Research on the Bottom Software of Electronic Control System in Automobile Electronics

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ABSTRACT: With the development of science and technology, car replacement faster and faster. The development of the automotive industry has a contradiction, on the one hand, the speed of upgrading the car technology can not keep up with the speed of the performance requirements of the car, on the other hand, the country's automobile exhaust emission standards become more stringent. In addition, the depletion of oil resources led to the rise in gasoline prices, the traditional car is facing a crisis. Considering the situation of gas fuel resource structure and supply situation in China, it is feasible to promote gas fuel engine[1].However, the pollution caused by the car has become one of the major pollution sources in the urban environment and the atmospheric environment, and this trend continues to deteriorate[2].Therefore, alternative energy vehicles and hybrid cars is the main direction of development, and any improvement in the car will be car electronics and software replacement for the premise. On the one hand, natural gas as an alternative to gasoline, with its low prices, excellent combustion emissions, the relative sustainable development and other characteristics of more and more car manufacturers favor;On the other hand, the mainstream of the automotive electronic control unit ECU software development to AUTOSAR structure, low power consumption, functional safety for the development direction. Based on the actual development of natural gas engine control unit, the structure and function of ECU software are studied with reference to AUTOSAR software design standard. This paper studies the structure of the application of the software layer of the electronic control system and the main control strategy under the various conditions of the structure, and puts forward the underlying software resources needed by the application layer software. This paper analyzes the internal and peripheral resources of Infineon XC2785x microcontroller and designs hardware abstraction layer software and ECU abstraction layer software. The current characteristics of the jet valve driven by the natural gas multi-point injection engine were investigated. Automotive electronics technology has been widely used in modern vehicles which, and gradually become the development of new models, improve the performance of the key technical factors[3].

Keywords: Gas engine; AUTOSAR; Software design; CCP; CANape

I. DEVELOPMENT OF AUTOMOTIVE ELECTRONICS AT HOME AND ABROAD

Automotive electronics is a general term for vehicle-mounted vehicle control devices and automotive electronic control devices. It can be used to improve the car's power performance, economic performance, emissions performance, therefore, automotive electronics is considered a revolution in the development of automotive technology. The increase in the degree of automotive electronics also marks the overall improvement in the automotive industry.

Automotive electronic software with the development of automotive electronic hardware and development, but the development of automotive electronic software has its particularity. The traditional automotive electronic software development is closed because there is no uniform standard. Different automotive controller manufacturers use different development standards, the ECU software is not open to the outside, the corresponding automotive electronic software can only use integrated programming development methods. Automotive electronics to develop, we must take the road of opening and standardization. In order to solve these problems, automotive electronics software development companies together, from closed development to the open development of the road up, so that the basis of continuous standardization of automotive infrastructure software.

The OSEK (Open Systems and the Corresponding Interfaces for Automotive Electronics) system, launched by the German OSEK Group, has gradually become the global automotive software design standard. The standard includes the operating system (OSEK OS), communication subsystem (OSEK-COM), network management system (OSEK-NM) three parts and some auxiliary standards.

After the operating system is standardized, I / O is also standardized. The famous HIS (Hersteller) I / O library is also presented for the first time after the OSEK standard appears. This I / O library completes the hardware abstraction, defines the standard interface, making the software portability possible.Automotive electronics also accelerates the realization of the ignition output.
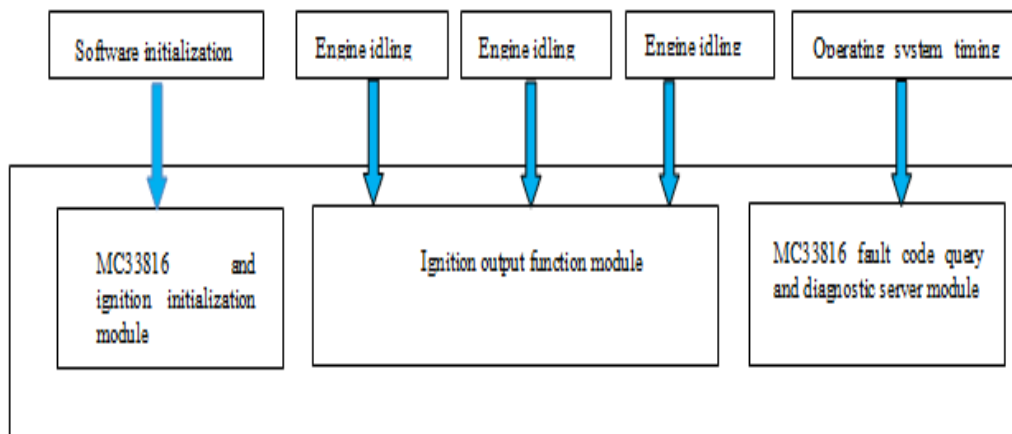
Figure 1-1 Ignition System Bottom Software Module

With the development of economy and society, people on the safety of the car, comfort, accuracy, fuel economy put forward higher requirements. In the rapid economic development, energy shortages, environmental degradation and other factors driven by China's gas fuel engine demand is very urgent.[5]Energy and environmental problems and forced the country continue to introduce more harsh laws and regulations on vehicle emissions. Which makes the car replacement faster and faster. Automotive electronic control system must be updated, as the core of automotive electronic control system, automotive electronics software will inevitably be replaced.

II. RESEARCH AND DEVELOPMENT OF NATURAL GAS ENGINE CONTROL SYSTEM

The automobile industry is an important industry of China's economy. China's auto industry after years of development, has a certain basis and entered a new high-speed development stage.[4]It has promoted the development of related industries, promoted the rationalization of the national economic structure and provided a lot of employment opportunities. China's auto industry to maintain a strong momentum of development in 2007, sales level than in 2003 doubled, then China's auto industry for nine consecutive years to maintain double-digit growth. To the first half of 2009, China's auto production and sales are ranked first in the world. China's automobile production and sales in 2015 were 24.553 million and 24.5767 million, respectively, compared with the previous year increased by 3.3% and 4.7%, and for seven consecutive years reelected the world's first.

The rapid development of the automobile industry has also brought some other problems. Such as emissions caused by air pollution is increasingly serious, to people's lives caused great health risks, but also restricts the healthy and sustainable development of other economies. In addition, China's per capita oil resources is low, mainly rely on imports, crude oil imports in 2013 amounted to 282 million tons, an increase of 4.03%. With the increase in car ownership, fuel supply and demand pressure will inevitably lead to rising oil prices, thus affecting the development of other industries related to petroleum products.To alleviate these problems, the developed countries have increased the development, utilization and promotion of non-oil-based fuel vehicles to gradually replace traditional fuels. Because of the relatively backward automobile manufacturing technology in China, the automobile fuel consumption is higher and the exhaust emission problem is more prominent. Therefore, the development of new energy vehicles becomes the inevitable choice. The main forms are oil and electricity hybrid, pure electric, fuel cell, alternative fuel, solar energy The Among them, alternative fuels are: hydrogen fuel, natural gas (CNG / LNG), liquefied petroleum gas (LPG), alcohol fuel and so on.

Solar energy by geographical and weather constraints, it is difficult as a conventional car energy. Hydrogen and methanol storage, transportation safety and other issues have not been resolved, and the practical application of hydrogen technology is still far from mature. And the current battery technology is still a low energy density, short mileage and security issues such as the current point of view, can not be widely used. A certain period of time, gas fuel vehicles will be a better choice.

III. OVERVIEW OF THE DEVELOPMENT OF AUTOSAR

The AUTOSAR (Automotive Open System Architecture) standard is a new set of guidelines for the development of automotive electronics systems[6].The emergence of the AUTOSAR standard is conducive to the exchange and updating of automotive electronics applications, and efficient management of increasingly complex automotive electronics applications, to ensure that the quality of products and services, while greatly reducing the development costs, economic benefits also improve. The AUTOSAR standard contains a set of specifications that

describe the software architecture, application programming interfaces, and development methods. The AUTOSAR layered software architecture makes it possible for independent development of software components. The application software developed based on the AUTOSAR standard can be applied to different types of vehicles, different parts and components of different manufacturers and multi-generation product platform, which has significant cost and reuse advantages, and to achieve a high system reliability and continuity.Complex driver software also used the MC33816 chip.
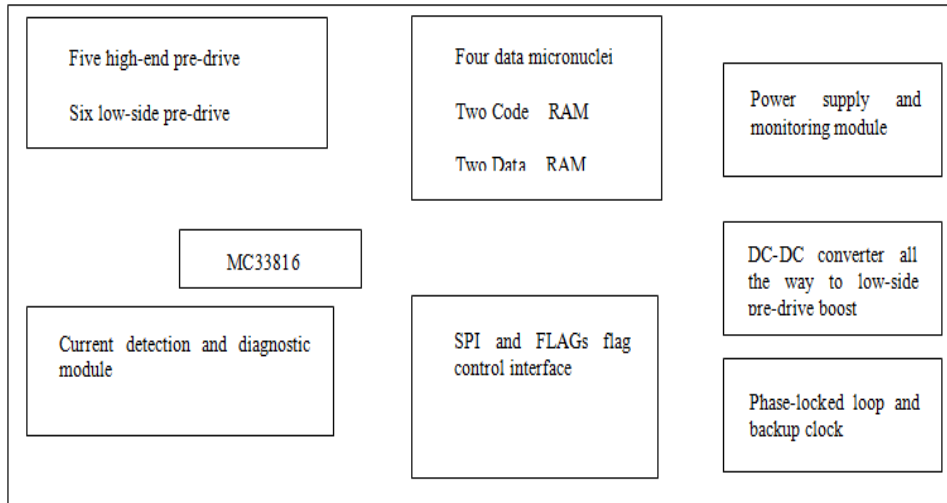

Figure 3-1 MC33816 kernel module

AUTOSAR standard hierarchical architecture, from top to bottom are the application layer, runtime environment (RTE), basic software layer (basic software, BSW) and the microcontroller abstraction layer.Since its establishment in July 2003, AUTOSAR has attracted more than 100 vehicle manufacturers worldwide, software tools developers and parts suppliers to join. AUTOSAR has undergone three phases of development: the first phase is from 2003 to 2006, with the primary goal of establishing a complete set of automotive electronic system development specifications for architecture and methodology. The second stage is from 2007 to 2009, the standard on the electronic control unit wake-up mechanism and network communication has been standardized, and the introduction of the concept of functional safety. The third phase is from 2013 to date, the main task is to maintain the existing standards and the corresponding increase in other needs function.

AUTOSAR has been widely watched worldwide by the industry. In China, Shanghai Automotive, FAW Group, Chery, Great Wall Motor and other companies have also joined the organization. With the addition of members of the organization, the improvement of functions, the promotion of industrialization, the emergence of dedicated basic software, automotive electronic system development will be more based on AUTOSAR standards to carry out. Major automotive electronics manufacturers such as BOSCH, Continental, Denso, and vehicle manufacturers such as the German Volkswagen, BMW, GM, and so on have been practical application development. According to AUTOSAR automotive electronics development system architecture alliance statistics, in 2011, AUTOSAR organization core partners to control the control unit, there are 25 million is based on AUTOSAR standard, by 2013 this number doubled to 50 million, to the present So far, such an electronic control unit has reached 300 million.On the basis of studying the architecture of AUTOSAR system, with reference to its organizational structure, a hierarchical and standardized CAN bottom layer communication module was developed[7].

In short, AUTOSAR standard has become China's automotive electronics industry's mainstream standards.

IV. SIGNIFICANCE

In China, energy shortages and environmental pollution problems make natural gas research and development of a popular. The emergence of natural gas vehicles can effectively solve the problem of energy shortages for social development to provide a good development environment[8].Natural gas engine and traditional gasoline or diesel engine has a great similarity, the development of simple, cost-effective. The use of natural gas vehicles reduces the consumption of oil resources and reduces the cost of users. At the same time, the extensive use of natural gas vehicles for the less car exhaust emissions, and thus improve environmental pollution plays a significant role. The study of natural gas multi-point injection engine is conducive to improving the ability of independent research and development, to break the monopoly of foreign technology, reduce vehicle costs,In recent

years, with the people on the economic, energy, environmental issues, accelerate the development of natural gas vehicle technology, natural gas vehicles are widely used in urban traffic[9].

China is facing a serious threat to air pollution, and the experience of many countries tells us that the promotion of natural gas vehicles is an effective means to improve air quality[10].In this paper, the natural gas engine controller for the project background, the laboratory has the controller hardware as a platform, focusing on the controller of the basic software development. The software builds the basic software platform of the whole system as the framework of the most popular AUTOSAR structure, which lays the foundation for the development of application layer software components. In this paper, the use of a number of new intelligent IC chip, the corresponding complex driver layer software is also a major focus of this study, therefore, this article on the complex software layer of a new exploration, the future of the study is important Reference value.

V.   LOOKING AHEAD

The research and development of the underlying software in the electronic control system of automobile electronic control as its future research direction, or as a prospect for the future, there are several aspects that need to be improved: the accuracy of memory allocation needs to be improved. Fuzziness of AUTOSAR Structure. Although AUTOSAR has standard software structure specifications and design guidelines, there are many companies on the market design of the AUTOSAR structure of the various software components, but each company's understanding of the structure of AUTOSAR is not the same. AUTOSAR itself is a normative standard for automotive software, but without a public software model, even software that uses the same specification is often incompatible. This article attempts to use the traditional method to design in line with AUTOSAR structure of the software, is obviously inherent deficiencies. Hope to have an open source code for the AUTOSAR specification as soon as possible.

The calibration protocol does not use the XCP protocol. The CCP protocol is a calibration protocol based on the controller's local area network (CAN), but the CAN communication itself has a rate limit, which may be affected by large volume calibration. Therefore, it is best to use a better compatibility XCP protocol as a calibration protocol, hope that the future software upgrades can take this into account.

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