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The Design of Car Window Control System on CAN Bus

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Abstract. For conventional mechanical car window control system, it is not easy to operate due to the wiring complexity and serious problems of electromagnetic interference. In the article, a control system of car window has been designed for CAN bus. And the software system and hardware system were both demonstrated. The structure, hardware configuration and software function of the whole system were explained respectively. The system of avoiding clip hand was designed for pressure sensor. And the experiment shows: the control system is more simple, reliable and valuable.

Key words: *CAN bus; System of car window; Pressure sensor*

I. Introduction

CAN (Controller Area Network) originated in the German company Bosch, and it was originally used to solve communication problem of the complicated electronic control equipment in modern automotive systems. It is a vehicle-specific serial data communication bus with streamlined constraints.

CAN[1] bus is an asynchronous communication protocol to avoid repetition of laying vehicle wiring harness, improve reliability, and reduce costs. Therefore, the CAN bus window control system designed to enhance the efficiency of the control system of the car window. The design achieved the pinch hand function by using CAN bus braking control, while adding a pressure sensor in the lower four windows.

Shen's[2] article based on CAN bus introduces the door control system. Its automotive power window control system, power windows' hardware and software design finally tested in a car and with good results.

Xiong[3] had researched on a detailed anti-pinch scheme for electric power car-windows in order to reduce the hidden troubles of electric power windows.

II. Car windows and anti-pinch system design

Figure 1 is for the automotive windows and anti-pinch system. The main structure includes left front window, right front window, rear left window, right rear window and four pressure sensors. Windows in different positions have different functions. So it is setting control module CAN bus communication network, including left front window module, right front window module and rear left window module. The right rear window module structure is shown in Figure 2. And the control module sends control commands to the other four modules according to the monitor switch status changes. While the four modules control the braking function of the corresponding position by the instructions from the control module.

III. Hardware Design

The intelligent node of the design was made up of the system that centered on AT89C1051 MCU and Intel 82527 CAN. Wherein, Intel 82527 CAN CAN2.0 controller supports standard, programmable global shield with standard and extended message identifier can output drivers and input comparator configuration settings.

The PCA 82C250 CAN bus transceiver and physical layer bus interface were selected for the program. The program can achieve the bus differential transmission and reception, high-speed slope control and standby three different operating modes. It can isolate transient interference and improve the ability to send and receive. In hardware design, 82527 achieves exchange information of CAN bus, and 89C1051 implement headlight relay drive; bypass input comparator exchange

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information with the 8051 by using interrupt, addressed 2FOO ~ 2FFFH; PT124G-111 pressure sensor convert pressure into electrical signals after amplified and filtered, and then communicate through the A/D converter circuit and AT89C1051 microcontroller, pressure changes, the window stops rising through the CAN bus. Hardware structure of the system is shown in Figure 3.

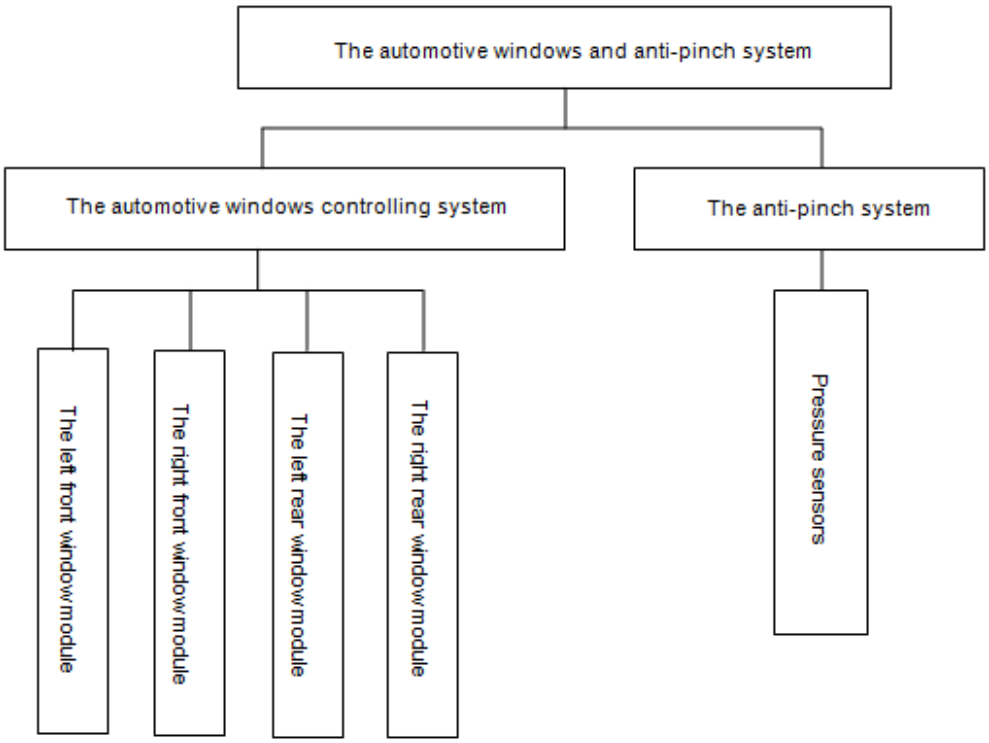

Fig 1. The automotive windows and anti-pinch system

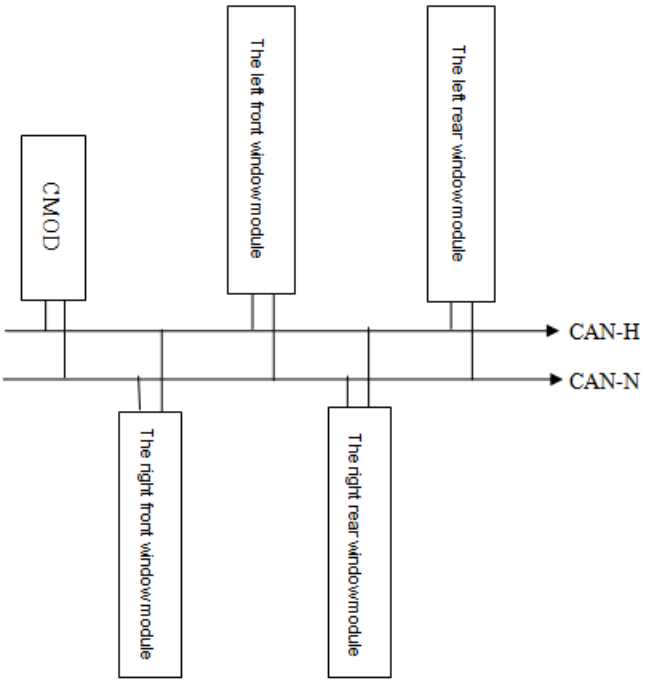

Fig 2. CAN bus window structure

IV. Software Design

CAN 2.013 protocol specify the physical layer and the CAN bus data link layer protocol. In the design of the system, it must be developed appropriate CAN application layer protocol based on user needs. Bus system based on each node is to achieve the desired function and determine the shared data between nodes. And each node needs to grasp receive and transmit signals to formulate a unified information. And CAN communication networks need to pass, and then a good network CAN transmission of information distribution identifier need to be developed. CAN protocol specify the smaller ID number, the higher priority. It can be seen, in determining the ID and the frame must first analyze the information which is urgent. The car windows positional distribution requirements as the basis for division of the modules to the control module, left rear window module, the right rear window module, the left front window module, right front window module, pressure sensors are assigned sequentially ID.

Information coding is the combination of related or similar information into a data block, so that their data in the same frequency is transmitted from the control node to the bus. CAN node can get the rest of the group of information simultaneously, and it can processes the rest of information. The window control system sends information by the main controller， the sub-node receives desired information by acceptance/shielding filter. It shields irrelevant information, and then makes the appropriate treatment based on the received content. Wherein, all the sub-nodes are set to a single filter.

The software was designed by a modularity design idea, according to different functions into a program control module, independent of each other to achieve a particular functionality between modules, which mainly includes the CAN node initialization, sending packets of data processing and packet receiving module. One module can call for the other module at the same time and share data in order to achieve the purpose of simplifying the code and code reuse. Its main program flowchart is shown in Figure 4. The window control system design is completed. Hardware and software of the window system have got many testing. Controlled trials, and a collection of the pressure sensor electrical signals to the controller's CPU for data processing, and then through the CAN bus control windows rise. The test results show that the window control system design is feasible and reliable.

V. Conclusion

Completed in the laboratory, window control system, simulation software, hardware design and the software and hardware system have repeated cascade debugged. The experimental results show that the CAN bus window control system designed to achieve a predetermined function can significantly reduce the wiring harness usage. It is of high reliability, with some prospect of engineering application.

VI. References:

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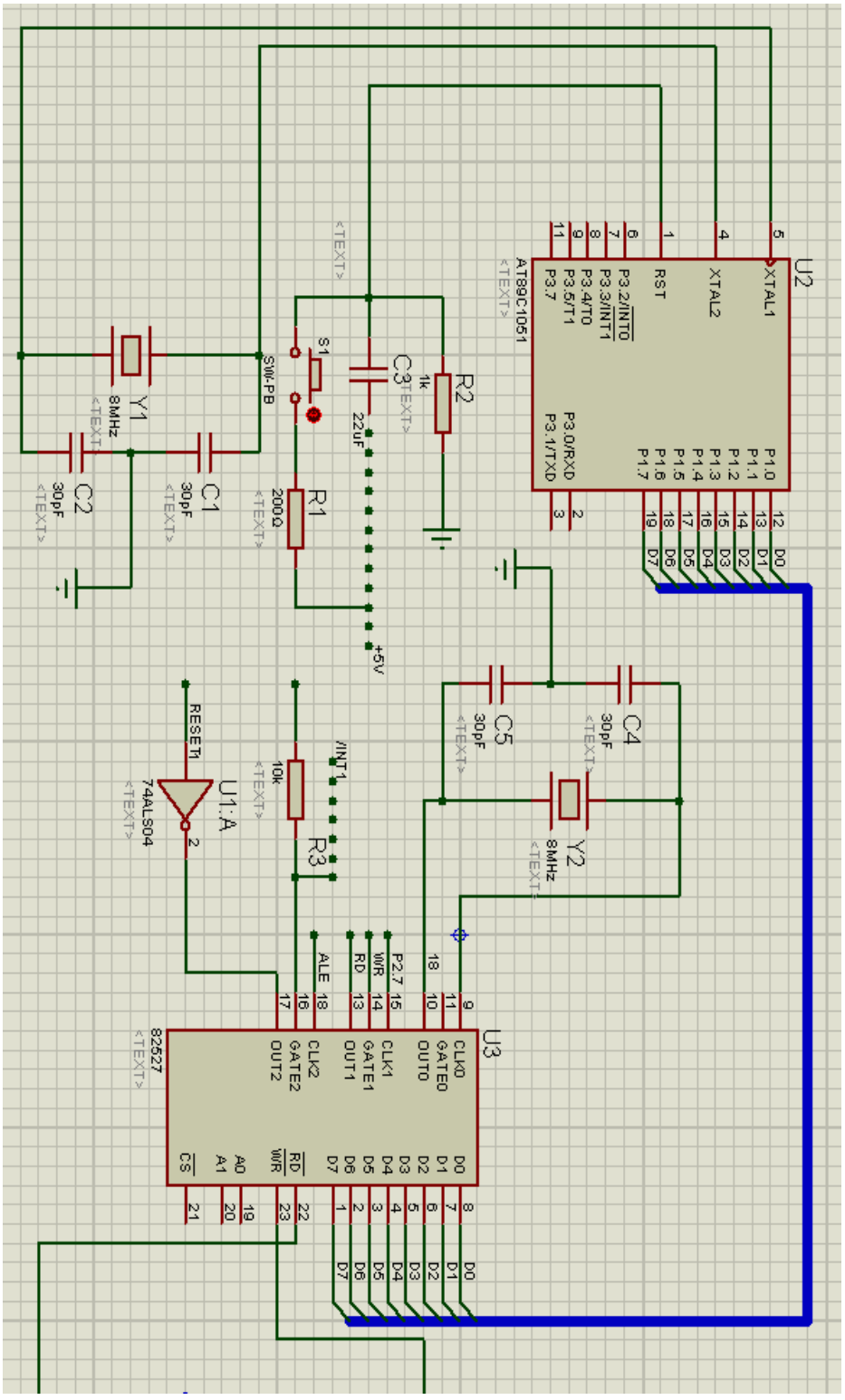

Fig 3. Hardware structure of the system

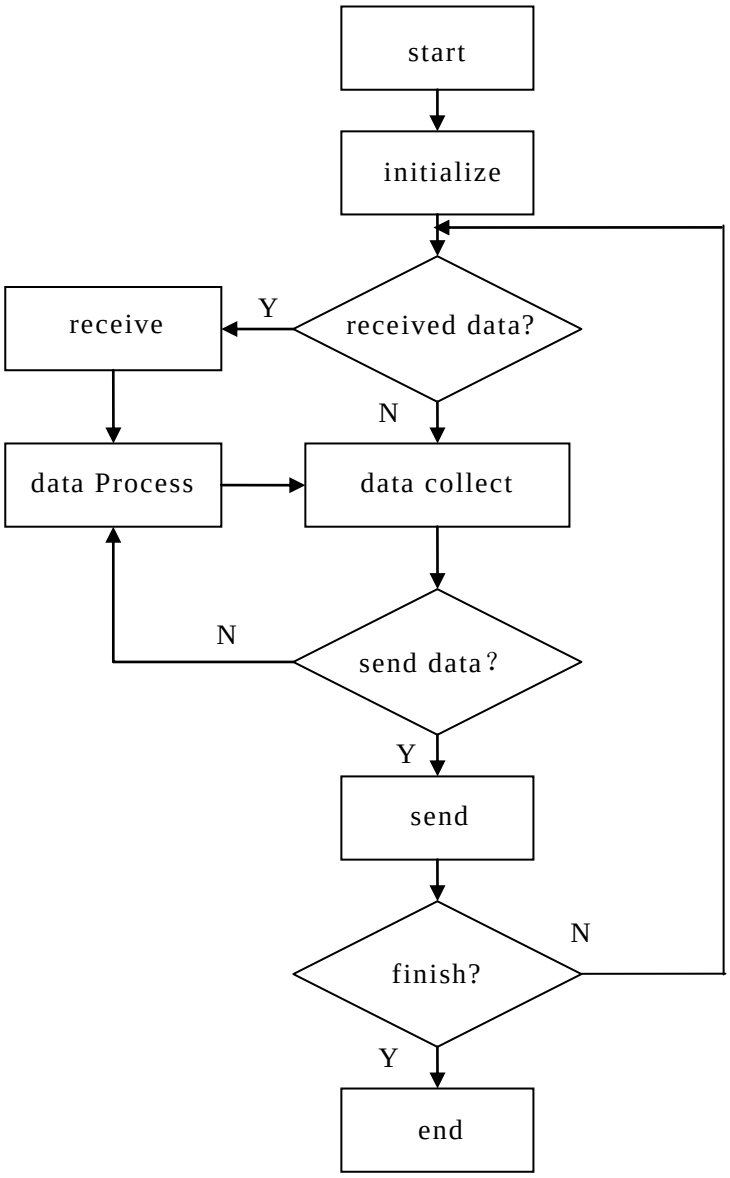

Fig 4. Main program flowchart