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On Board Data Acquisition System for Aircrafts

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ABSTRACT: A launch induced acoustic equipment represents a dynamic load on the exposed facilities and ground support equipment in the form of random pressures fluctuating around the ambient atmospheric pressure. In response to these fluctuating pressures, structural vibrations are generated and transmitted throughout the structure and equipment supported to it. During the testing of aircrafts, there is a need of measuring and monitoring of various physical parameters. These physical parameters like vibration, temperature, pressure, obstacle range etc., should be within specified limits. So based on the limits we can estimate and secure or protect them in required way to utilize in real time. So for that purpose here we are including various sensors, controller. And it can be monitored on PC or LCD.

KEYWORDS: DAQ (Data acquisition system) Sensors, Dynamic loads, Controller, Liquid crystal display (LCD).

I. INTRODUCTION

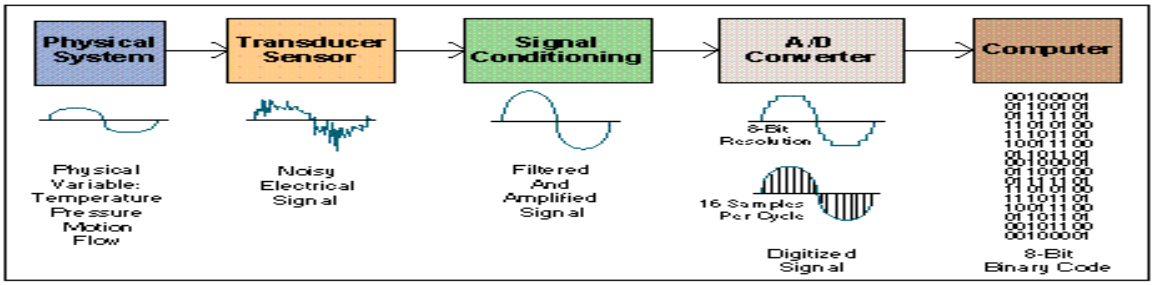
DAQ (Data Acquisition System) is the process of taking a real world signal as input, such as a voltage or current or any electrical input for processing, analysis, storage or other data manipulation or conditioning. A physical parameter represents the real world signal. A data acquisition system converts a signal derived from a sensor into a sequence of digital values. So the sensors are the primary elements which involves in reading physical quantities (such as temperature, vibration, pressure, obstacle detection etc.,) into a DAQ system.

Signal conditioning and processing means manipulating the analog signals in such a way that it meets the requirement of the further processing. Actually it is common to have a sensing stage (sensor) a signal conditioning stage (where usually amplification is done) a processing stage (normally carried out by an ADC and a microprocessor).

In this project an ARM processor is used as DAQ system, through which signal conditioning and processing can be done. The provided information is processed and thus it can be displayed on LCD or monitored on PC via RS232 cable. There is a reason behind choosing the ARM processor i.e., it has multiple channels so, can connect more inputs at a time and it also has inbuilt ADC and DAC circuits.

II. NEED OF A DAQ SYSTEM

DAQ (Data acquisition) is the process of measuring an electrical or physical phenomenon such as voltage, current, temperature, pressure etc., the below figure shows the basic Data Acquisition system.



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DAQ (Data acquisition system) is an enabling technology for large complex systems like aircrafts, spacecrafts, industrial automation because it provides automatic alerting, monitoring and memorizing necessary for efficient operations. DAQ system is vital in the development phase of aircrafts because the system might be destroyed after/during the test. So there is a need of critical parameters in order to analyze the performance of the system. Without DAQ it is not possible.

Basically a DAQ (Data Acquisition system) is defined as the process of taking a real world signal as input, such as a voltage or current etc for processing, analysis, storage and other data manipulation or conditioning. A physical phenomenon represents the real world signals that are used to measure. DAQ system has basically signal conditioning and signal processing.

The signal conditioning circuit improves the quality signals generated by transducers before they are converted into digital signals. It performs operations like amplification, attenuation, shaping or isolation of signals before they are sent to processing unit. The signal processing unit involves A-to-D converters which involves sample and hold circuit, quantizer and encoder.

Sensors are the primary input elements which involves in reading physical quantities (such as temperature, force or position) into a DAQ system.

III. IMPLEMENTATION

This paper proposes on board data acquisition for aircrafts which critically involves various types of sensors, an ARM processor, LCD display or PC (via rs-232 cable). The two main functions of DAQ, signal conditioning and processing are handled on board by an ARM processor. ARM is based on a reduced instruction set computing architectures (RISC). This approach means it requires significantly fewer transistors than typical processors in average computers. This approach reduces cost, heat and power use. It also has multiple channel facility by which more inputs can be connected at a time and it also has inbuilt ADC and DAC.

ARM7 (LPC2148):

An LPC2148 is used in this project. It is a 32-bit ARM& with real time emulation and embedded trace support, that combines the microcontroller with embedded high speed flash memory ranging from 32KB to 512KB. Due to thin tiny size and low power consumption, LPC2148 is ideal for applications where miniaturization is a requirement.

- 8 to 40KB of on chip static ram.
- 128-bit wide interface/ accelerator enables high speed 60MHZ operation.
- One or two10-bit A/D converters provide a total of 6/14 analog inputs, with conversion time as low as 2.44s per channel.
- Single 10-bit D/A converter provides variable analog output.
- Two 32-bit timers/external event counters, PWM unit and watch dog.

SENSORS:

Devices that are used to transform physical parameters into electrical parameters . The electrical parameter is measured by measurement hardware and the result is converted to engineering units. Different types of sensors are used in this project such as temperature sensor, vibration sensor, pressure sensor, ultrasonic sensor.

LCD:

LCD is a flat panel display. It allows the display alphanumeric characters.

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RS232:

RS232 communication enables point-to-point data transfer. It is commonly used in data acquisition applications, for the transfer of data between the microcontroller and a PC.

IV. KEIL SOFTWARE

It is possible to create the source files in a text editor such as Notepad, run the Compiler on each C source file, specifying a list of controls, run the Assembler on each Assembler source file, specifying another list of controls, run either the Library Manager or Linker (again specifying a list of controls) and finally running the Object-HEX Converter to convert the Linker output file to an Intel Hex File. Once that has been completed the Hex File can be downloaded to the target hardware and debugged. Alternatively KEIL can be used to create source files; automatically compile, link and covert using options set with an easy to use user interface and finally simulate or perform debugging on the hardware with access to C variables and memory. Unless you have to use the tolls on the command line, the choice is clear. KEIL Greatly simplifies the process of creating and testing an embedded application.

4.1.3 Projects:

The user of KEIL centres on "projects". A project is a list of all the source files required to build a single application, all the tool options which specify exactly how to build the application, and – if required – how the application should be simulated. A project contains enough information to take a set of source files and generate exactly the binary code required for the application. Because of the high degree of flexibility required from the tools, there are many options that can be set to configure the tools to operate in a specific manner. It would be tedious to have to set these options up every time the application is being built; therefore they are stored in a project file. Loading the project file into KEIL informs KEIL which source files are required, where they are, and how to configure the tools in the correct way.

KEIL can then execute each tool with the correct options. It is also possible to create new projects in KEIL. Source files are added to the project and the tool options are set as required. The project can then be saved to preserve the settings. The project is reloaded and the simulator or debugger started, all the desired windows are opened. KEIL project files have the extension

4.1.4 Simulator/Debugger:

The simulator/ debugger in KEIL can perform a very detailed simulation of a micro controller along with external signals. It is possible to view the precise execution time of a single assembly instruction, or a single line of C code, all the way up to the entire application, simply by entering the crystal frequency. A window can be opened for each peripheral on the device, showing the state of the peripheral. This enables quick trouble shooting of mis-configured peripherals. Breakpoints may be set on either assembly instructions or lines of C code, and execution may be stepped through one instruction or C line at a time. The contents of all the memory areas may be viewed along with ability to find specific variables. In addition the registers may be viewed allowing a detailed view of what the microcontroller is doing at any point in time.

The Keil Software 8051 development tools listed below are the programs you use to compile your C code, assemble your assembler source files, link your program together, create HEX files, and debug your target program. µVision2 for Windows™ Integrated Development Environment: combines Project Management, Source Code Editing, and Program Debugging in one powerful environment.

- C51 ANSI Optimizing C Cross Compiler: creates relocatable object modules from your C source code,
- A51 Macro Assembler: creates relocatable object modules from your 8051 assembler source code,
- BL51 Linker/Locator: combines relocatable object modules created by the compiler and assembler into the final absolute object module,
- LIB51 Library Manager: combines object modules into a library, which may be used by the linker,
- OH51 Object-HEX Converter: creates Intel HEX files from absolute object modules.

4.1.5 What's New in µVision3?

µVision3 adds many new features to the Editor like Text Templates, Quick Function Navigation, and Syntax Coloring with brace high lighting Configuration Wizard for dialog based startup and debugger setup. µVision3 is fully compatible to µVision2 and can be used in parallel with µVision2.

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V. CONCLUSION

An application program with all above mentioned constraints is successfully designed and tested**.** Integrating features of all the hardware components used have developed it. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC's and with the help of growing technology the project has been successfully implemented.

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BIOGRAPHY

Y. Gayathri passed B.Tech (ECE) at Santhiram Engineering College, Nandyal, in 2012 and Pursuing M. Tech (DECS) at Sri Padmavathi Mahila Viswavidyalayam.

Prof. A. Suresh kumar, obtained his bachelor, post graduate and doctoral degrees from Sri Venkateswara University, Tirupati, (AP) India. He was the founder professor of instrumentation both for PG course and research. Presently he is working as a coordinator for physical sciences and I/C Head of the Department of Electronics and Communication Engineering at Sri Padmavathi Mahila Viswavidyalayam, Tirupati (AP). His main research interest areas are photonics and instrumentation.