Information Unloading and Processing Synthesis System for Airborne Flight Parameter

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Abstract—**The questions about flight parameter equipment of military aircraft assurance, which needs longer time to process; unload devices are not interchangeable for different aircraft; the reliability is lower, etc, in this paper an information unloading and processing Synthesis System for airborne flight parameter equipment, which can swiftly and accurately unload and process the data is introduced. With embedded PC/104 computer as its core, fully applies the software and hardware resource of the PC/104 board, programmed with VC++, this system implement the requirements to swiftly and accurately unload and process the data. Base on the technology of FPGA, USB etc, reliability and flexibility is greatly enhanced. By testing, the device can quickly unload and process the flight parameter with a small size, good reliability and wide suitability. It has important significance for ensuring flight safety and increasing combat effectiveness.**

Keywords—**flight parameter, unload and process System, embedded PC/104**

I.   INTRODUCTION

Flight parameter recorder is usually called "Black Box", it's used to record the aircraft's state parameters in flying procedure. It plays an important roll in judging systems state of plane, and the reasons of the accidents. Flight parameters must be sent by assistant systems to the workstations on the ground to be processed。 The workstations unloading and processing the data of flight parameters nicely and quickly is signified to find out the faults betimes, that can shorten the planes' preparative time to the next flight. But right now the modern information unloading and processing synthesis systems for airborne flight parameter have three shortages in the ground systems: the first, the long processing time; the second, the ground unloading systems are not universal; the third, it's not reliable. Aim at the above bugs, a novel information unloading and processing synthesis system for airborne flight parameter that can unloading and processing data quickly was proposed. The development of this system realize the information unloading and processing synthesis system for airborne flight parameter made in our country, it provides advanced technology for enhance battle effectiveness[3,5]. The probation indicate the system proposed is universal, adaptive and reliable. It not only can substitute the existing systems, but also has more advantages, it's worth to be generalized.

II.   HARDWARE DESIGN

The hardware systems of information unloading and processing synthesis system for airborne flight parameter are made up of embed industrial control computer system (PC/104), signal generator, displays, communication interface, analog signal conditioning multi-switch, keyboard, power supply and so on. The frame is shown as fig.1.
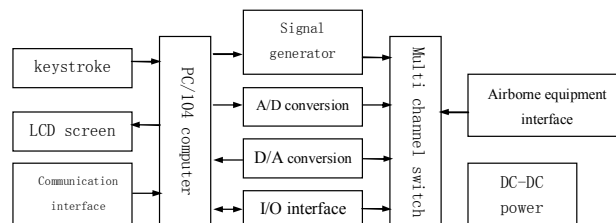

Figure 1.   System Structure

(1) Interface of airborne equipment is made up of cables and airborne equipment connection-peg. Difference airborne equipments can change the appropriate cables to realize a universal system. Information unloading and processing system identify equipments and enter into process programs by cables.

(2) PC104 computer board adopts 80586 micro computer as CPU. It is embedded with floating point processor. Its memory on board is 16M. The configuration can satisfy the demand of quick processing data. There are two 16C550 high speed serial port, one bidirectional parallel port and PC/AT keyboard interface. A lot of Flight Data can be stored on SSD. Watch dog can make sure that the system work reliably[1,4].

(3) Analog signal conditioning multi-switch was made up of operation amplifier, trigger and switch. It pretreats the airborne equipment output signal and controls the airborne equipment's state.

(4) High speed A/D, D/A and multi-switch are mainly used to watch the signal amplitude of the connection airborne equipment, it can judge whether each   and amplifier circuits are good or not.   was adopted is mainly considering the function extend, for example, as the ground unloading equipment for COK.

(5) Power supply adopt DC/CD, supplied by О Б З О Р К П А receptacles directly. To avoid short circuit, each power supply systems of unloading processor all mounted protected circuits. Fuses riveted on the rind are set to guarantee the security of equipment and easy to change.

This system suffices the requirement of airborne flight parameter ground exact unloading and quickly data processing. It is realized made in our country. It has the following main functions: unloading and fast processing the data of airborne

recorder; reporting faults of airborne equipments and machines; searching the section of recorded information; uploading data to flight processing workstation; checking every parts of circuits when electrify.

III.   THE COMPOSING AND FUNCTION OF SOFTWARE

The software of information unloading and processing synthesis system for airborne flight parameter is developed by C++ program language under WINDOWS operation system. The program is easy to be extended for its modularize design. The software system is composed as the main program block, hardware control block, data downloading block, data processing block, parameter uploading block and so on, as shown in fig. 2. Different programs are compiled according to the data structure of different flight parameter processing workstations.
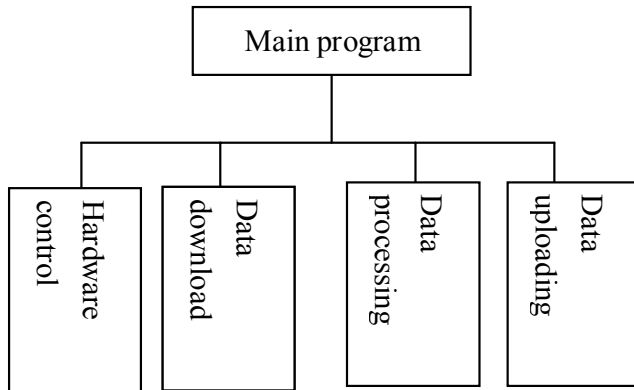
Figure 2.   Software Block diagram

The main program is the core of system, it manages and controls all the hardware and software of the system. For example, keyboard scanning,

IV.   PRIMARY TECHNIC

A.   FPGA

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FPGA figures Field-Programmable Gate Array.FPGA device and the empolder system is the new technic for the development of the digital Large scale integrated circuit .FPGA is able to be programmed infinitely and used expediently, it also can be simulated in field. So that it increases the reliability and the agility, lessen the device's weight, decreases the workload for the software. Therefore, the I/O interface of the signal pre-dispose is carried out by FPGA. This system adopts Complex Programmable Logic Device(CPLD),the function of CPLD is designed and simulated in MAX+PLUS II, possessed by Altera. MAX+PLUS II bear multi-input, which offers great convenience. AHDL, possessed by ALtera, is adopted for the hardware design. AHDL is integrated in MAX+PLUS II, adapts to describe complex Combinatory logic, State machine and truth table. The CPLD, which achieves the connection between signal pre-dispose system and PC/104,is carried out by

PM7128ESLC84,which is in the MAX7000 Series. As MAX+PLUS II bear online-download, the programme could be downloaded into the CPLD chip after the design is edited, translated and simulated. The object program could be downloaded repeatedly, and will not be lost after power-cut, so that the design and debug is very convenience.

B.   data transport over USB

USB interface is used for the date-transport between the Information Unloading and Processing Synthesis System and Airborne Flight Parameter processing station, so that it achieves plug and play and the data could be transported conveniencely.
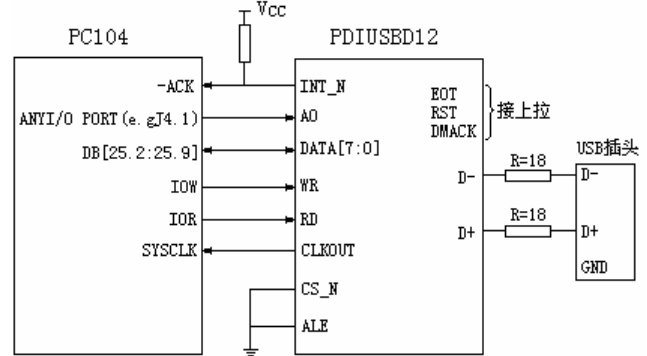
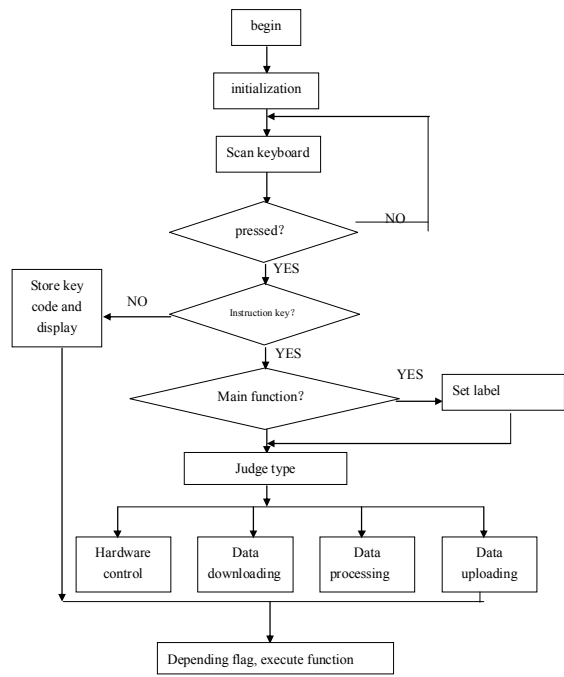Figure 3.   Hardware Schematic diagram

Figure 4.   Software flowchart

As a new mature peripheral equipment interface, USB is provided with many merits, for example, the transport is fast, extend easily, low interfere, plug and play, and so on. The unloading processor adopt PDIUSBD12,a appropriative chip possessed by PHILIPS, to extend the USB interface. The chip could realize the interface between the parallel bus and the USB bus. It is provided with the PLL(phase locked

loop),SIE(serial interface engine),FIFO module for the realization of the USB function, so that it could realize the maturity USB exterior equipment after being connected to the common microprocessor.
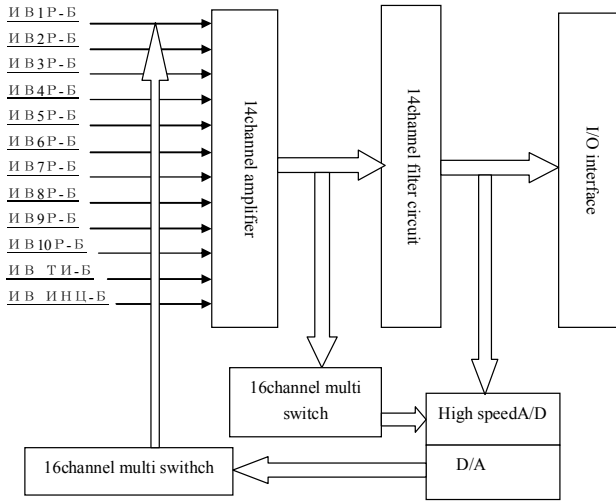

Figure 5. Signal predispose diagram

The transport speed could get to 1MB/S if PDIUSBD12 is used. The interface is simple if PDIUSBD12 is used as the memory equipment for the PC/104 labor controls machine. At the same time, the $\overline{\text{DMACK}}$ pin in the PDIUSBD12 should be connected to High level, otherwise it could not receive any command or data. The EOT_N should be connected to +5V in the USB via a resistor to detect the USB connection correctly. The I.NT_N should be connected to Vcc via a resistor. The circuit for interface is shown in figure 4.The software design for the interface is composed of three parts, USB driver, firmware and application. Application is programmed by VC++6.0.Its primary function includes the open and close of the USB equipment, USB detection, setting the USB data-transport pipe, startup of the data uploading module, show and analysis the data.

C. signal predispose

For the sake of conversion in the Airborne Flight equipment and the control of tap memory in the flight Parameter, the signal predispose system is installed in the processing system. The signal predispose system is composed of 14-routes recur amplifier,14-routes correct circuit, I/O interface,16-routes multiplex switch and 8-bits A/D D/A conversion chip. shown in figure 5.While unload flight parameter information, recur amplifier magnifies the information comes from flight parameter system. Especially when unload COK information as a patulous function, recur amplifier could magnify COK information in the tap. Because of distortion, the signal comes from recur amplifier is not normal rectangular pulse. The correct circuit will disposal the shape of the input signal.

V. CONCLUSION

The preferred spelling of the word "acknowledgment" in America is without an "e" after the "g". Avoid the stilted expression, "One of us (R. B. G.) thanks . . ." Instead, try "R. B. G. thanks". Put sponsor acknowledgments in the unnumbered footnote on the first page.

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