Research on Approach of Equipment Status and Operation Information Acquisition Based on Equipment Control Bus

Xu Li [a, *], Chen Meng, Huixia Jiang, Cheng Wang

Army Engineering University, Shijiazhuang 050003, China.

[a]764468402@qq.com

Abstract

Equipment status and operation information acquisition are the basis of information technology support. The distributed design of serial bus is widely used in modern weapon equipment. Based on the equipment control bus, it is more economical and convenient to realize the equipment status and operation information collection. The equipment status and operation information acquisition method based on equipment control bus is studied and two kinds of information acquisition mode are explored particularly in this paper. That application and existing problems are also analyzed. The future development of equipment status and operation information acquisition based on equipment control bus is summarized in the last.

Keywords

Equipment control bus; status and operation information; acquisition method; application.

1. Introduction

The "cognitive level sharing" and "timely guarantee" proposed by the future integrated joint operations require the establishment of a unified information system for equipment research and contracting units, use of troops, and repair agencies at all levels to achieve information sharing throughout the life cycle of equipment and achieve health. The purpose of comprehensive improvement of management and equipment quality assurance [1]. The traditional planned maintenance based on the restoration of the equipment's inherent technical state can no longer meet the requirements of modern joint operations for equipment and technology support. Based on the equipment's full-dimensional information, comprehensive analysis and processing, and access to real-time health status-based maintenance to improve maintenance efficiency have become equipment. The development trend of information technology support. The acquisition and information sharing of equipment status and operation information is the basis for the establishment of an equipment maintenance support information system and the transformation of the maintenance support model. With the development of computer technology and modern weapon equipment design, the system's operation control is usually based on a serial bus-based distributed design, so that the equipment status and operation information collection can be achieved economically and conveniently through the serial control bus. This article focuses on the general method of equipment status and operation information collection based on equipment control bus.

2. Equipment-State and Operation Information Collection and Application Overall Architecture Based on Control Bus

The overall architecture of equipment status and operation information acquisition and application based on the equipment control bus is shown in Figure 1. In order to realize equipment failure

prediction and health management, external dedicated acquisition equipment is used to obtain the status information and equipment operation information provided by the equipment BIT in the form of equipment information exchange (through the equipment design test interface or storage medium required by the test design) [2].The process of information. After the equipment status and operation information are obtained, they are expressed in a standardized format and published to provide information support for the implementation of state-based maintenance and other equipment information technology guarantees.

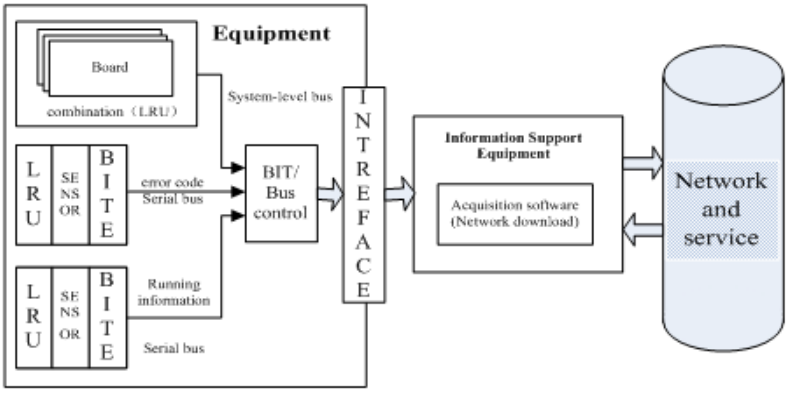

Fig.1. Overall Architecture

For electronic systems in equipment, LRU (field replaceable single element) may be combination itself (such as microwaves), or it may be a combination of internal circuit boards (such as communications). Such system BIT passes a specially designed self-test circuit. The self-test circuit monitors the function and performance parameters of the internal circuit and performs fault diagnosis. Through the internal control bus, fault codes (equipment operation status) or functions and performance parameters (equipment operation information) given by BIT can be obtained. For equipment in the electromechanical system, LRU is usually a component. This type of system collects equipment operating parameters through a component-level BITE (in-machine test equipment), and performs fault identification, sending fault information to the equipment control bus; for core components The operating parameters or the key operating parameters of some components are transmitted by BITE to the equipment information exchange interface through the equipment control bus to facilitate the use of external equipment to obtain these operating information for comprehensive fault diagnosis or operation status monitoring.

3. General Method of Equipment Status and Operation Information Collection Based on Equipment Control Bus

With the widespread application of serial bus distributed design in equipment operation control, the equipment state and operation information acquisition based on the equipment control bus is gradually deepened. There are mainly two modes of equipment status and operation information collection methods based on the equipment control bus, based on the information acquisition mode of the equipment test interface and the information acquisition mode based on the storage medium.

3.1 Information Acquisition Mode Based on Equipment Test Interface

The information acquisition mode based on the equipment test interface is mainly used to design the test interface equipment according to the testability requirements, and to acquire the state and operation information on the equipment control bus through the equipment test interface. The equipment status and operation information acquisition system in this mode consists of three parts: information acquisition interface, bus conversion module and portable computer module. The

information acquisition principle block diagram based on the information acquisition mode of the equipment test interface is shown in Figure 2.

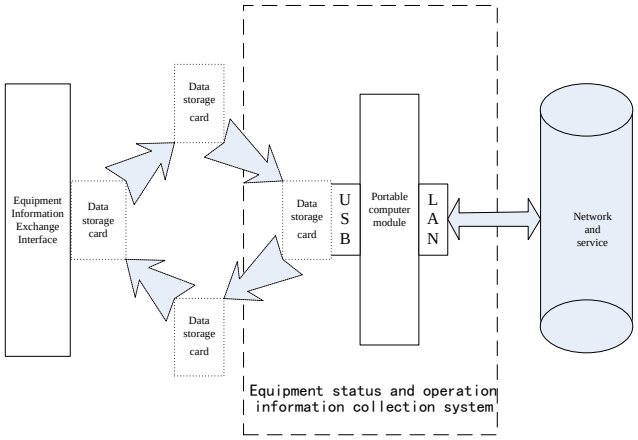

Fig.2. Block Diagram of Information Acquisition Based on the Information Acquisition Mode of the Equipment Test Interface

The information acquisition interface is connected with the equipment test interface to obtain the equipment status and operation information. The interface adopts a compact universal connector and is electrically matched with the equipment information exchange interface. After the information is acquired, it is transmitted in a wired or wireless manner[3]. The wireless transmission method does not require transmission media such as cables, and is farther than the wired transmission distance. This facilitates remote access to information and can also be transmitted when the vehicle is running dynamically. However, compared with wired transmission, the security and the anti-interference ability of wireless transmission are poor. Most of the weapons and equipment information collection uses wired transmission, and wireless transmission is widely used in the automotive field[4]. The bus conversion module realizes the conversion from various equipment control buses to the USB bus, in which signal adaptation and level conversion circuits implement bus signal adaptation and electrical matching, and the serial protocol conversion module implements communication protocol conversion. The portable computer module adopts a miniaturized handheld computer equipped with USB and LAN standard interfaces and installs information acquisition software.

3.2 Storage Medium Based Information Acquisition Mode

The information-acquisition mode based on the storage medium is mainly used for equipment that is not easy to design a test interface on the surface or inside of the equipment, such as an aircraft that increases the test-type interface to change the structure of the entire machine. Based on the information acquisition mode of the storage medium, the embedded data storage card is designed on the equipment through the design phase, and the state and operation information on the equipment control bus is acquired through the memory card. The hardware configuration of the equipment status and operation information collection system in this mode only requires a portable large-memory computer module with USB and LAN interfaces. The computer has dedicated information reading software. The information acquisition principle block diagram based on the information acquisition mode of the storage medium is shown in Fig3.

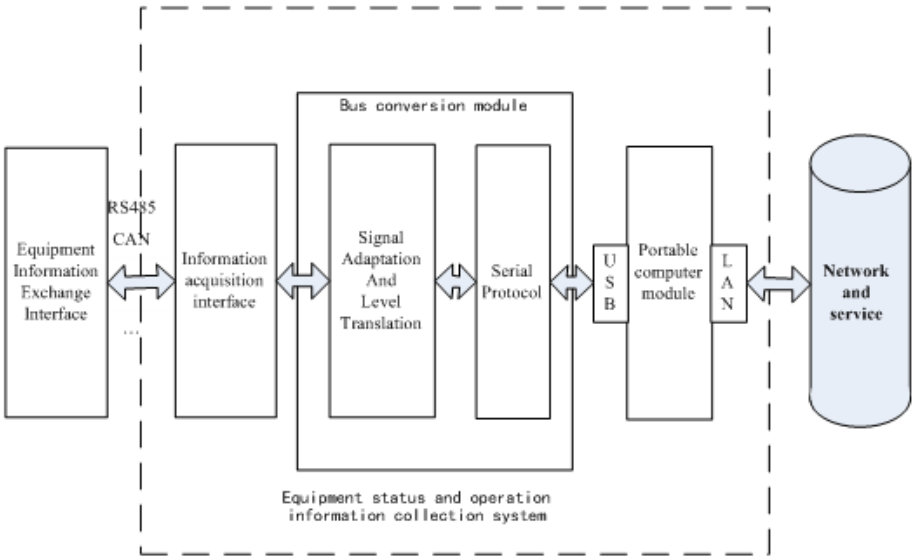

Fig 3. Block Diagram of Information Acquisition Based on Information Acquisition Mode of Storage Media

During the use of the equipment, the memory card acquires the status and operation information on the bus and saves it in a fixed data format. After use, the software reads the data through the dedicated information and obtains the information. After the information is acquired, the data storage card is embedded in the equipment.

4. Application of Equipment Status and Operation Information Collection Mode Based on Equipment Control Bus

The information acquisition mode based on the equipment test interface is generally used to design the equipment that the test interface has little impact on the overall structure (such as artillery, tanks, radar, etc.). The information acquisition system hardware modules mostly use mature products on the market, and the design cost is low; It can obtain real-time status and operational information of equipment and real-time information that changes with operating conditions. The real-time performance is strong. However, due to the inability to obtain full-time information of the equipment, the integrity of the acquired information is poor, and it is suitable for ground weapons with low reliability requirements. equipment. The information acquisition mode based on storage media is generally used to design test-type interfaces for equipment that has a large impact on the overall equipment structure (for example, airplanes, etc.). In the equipment design phase, the bus data and memory card signal matching must be considered, and the required memory card memory is sufficient. For large issues, the design cost is relatively high; regular acquisition of equipment information can not always obtain timely real-time information of equipment changes with working conditions, and the real-time performance is poor, but the data obtained is complete and suitable for air transport equipment with high reliability requirements.

At present, due to the lack of uniform specification of concepts, structures, and meanings of equipment BIT information, the data encoding and format on the equipment's internal control bus are all different, resulting in heterogeneous data structure and information semantic heterogeneity in information data[5,6]. The control buses used in our military's weapon equipment include RS-485 bus, 1553B bus, CAN bus, and industrial Ethernet. As there is no universal interface standard for testing interfaces, the equipment testing interface in the information collection mode based on the equipment testing interface is in the form of Not unified, the next step should be through comprehensive comparison of various

common control bus performance indicators, scope of application and electrical standards, standardizing the application requirements of the equipment control bus, and through the optimized combination of design equipment, external information exchange universal interface series; based on storage media In the information acquisition mode, the limitation of the capacity of the data storage card, the data storage format, and the inconsistency of the information reading software are important factors restricting the information collection and development.

5. Conclusion

Through the analysis of equipment status and operation information collection methods, devices and applications based on the equipment control bus, it can be concluded that:

(1) The requirement of the BIT based on the equipment control bus in the equipment structure design and the support equipment status and operation information collection function is the prerequisite for the next development of the equipment state and operation information collection based on the equipment control bus;

(2) Equipment standardization of external information exchange and description of equipment information standardization are the hot spots for the next step of research on equipment status and operation information collection based on equipment control bus.

Acknowledgements

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