CAN bus applied to the vehicle throttle controller

Computer Network Applications

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Abstract: CAN bus in the electronic throttle application the main issues is how to make it stable and reliable utility.This article will be applied to the vehicle CAN bus electronic throttle controller, combining practical projects, in view of the anti-CAN bus in-depth analysis of the deduced, according to analysis of bit timing parameters, and then dedicated on-chip CAN controller SJA1000 initial programming. Papers from the vehicle CAN bus system in the analysis of the structure of the beginning, and then an analysis of CAN bus in automotive electronic throttle controller in hardware design, the use of a typical chip CAN controller SJA1000, complete CAN bus node communication between the underlying hardware network construction. In the software part of the paper against the bottom of the SJA1000 build communications hardware, bit timing parameters according to the results of analysis, program design of its initialization procedure, and then do not give a message to send and receive process of design and programming elements thesis will be applied to the vehicle CAN bus electronic accelerator hardware and software design, debug, through the actual load, the node design to verify the correctness and reliability.

Keywords: The CAN bus；CAN controller；Bit timing；Message

Introduction：

CAN bus in automotive applications in the increasingly widespread, but the basis of the existing bus articulated electronic throttle module, and how to make it stable and reliable and practical, is the CAN bus, a new practical application.

1：vehicle in the structure of the CAN bus system

The use of modern vehicles CAN bus has been completely replaced by sensors, electronic control units and actuators and electronic control unit between the line between the contacts, constitute the vehicle based on CAN bus control system network, as shown in Figure 1. In the figure, the network, including engine control, powertrain control, vehicle control and instrumentation, such as the four functions of an independent control unit, each control unit has its own ECU, can be run alone. There is also a control system of the main ECU, the ECU control unit and between the main ECU to communicate through the CAN network[1].

2：CAN bus bit timing parameters

In this paper, Hebei Science and Technology Agency is the outcome of the research topic for automotive electronic throttle control, project

In order to ensure the practical application of electronic throttle and stability in the process of reliability, in the actual CAN bus communication system, noise is inevitable. As a result of noise interference, may lead to re-synchronization interval between the edge of more than 10-bit cycle, may enter the error-handling model. Under such circumstances, as a result of synchronization between the edge of a long time, so that each one will be able to sample exactly on the more important. If this can not be accurately sampled, would lead to error detection and error handling.

Specific to the place from time to time in accordance with a reasonable set of parameters that can reduce this interference. The principle of specific parameters: the system in extreme weather conditions between the two nodes can correctly receive and decode the information on the network frame. Refers to the precarious conditions of the two nodes in the system Zhong deviation deviation tolerance limits at both ends, and between the two nodes with the largest propagation delay. Noise in the absence of the normal communication circumstances, the accumulated phase error of the worst-case scenario is that the re-synchronization interval between the edge 10-bit cycle. This is the definition of the minimum

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conditions of SJW.

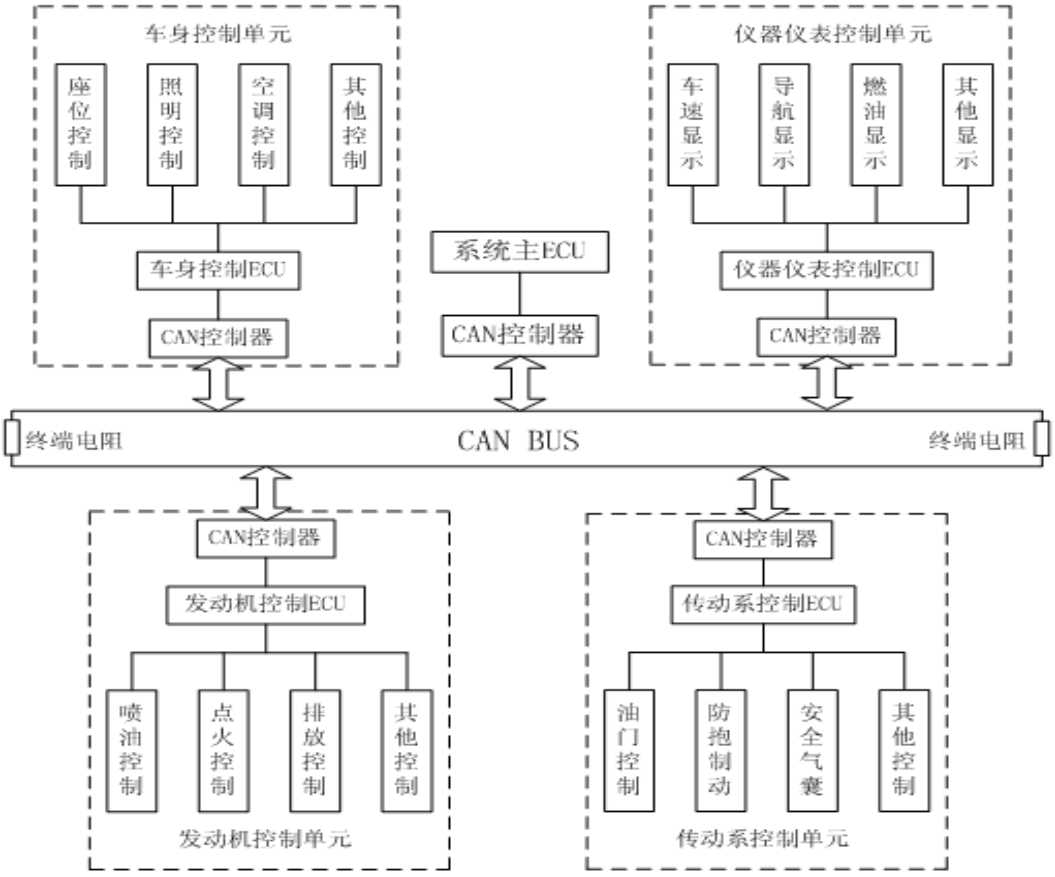

Figure 1: the CAN vehicle network

$$SJW_{\min} = MAX\left\{\frac{20\times NBT\times\Delta f}{1-\Delta f}, \frac{20\times NBT\times\Delta f+1-\Delta f-PROP_{\min}}{1+\Delta f}\right\} \quad (1)$$

$$SJW_{\max} = 4 \quad (2)$$

$$SEG2_{\min} = MAX\{2,\ SJM\} \quad (3)$$

$$TSEG2_{\min} = MIN\left\{8, \frac{NBT\times(1-25\times\Delta f)-PROP_{\max}}{1-\Delta f}, \frac{NBT\times(1-25\times\Delta f)-PROP_{\max}-(1-\Delta f)+\frac{PROP_{\min}}{2}}{1-\Delta f}\right\} \quad (4)$$

Timing parameters set formula as follows:

Here only a model of sampling points as an example the process parameters:

(1)-(4)According to the formula, you can push:

SJWmin in the calculation, the calculation of check is greater than the minimum integer value;

TSEG2max in the calculation, the check is less than the maximum integer calculations. Can be seen from the above formula is derived, SJW and TSEG2 by NBF, Δf, PROP, respectively.

The results thus calculated, and then these parameters directly through the single-chip PIC16F877 programmed into the corresponding register SJA1000. Timing of the communication controller to optimize the parameters determined so as to enhance the electronic throttle system in the entire communication process of stability and reliability[4].

3：CAN node software

According to automotive electronic throttle in the automotive CAN bus networks, the relationship between the data flow, as shown in Figure 2, and then on the CAN bus node communication software design.

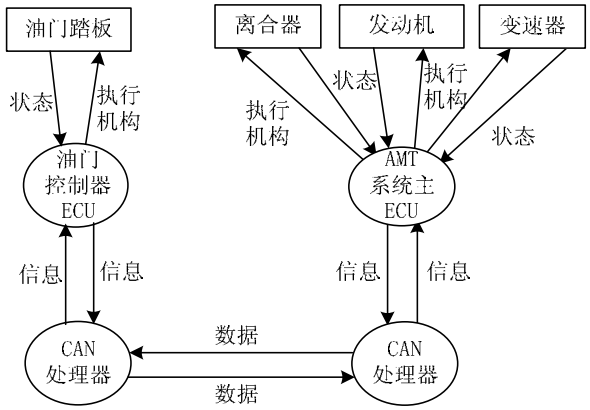

Figure 2: ECU map data flows between

CAN nodes on the network to engage in normal communication, in addition to the hardware to connect the right, but also must have the support of software. CAN node in the design of the software, including most of the contents of c: CAN node initialization (initialization controller SJA1000), message sending and receiving messages. Nodes of the overall flow chart of program design as shown in Figure 3.

1）、CAN Controller SJA1000 initialization program design

SJA1000 initialization is in its reset mode, the initialization includes setting work, the way to receive filter settings, receive Mask Register (AMR) and receive code register (ACR) settings, baud rate parameter allow the set-up and interrupt registers (IER) and other settings. Upon completion of the initialization settings SJA1000 can return to work after a state mandate to carry out normal communications[2].

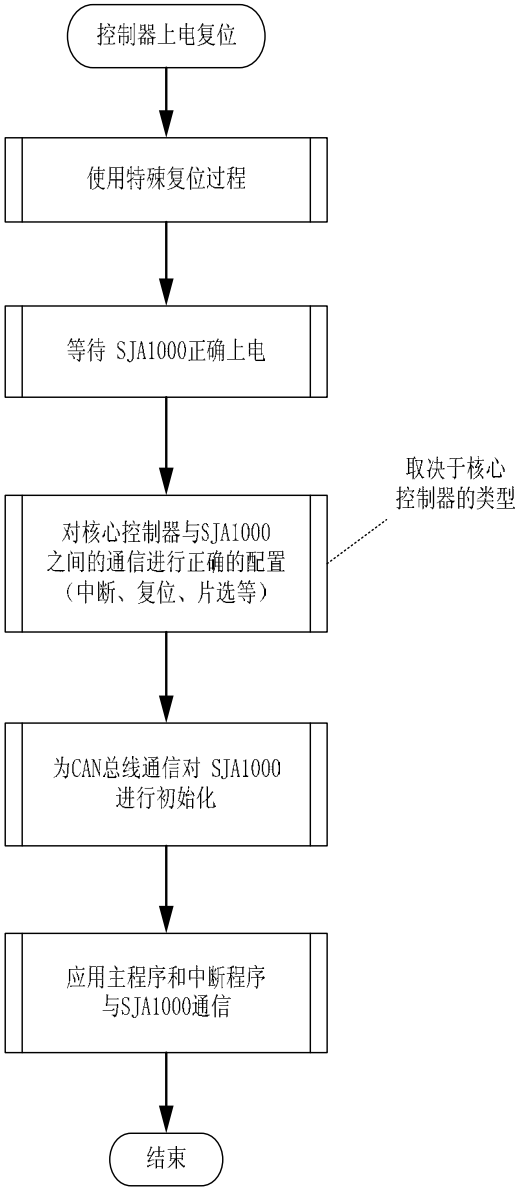

Figure 3: CAN nodes of the overall process flow chart

2）、Send Program Design

Send the message by the CAN controller SJA1000 to complete independence. Host controller will be sent to the message sent to the CAN send buffer, and then register in order "to send request" home signs, and the sending process will start[3]. When SJA1000 message is sent, the send buffer is locked, then the main controller of the message to send in its own temporary storage of a temporary

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storage area, when the CAN sending buffer is released, the host controller will be in its their temporary storage area of the new message into the send buffer and digital home "to send the request (TI)" signs, to launch a new delivery process. Can be used to send the process to be controlled in two ways: query mode and interrupt mode. Disruption in the manner used here. In the interruption of the way, sending process is divided into two parts: one is the main program (Main processing), the other one is the interrupt service routine (Interrupt processing). The main program used to send control information, and CAN send buffer when the time expires, it is necessary to send the information to their own temporary a temporary storage area which, when the send buffer when empty and then the information sent to the CAN send buffer, send the process to start. Send process is responsible for disruption of the temporary storage area in temporary information sent.

3）、Acceptance of program design

Message reception by the CAN controller SJA1000 to complete independence, it will receive the message stored in the buffer to receive them. Receiving control process can also be used to carry out in two ways: query mode and interrupt mode. Here we used the query. Query methods, the main controller SJA1000 to regular reading of the status register to check receive buffer status flag (RBS) to see if a message received. When the receiver buffer state flag expressed as "empty" when that did not receive any message. Host controller to continue the task until the buffer received a check to receive a new request state. When the receiver buffer status symbol that the "full", the note received by one or more messages, then master controller can be obtained from the SJA1000 message and send a command release receive buffer.

4：to sum up

In this paper, a network of CAN bus communication nodes of the software and hardware design. In hardware, CAN controller we have chosen is the SJA1000, in the design of the software before the first Communication on the reliability of CAN mathematical analysis, and then combining the results of the calculation rules packet of information system software design, to Communications of the main program, SJA1000 initialization procedure, the send message and receive the design process. Actual load testing, application of effective, this paper will be applied to the vehicle CAN networks of electronic throttle control, the design ideas should be related to the application and promotion of development and technical drawing.

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