The Research of Area Network Control of Vehicle Lights Hardware System

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Abstract. As more and more electronic devices used on the modern car, the automotive wiring is becoming more and more bloated. Therefore the CAN bus technology is used to reduce the amount of the vehicle wiring harness.

1. Introduction
The CAN node is the key of the design of the lamp control system based on CAN bus. According to whether bring a microprocessor, the CAN node can be divided into two categories: The intelligent CAN node and intelligent CAN node. We adopt the intelligent CAN node. It is composed of three parts: microprocessor, CAN controller and CAN transceiver.

The microprocessors choose 80C51 series single chip microcomputer for the node. The independent CAN controller choose SJA1000. The CAN bus transceiver adopting PCA82C250.

2. The hardware design
2.1. The vehicle network system
The CAN nodes system includes the main control node, lighting node, air conditioning node, door node and instrument node, etc. As shown in Fig 1.

![Fig 1 The vehicle network system diagram](image-url)

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Head lights node control including six control unit: left and right headlamp, left and right low beam headlamp, right and left front fog lamp, etc. Rear lights node control including six control unit: left and right rear side lights, left and right rear steering lamp, left and right rear Brake lamp, left and right reversing lamp, etc. The master node is mainly accept some switch input signal from the driver.

According to the system function requirement to design the intelligent node circuit principle diagram. As long as the individual nodes on the CAN bus, the system can work normally. Because each lamp node function requires almost unanimously, so the design CAN network only sample given head lights node and the master node. In order to improve the function, the display module of the lights fault detection, alarm module was designed. And integrate it in the above two node. The hardware is designed according to the function block.

2.2. The basic circuit of single chip microcomputer
The basic circuit of SCM mainly includes power circuit, reset circuit and clock circuit.

The clock circuit consists of a 12 MHz crystal vibration and two 15PF capacitor, as shown in figure 2.

![Fig2 clock circuit](image)

The power part adopts DC isolation micro switch power supply (DCMD). It can make the car battery to DC - DC power supply voltage transformation. At last get stable +5v voltage as the working voltage of the chip. The application circuit is shown in figure 3.

![Fig3 power circuit](image)

2.3. The photoelectric coupler
Using photoelectric coupler can effectively separate the chip microcomputer and the power module, the SCM and the digital input channels, cut off the direct link between them, and effectively prevent the interference from the process path to the micro controller. The main advantage of photoelectric coupler is able to effectively inhibit the spikes and various kinds of interference signal, thus greatly improve the process channel SNR.

There are two kinds of light node adopts photoelectric coupler, 6N137 and TLP621-4. 6N137 as frequency response up to 10 MHZ high-speed schmidt type photoelectric coupler, Used for CAN bus communication. In other ways, such as the power switch control adopted the medium-speed photoelectric coupler TLP621-4.

2.4. The CAN communication circuit
With 80C51 series single chip microcomputer itself does not take CAN control module. So this topic chose independent CAN controller SJA1000, and auxiliary CAN transceiver PCA82C250. The P0 mouth of the SCM is combined with the input port SJA1000. The Optical root isolator 6N137 connection the TXD and RXD for SJA1000, and the TXD and RXD for PCA82C250. Then connection the PCA82C250 CAN H and CAN L feet with CANH and CANL respectively. The circuit is shown in figure 4.
3. Light node hardware design

3.1. Single road lighting circuit design
Head lights node control including six control unit: left and right headlamp, left and right low beam headlamp, right and left front fog lamp.

Among them:
The circuit diagram of single way lights BTS442 of the photoelectric coupler. As shown in figure 5.
The circuit diagram of single way lights BTS442 of The photoelectric coupler. As shown in figure 6.

3.2. Master node hardware design
Master node is mainly used to detect the light control switch, show light condition and fault alarm. The hardware circuit including: the switch state detection module, CAN bus communication module, Lamp...
status display and fault alarm module.

The MC33993 application circuit as shown in figure 7.

![Figure 7 MC33993 application circuit](image)

4. The realization of the lights control system based on CAN bus

4.1. The master node

Master node is mainly used to detect the light control switch, display light condition and fault alarm. And through the bus sent to the light switch states nodes. Its corresponding hardware circuit including switch state detection module, CAN bus communication module and lamp status display, fault alarm module.

The switch of the master node control all the lights. A total of eight control switch: left turn signal switch, right turn signal switch, high beams switch, light lamps switch, fog lamps, tail lamp switch, reversing light switch, brake lamp switch. As shown in figure 8.

![Figure 8 The master node](image)

4.2. The headlight node

The headlight node control including six control unit: the left and right headlights with the high beams switch and the light lamps, left and right fog lamps. As shown in figure 9.
4.3. The back lamps node
Back lamps node control including 10 control units: the left and right outline marker lamps, the left and right turn signal, the left and right brake light, the left and right taillights, the left and right reversing lights. As shown in figure 10.

4.4. Vehicle lights control system
This design adopts CAN bus technology to establish the vehicle lights control system. Complete the information communication between the master node and the lighting control system. As shown in figure 11.

The implementation of the lighting control features include: brake control, reversing light control, taillights control, outline marker lamps control, the high beams and the light lamps control, the fog lamps control.
Figure 11 Vehicle lights control system

5. Conclusion
Hardware must be combined with system software to realize the function of the hardware circuit. This article just only expounded the design of the hardware part, did not give the software design part. The design of the hardware system and software system after the match, can accurately complete control the fog lamps, Turn light, reversing light, etc.

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