Research on the Embedded Navigation Computer System Design and Engineering Realization

Yu Mingyi

Address: Chongqing College of Electronic Engineering, Chongqing, China

Email: 12399395 @qq.com

Keywords: Embedded Navigation Computer System, Design, Engineering Realization, Research

Abstract. Good or bad performance embedded navigation computer system directly affects the accuracy of the navigation system and real-time, in the moment has been more widely used. Papers based on practical engineering application requirements for implementation of embedded computer navigation system were analyzed demonstration focuses on the embedded navigation computer system design related content through the analysis of its structure and characteristics of the hardware, using TCP / IP protocol, designed navigation DOS-based computer systems, and how to implement the system for the relevant elaborate.

Introduction

Satellites, aircraft or ships and other moving vehicle during the voyage need time to know their position, velocity and attitude and other navigation information, which can be obtained through a variety of navigation devices. Inertial navigation systems rely on their own works [1], as a carrier to provide a full range of navigation information continuously, without the need to exchange information with the outside world, so its anti-interference ability, autonomy, and can work continuously, has been extensively studied and application. With the introduction of the inertial navigation system, small size, low power, and other application requirements, as well as the development of modern electronic technology, inertial navigation system (Strap-down Inertial Navigation System, SINS) gradually replaced the traditional inertial platform Navigation System. Inertial navigation system using a digital computer platforms instead of the physical platform inertial navigation platform, size, power consumption and cost inertial navigation system are greatly reduced, so that the application and scope of INS are more widely, not only in the defense being taken seriously, in the civilian market, more and more attention, such as car navigation, oil well drilling, and other fields. To enhance national defense strength, promote economic development, countries around the world for the sins done a lot of research, trying to achieve SINS with high performance, miniature, low power consumption characteristics.

After decades of development, algorithm SINS gradually matured, the current began to focus more and more to invest in the navigation computer system hardware, namely, how to construct a navigation computer system platform, making the system during operation play accuracy, timeliness, or reliability maximum. This requires a navigation computer hardware system to meet the needs of simple and compact structure, small size, power consumption, fast speed and high precision.

At present, for navigation computer studies abroad is very hot, there have been various structures embedded navigation system computer programs, but most are based on the functional realization research into the practical application of further research is needed, the paper from the specific engineering applications starting temperature studies can adapt to harsh environmental requirements, and high performance, miniature and has a rich communication interface features such as embedded navigation computer system in order to achieve high reliability, high-precision sins, for more extensive the practical application basis.

The earliest embedded navigation computer system by the United States AMPRO launched in 1990, such a computer system is suitable for embedded occasions, and has a high reliability, better able to meet the actual production needs. In this paper, embedded navigation computer system design and implementation issues analysis process to PC / 104 modules and discusses how to use

the module embedded navigation computer system design.

Specific Functions of Embedded Navigation Computer System

The navigation computer system needs to have binding and Compass calibration function. Paper AHRS system is currently used in magnetic and SINS combination, the system is heading mainly to the geomagnetic sensor output reference speed heading by way of amendments to the oblique direction of the geomagnetic sensor output. Before the plane took off, in order to ensure the accuracy of the geomagnetic sensor sensitive to the magnetic field vector, you need to interference magnetic field around the magnetic sensor is corrected. Currently a better common correction method is an eight-position of the magnetic Compass calibration method that allow the aircraft in eight different locations, the navigation computer system of three-dimensional magnetic field data collected by poor calibration interface is sent to the computer for processing calibration calculate the difference and get the magnetic compass correction coefficient, and through the Compass interface correction factor binding to the navigation computer system for its use and storage, so that next time the plane before take-off without further calibration work Compass used directly stored in the navigation computer system magnetic Compass difference correction coefficient. Visible navigation computer system needs to have poor communication interface, and through the interface Compass calibration parameters, load and read function; the same time the need to achieve Compass calibration parameters non-volatile storage. To improve the reliability of communication, Compass will use the RS422 communication interface standard serial port.

The navigation computer system needs to have self-BIT fault detection and storage. All electronics are all age and condition and other restrictions, we cannot always guarantee absolute reliable operation. When the navigation computer system used for some time in the bad environment, some devices may not work properly, causing the system error, this time for real time navigation computer should be able to troubleshoot the fault and the system output displays status messages so easy to pilot decided how to take off or whether the decision should be after takeoff, in order to ensure safety; once found fault, navigation computer system should also be timely fault information stored in non-volatile memory for the aircraft back to the ground after reading out the fault of information, accurate fault location and to be eliminated. Therefore, after the boot, the navigation computer system first BIT to be a power function: if critical diagnostic system for proper operation, inspection and other key data area is complete; enter the normal working condition, the navigation computer systems needed for online checking BIT, A monitoring system, power supply is normal, interrupt function is normal and so on. Once a problem is found, it must immediately indicate fault conditions and fault information is stored. When the plane comes back to the ground, the access operations such as clearing the fault information by an external computer interface to the navigation computer system sends the appropriate commands to complete by Compass.

The navigation computer system needs to have online update feature. When navigation software or add new features to further optimize performance, you need to synchronize the navigation computer system software update, already in use in the case of AHRS system, if the system will still be removed by removing open board navigation computer, then use the emulator board software updates, which will bring the tedious work of dismantling the system, increase the system on-site maintenance time, there may be other problems caused by disassembly risks. Therefore, the system is put into use, should be studied online upgrade program, such as serial communication can be studied using computer navigation system software updates.

The navigation computer system needs to have working status indication I / O signals. Navigation software during operation, to facilitate the work of the state monitoring system, through I / O port indicates navigation computer system working state, such as navigation software is running properly and so on. According to the actual requirements, the navigation computer system will require three to output navigation computer system working state I / O port.

The Hardware Configuration of the Embedded Navigation Computer System Design

In the use of PC / 104 modules embedded navigation computer system design process, the need to take into account the PC / 104 module selection, navigation center to ensure a plurality of navigation equipment for effective treatment, and related information gathering in order to better realize monitoring and management. During the hardware selection process, mainly in AMPRO's PC / 104 card-based, using TCP / IP protocol, the system to send and receive information. EMERALD-MM use multiport serial card, combined with RS232 / 422 protocol, navigation information received, the use of multi-function display card CM112, the information is displayed. During the hardware selection process, taking into account the needs of embedded navigation computer system design, and can ensure that the system is compact and lightweight, to better ensure the system are functioning.

We can see that during the navigation computer embedded system design process, also need to be considered to achieve DOS system functions. DOS operating system is a rigorous system during serial connection process, to ensure that the TCP / IP protocol to better play its role so that it can ensure the efficient transmission of relevant information, to ensure the system between the various parts of effective control.

The Programming Analysis of Embedded Navigation Computer Systems

In embedded navigation computer system design process, the need for effective programming process to ensure that the relevant procedures run reliably. During programming, take a standard socket programming interface is coded using the Windows operating system, and thus be better encapsulated socket. In embedded systems programming navigation computer processing, also we need to use the C programming language, to better achieve functional HTTP and other network applications. Embedded navigation computer system design process, using BSDUNIX provides the appropriate network programming interface, a "client - server" communication mechanism based, to better enable network connectivity and data exchange. At this stage, the socket application programming process, mainly related to three types, namely streamsoekets, datagramsoekets and rawsoekets. In the application, we need to transfer data to the actual situation of network traffic and effective design. In this paper, embedded systems programming navigation computer design process, we took Socket_open () and Socket_loadconfi gf ile () mode by calling for Socketcreate, and better able to achieve a local network connection, in order to achieve effective control of the system.

The Achievement of Embedded Navigation Computer System Design

Making embedded navigation computer system design process, mainly related to the GPS navigation information, we need to use RS232 / 422 protocol, to better achieve the effective integration of data between the network, which can play a role in GPS navigation information. After carrying out the integration process, using the Internet protocol, it will send information to the internal system in ASCII for transmission. In addition, you can also take advantage of BCD code information is sent, this way with respect to the issuance of the ASCII code, the advantage of having a small amount of information, better able to improve system performance. For example, when the ASCII code for data transmission requires 10 bytes, but BCD code requires only 5 bytes, you can complete the sending of information. In the navigation information network communication data frame design process, mainly in binary mode, so that, it is possible for the length of the message frame is effectively solved, and better able to guarantee the reliability of data communication. In the navigation center for data transmission, mainly related to the form of a data frame start flag, the length of data bits, reserved bits state identification, GPS information, data and other relevant information parity bit frame format.

About embedded navigation computer messaging system implementation. Embedded navigation computer system in the application process by the people, need to consider how to implement the system functions, so that, you first need to DOS initialization process, capable of network data

transmission process interrupt number set, and I / O address and interrupt level for effective design. Secondly, the need for system initialization process, involving the IP address, subnet mask, and other related information setting, and after the system initialization process, to be able to expand their applications and protocols, and add the UDP protocol. Next, the system in the application process, the navigation center to the corresponding navigation information transmission and processing, and complete GPS information receiver, so that information into the transceiver module. In the process, the first information into a library file, after a successful, adjust the configuration file, create a TCP socket, and connect to the server, the relevant information transmission, processing. In this process, we need to set the appropriate module code to ensure the system has high fault tolerance and robustness. Centre navigation system in the application process, which involves the code is compiled in BORLANDC3.1 system, the system can ensure the navigation information compiled with high reliability, and implementation is simple, fast. At the same time, the system is running, with a more stable communication, better able to meet the actual needs of the people.

Conclusion

Before embedded navigation computer system design process, the need to take into account the TCP / IP protocol effective application, and can be combined with the actual characteristics of a good choice for performance hardware, the application process to ensure that the system has higher performance. In this paper, the design process of embedded computer systems, the use of socket library to achieve the real-time communications DOS platform, analyzes its hardware architecture. Through analysis, we found, DOS system has good performance and openness high data overhead is relatively low, which has a better economy in large part to ensure the system.

References

[1] Gao Shesheng: Chinese Inertial Technology, Vol. 6 (2014) No 53, p.25-26

[2] Guo Zhenxi: Beijing Institute of Technology, Vol. 12 (2015) No 27, p.74-76

[3] Zou Xiangyang: Control and Command Control, Vol. 1 (2012) No 33, p.11-14

[4] Jing Peipei: Computer Measurement and Control, Vol. 3 (2010) No13, p.58-63

[5] Xue Zhihong: Embedded Systems, Vol. 12 (2011) No33, p.121-124