Design of Vehicle Body Control Module for Electric Vehicles

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Abstract

This paper presents a vehicle control system based on pure electric vehicle. Combined with the characteristics of pure electric vehicles in the fuel vehicle Body Control Module based on the increase in time-sharing rental function, battery power major fault handling. The networked control of the vehicle body is realized. At the same time, the vehicle body control system receives the other control module control commands and executes the corresponding action, and returns the state of the corresponding implementing agency to other control modules. In this paper, the structure of the system design, hardware and software design ideas and methods. The debugging results show that the information transmission of the system is stable and the network control of the vehicle body electrical appliances is realized. Meanwhile, it has a high reference value for time-sharing rental of electric vehicles and handling of major faults of power batteries.

Keywords

Electric Vehicle, Body Control, Vehicle Rental, Battery Warning.

1. Introduction

Electric vehicles as an emerging means of transport, because of the use of energy-saving and environmentally friendly, so this year, the electric car industry in the country has developed rapidly, people electric vehicle driving safety, comfort, power consumption requirements are getting higher and higher, The function of the body control system becomes more and more complex. However, because of the existing temporary charging stations for electric vehicles is too small, this reason directly limits the popularity of electric vehicles. Car rental, is a new car method, compared with the ordinary tool rental, due to high cost of the car, the rental monitoring is too much trouble, there is no good way of rental and rental system, electric car rental is still not perfect, universal Intensity is not big enough. While the electric vehicle battery monitoring system is not mature enough to lead to the operation of electric vehicles there are some security risks. In order to solve this kind of contradiction, this paper puts forward the design of the vehicle Body Control Module based on pure electric vehicle, and through the CAN bus, serial port and other node module of the vehicle effectively combine to realize intelligent control of vehicle body electrical equipment and power battery fault early warning. This article will be the Body Control Module of the hardware and software design to do a detailed introduction, and that the Body Control Module and other nodes of the communication implementation [1].

2. System Structure Design

This article takes the pure electric vehicle body control system as the example to carry on the system design. The body control system consists of six modules: switch signal input module, master MCU module, CAN module, serial port, RKE (Remote Keyless Entry) module and drive module. The commonly used control objects of the body control system include wiper, light, Speakers, windows, defrosting, mirrors and so on. At the same time with the characteristics of pure electric vehicles, body control system as a node of electric vehicles, through the CAN bus and PEPS (Passive Entry Passive Start) nodes, vehicle terminal nodes, BMS (Battery Management System) nodes to communicate, to

achieve vehicle body electrical parts control, increase electric vehicle rental and power battery Fault early warning function.

The switch signals and other switch signals of each electrical load in the system are collected by the body controller node and receive real-time information from other network nodes. The vehicle Body Control Module completes the control of the body electrical parts according to the switch signal and network control instruction. Body structure of the overall network shown in Fig.1.

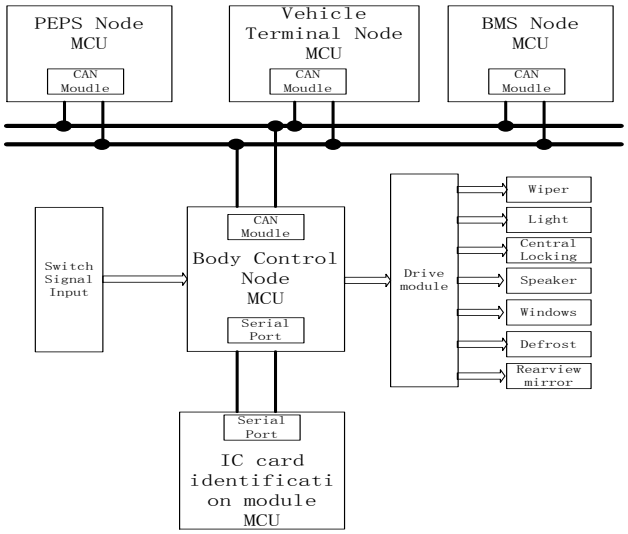

Fig.1 The overall structure of the body network

3. Body Control Module Basic Circuit Design

3.1 Switch Signal Input Module

Various switch signals on the car, this MCU, IO resources is very valuable, in order to save IO resources, you need to IO port expansion, in order to meet the actual needs. Fig. 2 is 8-bit parallel or serial input / serial output register HCF4021 application circuit, HCF4021 has a common CLOCK and P / S input, a serial data input SERIAL_IN, each register has a parallel input and D-type Master-slave flip-flop, register 6 ~ 8-bit Q output. PARALLEL / SERIAL and PARALLEL / SERIAL signals control the input mode of the data. When the input is low, the serial input is valid. When it is high, the parallel input is valid. The switch signal data at the rising edge of the clock signal through the parallel entry PI_1 ~ PI_8 asynchronous access to the register, through the serial data output Q8 serial output data to the MCU processing, which by the MCU to determine which channel switch pressed to achieve the signal Switch detection. HCF4021 When the parallel input, the internal register bit clock signal are valid, you can use multiple HCF4021 register expansion, in order to achieve more switching signal detection. The design of the actual use of the chip 4 switch signal detection, further saving MCU controller IO resources [2].

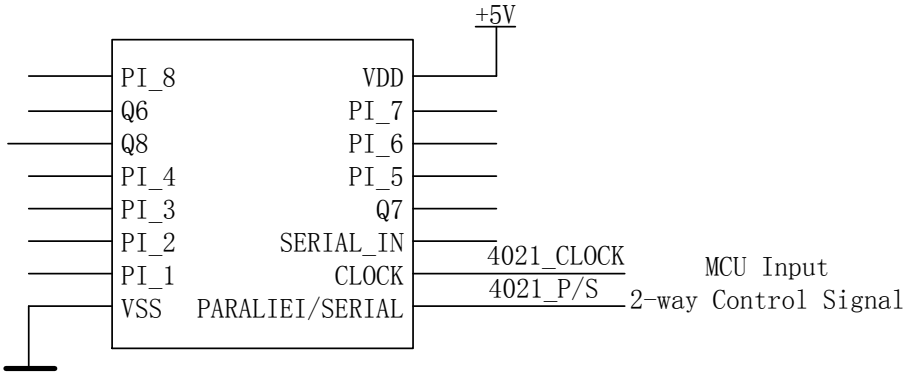

Fig. 2 HCF4021 application circuit

3.2 Output Signal Drive Module

Electric vehicle Body Control Module executive body can be divided into two categories: motor class and lighting class. One motor class, can be divided into positive and negative motor and one-way motor. Electric vehicle is reversing the motor, such as central locking motor, window motor, electric mirrors motor; single direction motor such as wiper motor, washing motor. Motor type actuators generally use relay control, positive and negative motor with twins relay all the way to achieve full-bridge control; one-way motor with single-way relay to achieve half-bridge control. In this paper, using ULN2003 drive relay output to the left front motor, for example, the MCU receives the lift left front window of the switch signal, the output of the left front window of the lifting control signal W_FL_D_OUT and W_FL_U_OUT to ULN2003, ULN2003 drive through the twins relay pull off , The realization of the window motor control signal W_FL_UP and W_FL_DN output in the motor circuit in series with a 0.01R Kang copper resistor to detect the motor running current, CURRENT can be connected to the comparator or MCU to detect whether the current exceeds the threshold or read Specific current value, according to the current size to determine the motor running to prevent stall. Fig. 3 is the realization of the twin relay window control application circuit (if it is a single relay, the motor is the application of the relay control circuit, the motor negative then a detection resistor).

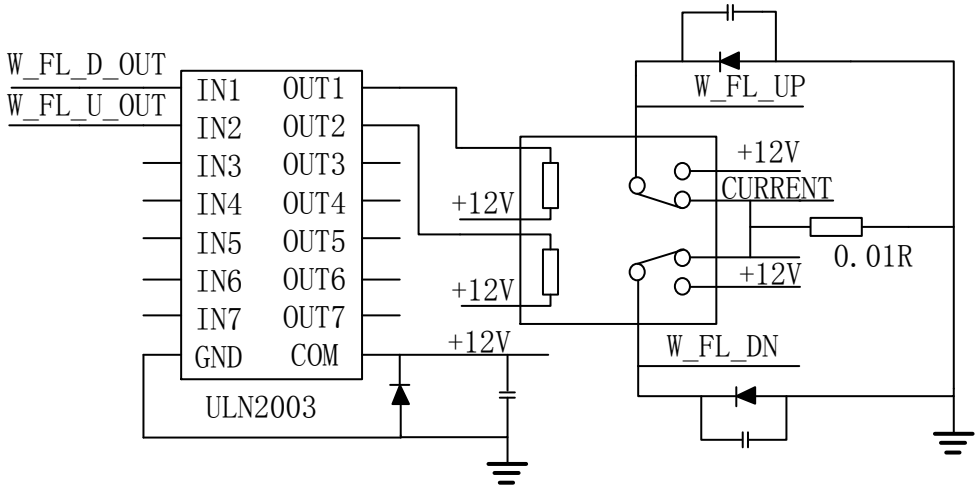

Fig.3 Output signal drive circuit

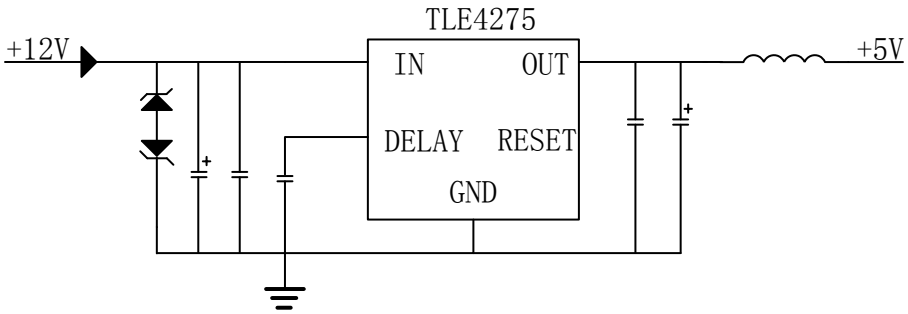

Fig.4 Power management circuit

3.3 Power Management Design

Body Control Module power management design, the Body Control Module has 12V and 5V two power supply network, 12V power supply system from the car battery to provide relay output, high and low side switches, intelligent power devices such as power supply, 5V power supply system from 12V power supply voltage regulator to get, to the MCU and signal input, port expansion system power supply. This 12V to 5V power supply program using TLE2475 voltage conversion chip, the power chip has low power consumption, low voltage drop, low temperature coefficient, high input voltage and high output current characteristics. In the 12V input, increase the transient suppression diode, inhibit the external voltage instantaneous change, the current impact. While increasing anti-reverse diode to prevent reverse power supply. The main part of the power filter using large

capacity electrolytic capacitors and small capacity of ceramic capacitors in parallel, filter out all possible interference, to ensure that the circuit in harsh environment, the normal work of the power module. TLE2475 specific application circuit shown in Fig.4 [3-4].

3.4 Communication Interface Circuit Design

Electric vehicle Body Control Module in the vehicle CAN network system itself is a CAN node, it and other electric vehicles on the exchange of information exchange nodes, to achieve resource sharing. The node is particularly important in the electric car rental, through the CAN bus and vehicle information terminals connected to the implementation of vehicle information terminal remote control module issued to the body control instructions. Can be remote control of the central control locks, windows and other implementing agencies; through the CAN bus and electric vehicle BMS nodes connected to the real-time operation of the vehicle to receive the battery failure alarm information, when the battery temperature is too high, the battery is lost and other models automatically open Control lock to facilitate the user to leave the vehicle as soon as possible; through the CAN bus and PEPS node connection, you can receive real-time PEPS node sent over the central control unlock command. In this paper, the use of high-speed CAN converter chip TJA1040T, the chip supports the maximum rate 1M baud rate, at least 110 CAN nodes can be connected in the standby mode has lower power consumption, while the bus can be awakened, wake-up is RXCAN will produce A low signal, the low level can wake up the MCU, the chip has good electromagnetic compatibility. Specific application circuit TJA1040 shown in Fig. 5, STB access MCU IO port, CANH, CANL is two CAN lines, working STB is high, controlled by the MCU.

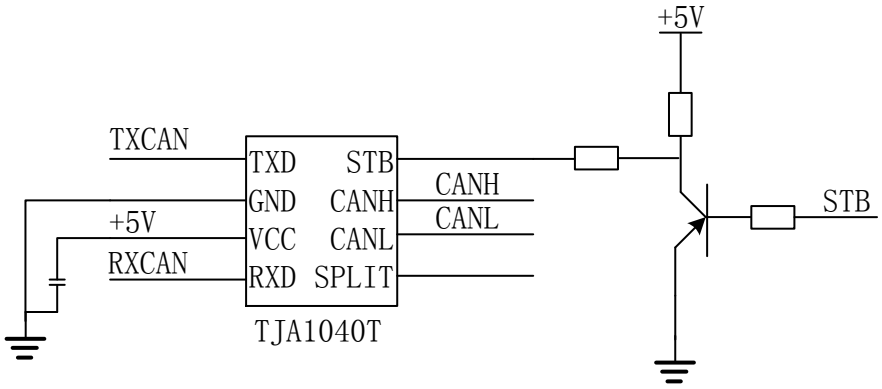

Fig.5 TJA1040T application circuit

4. Software Design

Body Control Module as a vehicle electric vehicle network node, the main task is to receive messages and drive related load on and off. According to the modular system design, it is divided into main program module, digital input module, drive output module and CAN data processing module. The main program module initializes the system after the system is powered on. The digital input module detects the external key input operation and drives the output module to execute the key input and other node message control commands. System initialization after the start of circular motion, when a key action is detected by the driver module directly to the implementation of key commands. When the serial port has detected data, the first processed by the CAN transceiver module through the CAN bus sent to the vehicle information terminal module, vehicle information terminal module to read the identity of the serial port information to verify and check the results through the CAN bus back The vehicle Body Control Module and the vehicle Body Control Module transmit the control command to the PEPS node through the CAN bus according to the correctness of the verification result [5]. The PEPS node carries out the key activation module and the keyless entry system to realize the rental service of the electric vehicle. During the operation of the vehicle, the BMS node real-time sends the battery fault information to the vehicle Body Control Module through CAN. When the battery has a major fault, such as the temperature is too high or the main battery is lost, the system will alarm and cause the passenger note. Body Control Module data transceiver software flow chart shown in Fig. 6.

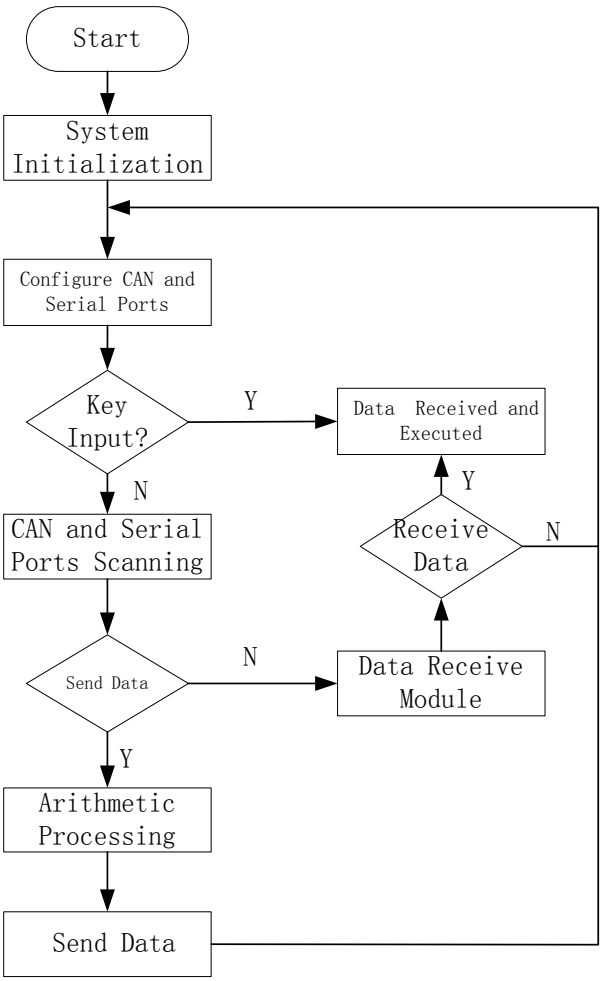

Fig. 6 Body Control Module data transceiver process

5. Conclusion

This paper designs a pure electric vehicle Body Control Module. The hardware design of the Body Control Module is described from the aspects of signal input and output, power management and communication interface. The software design flow of the vehicle Body Control Module is described from the state of the switch signal and the CAN data interaction of the electric vehicle nodes, the control of the body electric parts and the remote rental and power battery warning of the electric vehicle. After testing the Body Control Module, operating results stability and Performance dependable. This paper has a high practical value in the field of electric vehicle time-sharing rental and battery early warning.

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