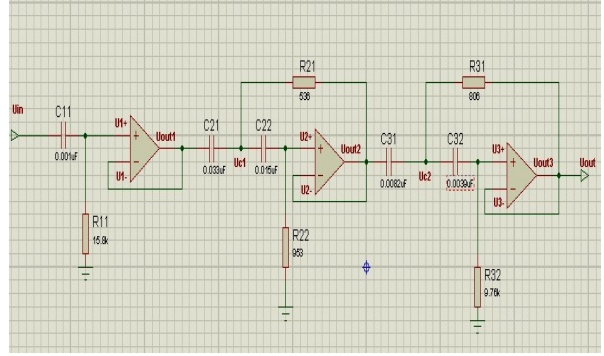


Figure 4. Principle circuit design of high-pass filter figure

Combined with all parameters of the high-pass filter circuit, it will be deduced the relationship between the input voltage and output voltage:

$$\frac{U_{out1}}{U_{in}} = \frac{R_{11}j\omega C_{11}}{1 + R_{11}j\omega C_{11}} \quad (1)$$

$$\frac{U_{out2}}{U_{out1}} = \frac{(R_{22})^2 R_{21} C_{21} C_{22} \omega^2}{(R_{22})^2 R_{21} C_{21} C_{22} \omega^2 - j\omega R_{21} R_{22} C_{21}} \quad (2)$$

$$\frac{U_{out3}}{U_{out2}} = \frac{(R_{32})^2 R_{31} C_{31} C_{32} \omega^2}{(R_{32})^2 R_{31} C_{31} C_{32} \omega^2 - j\omega R_{31} R_{32} C_{31}} \quad (3)$$

Thus, the relationship between the input voltage and output voltage is the product of the Eq. (1)(2)(3). The parameters of equation refer to as follows:  $C_{11}=0.001\mu\text{F}$ ,  $R_{11}=15800\Omega$ ,  $C_{21}=0.033\text{pF}$ ,  $C_{22}=0.015\text{pF}$ ,  $R_{22}=953\Omega$ ,  $R_{21}=536\Omega$ ,  $C_{31}=0.0002\text{pF}$ ,  $C_{32}=0.0039\text{pF}$ ,  $R_{31}=905\Omega$ ,  $R_{32}=97000\Omega$ . The stop band frequency is 1000 HZ, the pass band frequency is 10000 HZ, pass band attenuation is -3dB, stop band attenuation is -80 dB. The simulation result is shown in Figure. 5.

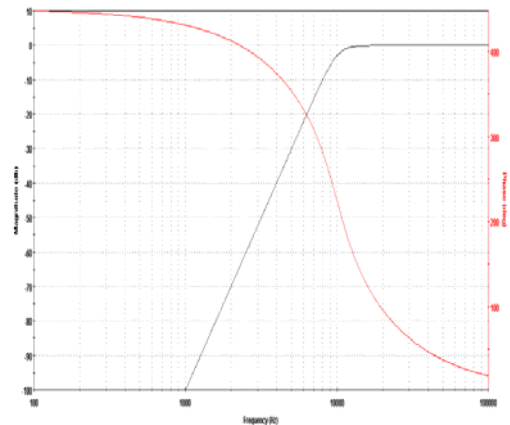


Figure 5. Simulation results of high-pass filter figure

## V. SOFTWARE DESIGN

In this paper, the traffic signal monitor interface is designed by LabVIEW<sup>[3]</sup>. System design of software block diagram is shown in Figure. 6.

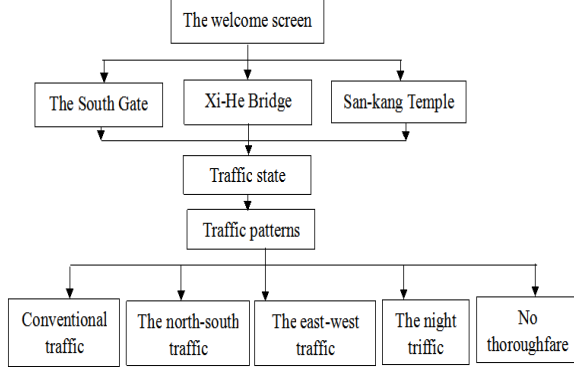


Figure.6. The system software design diagram

### A. The interface of Entering Window

System interface includes enter the initial page, display product basic information. This system provides three intersection to monitoring, and clicking different button can be observed in the operation state.

### B. Traffic patterns

The design of crossing traffic lights has five kinds of patterns: Conventional traffic, North-South traffic, East-West traffic, Night traffic, No Thoroughfare traffic.

Conventional traffic is described as follows: green light countdown 30 seconds and pass in the north-south direction, while no thoroughfare in east-west direction. Then yellow light in the two direction countdowns five seconds and the green light turns to red light in north-south direction, countdowns to 30 s, while instead of the east-west direction, the cycle is continuous. The front panel of conventional pass is shown in Figure.7<sup>[7]</sup>.

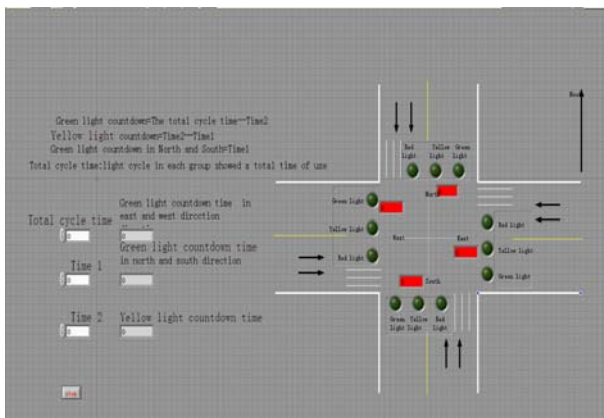


Figure 7. Conventional pass through front panel

Conventional pass program diagram is shown in Figure. 8.

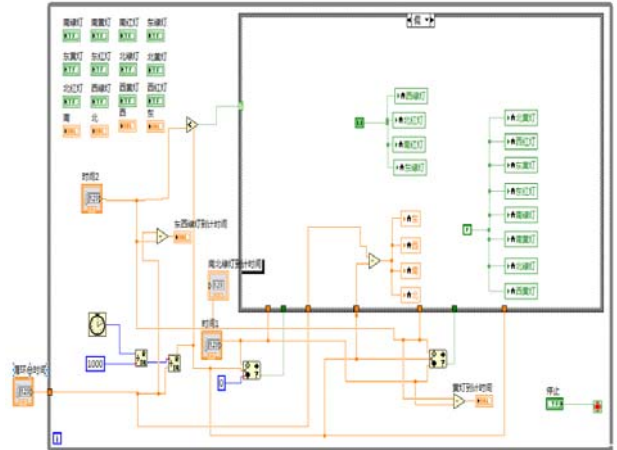


Figure 8. Conventional pass program diagram

## VI. SUMMARY

In this paper, the wireless sensor network is based on LabVIEW, which uses wireless sensor network (WSN) technology perceived as intelligent transportation front end and communication, combined with perception and fusion of GPRS technology. It provides a more convenient solution to the traffic problems. Dynamic vehicle detection algorithm is proposed, using magnetic resistance sensor for vehicle traffic caused by the geomagnetic disturbance signal. After analysis of algorithm, the system provides accurate traffic data for decision-making management of intelligent transportation in real-time.

## VII. ACKNOWLEDGMENT

The research has been supported by the Science and Technology Plan Projects of Jiangxi Provincial Education Department(GJJ12353) and the Natural Science Foundation of Jiangxi University of Science and Technology(JXXJ12046) and the National Natural Science Foundation (NO: 61163063).

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