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SCE
Familiy

Smart Customizable Equipment
A Compact, cheaper and performant solution to a custom equipment

Overview

The GEB Smart Customizable Equipment was designed such as a development starter kit of controls and test systems where it is needed to make, in a small space, custom functions that can't be bought on the market, such as:

- Storing and playback of radar, sonar, Video, IR sensors signals
- Measurement and verification of non-standard protocols
- RF or micro wave mux/demux switches
- Simulators of non-standard protocols
- Situation simulation with injection of simulated pattern in real environment
- All equipments that handling and digital preprocessing analog signal.

This kind of equipments are generically composed of two parts:

- A custom part, in the field of knowledge and application of the customer
- A standard part that realizes the graphical human interface (GUI) and the communication using standard protocols.

Often it is also required the capability of local control through some local control panels with a remote control by TCP-IP on ethernet or by USB. Finally, the equipment is usually integrated in a rack with other ones, it must not need the requirement (caused by the use of an integrated Windows PC) to request a shutdown sequence, it must be possible to switch off the entire rack without turning off one by one all the subsystem that compose it.

Similar devices are often made by a PXI subsystem, using a 4U enclosure, a PC, standard boards, one or more FPGA boards that will be able to handles the non-common signals and protocols. Many times the FPGA card can't directly manage the application's signals, due the electrical levels, the impedances, the frequencies mismatch, causing a needing of custom interface logic. That last logic will be normally placed in the same PXI enclosure or in a separate case such as a 1U-3U Sub Rack.
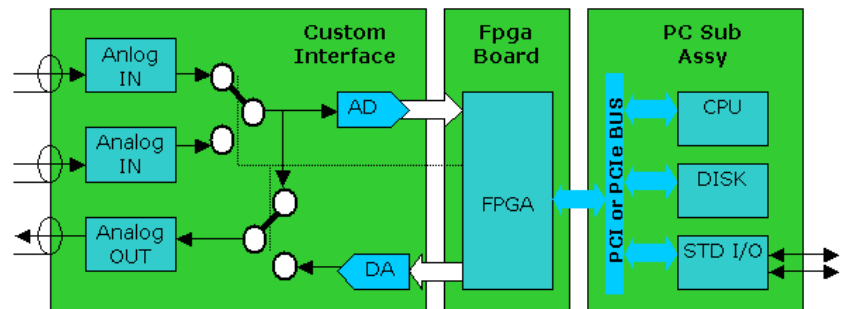
The final result will be that the equipment takes almost 6 rack unities, excluding monitor keyboard and mouse, with a cost of several thousand of Euro spent to buy the standard PXI components (PC, case, I/O boards, FPGA board, Power Supply, etc..). These expensive parts will be over dimensioned and, in a large part, unused. The user continues to have a lot of problems such as to make the custom interface logic (board or sub rack), that involves to make some mechanical panels to carrier connectors and to make the connection to the FPGA board, often made by rather long cables, and these cables can bring out signal integrity issues.

The Smart Customizable Equipment make available in small space at low cost a modular alternative. It consists of an industrial PC (SBC) fanless, Embedded Operating System Seven 32bits, one mini PCIe I/O interface card based on Altera FPGA, in a 2U rack case. The industrial PC is equipped in the basic version, with a CPU Intel Atom D2550 Dual Core 1.86GHz, 2Giga DDRIII, a Hard Disk solid state 16Gbytes size, a 5 inches LCD touch screen 800x480, some standard interfaces such as HDMI (Reserved to an external optional monitor) 2x1Gbit Ethernet, 2xUSB2, 2xRS232, 2xRS485 (See table on next page).

The case has free space to host the custom interface (board), it is designed to have extreme flexibility and modularity through the use of preformed, small, panels that allow an easily placing of the interface connectors (DSUB, mini-DSUB, HEADER (IDC), COAX , SMB, SMA, MCX75, etc). The Seven 32bits Embedded Operating System, fully compatible with 32bits Standard Seven, has been customized to allow the system to be turned off "like a light bulb", i.e. without performing the normal procedures required shooting down a Windows OS. Further removal of agreed programs and parts of the operating system allow you to use the device as a

standard instrument and not a PC. The Mini PCIe card (PCIEm-15-IO) using an Altera CycloneIV GX FPGA through its 53 I/O offers the possibility to wire the application signals in a simple way. The transfer speed from/to PC Memory can reach up to 160Mbyte/Sec. in half duplex or 250Mbyte/Sec. in Full Duplex (overall). The FPGA Subsystem can be easy created using Altera SOPC Builder or QSYS, some example Systems are available. The PCIEm-15-IO Board drivers allow the user to a simple management of registers, interrupts and DMA using popular languages and tools such as C, C++, Visual Basic, LabView and LabWindows.

Application Example

Taking as reference the block diagram of an example of a previous page the FPGA system is shown below. Again by way of example the signals sampled by the AD can be transferred in DMA to the memory or to the hard disk of the PC and /or vice versa. A FPGA system like this can be made starting from SGDMA base system in few hours using Altera SOPC or QSYS. The AD data could be processed adding to the REG block the needed VHDL code (see REG/DSP block on picture). Software on ATOM CPU can perform more data processing and/or show on built in local LCD or on an external, local or remote, monitor. Selection and parameter can be entered from the local touch screen or from a remote device and sent by Ethernet or USB.
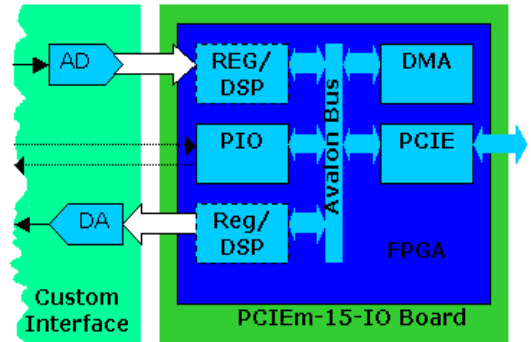
PCIem-15-IO **Mini-PCIe size**, The best and cheapest solution for **systems on box** allows the user to control electrical interfaces of your SBC to external I/O resources (i.e. motors, transducers, sensor, CCD and so on). Altera Fpga provides the user with up to 53 general purpose I/O and 3 dedicated Clocks with PLL, and up to 2Mbytes of on board SRAM, and a FPGA with about 15KLE (400Kgates) or 30KLE (800Kgates) resources. The JTAG connector allows the ISP programming using an ALTERA USB blaster.
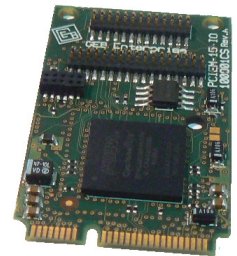
Related Documents

- PCIE-Family   Express Family Data Sheet.
- PCIEM-CIV-15-IO   Mini PCI Express board Data sheet.
- PCIe-SYS-REGS   PIO Registers FPGA loadable system.
- PCIe-SYS-2SGDMA   Dual Scattered Gate DMA and PIO Registers FPGA loadable system.

Main Features

Features	Base Equipment
SBC MainBoard CPU	Intel Atom Dual Core D2550 1.86GHz, 2Giga DDRIII
Disk	SSD 16Gbytes
Standard I/O (User available)	2xUSB, 2RS232, 2xGigaBit Ethernet, 2xRS232/RS485
Monitor	LCD 800x480 Touch screen Up to 1920x1080 External Monitor
FPGA Resource	Altera EP4CGX15, 15KLE Optional EP4CGX30, 30 KLE

Features	Base Equipment
FPGA I/O	1xPCIe GEN1 , 53 LVTLL GPIO, 2 Clock Out, 1 Clock In
Operative System	Seven Embedded 32 Bits with Safe Power Off.
User Internal avail. area	35x35cm
User Front Panel Areas	48TE, 12 Modules (*1)
User Rear Panel Areas	48TE, 12 Modules (*1)
Power Supply	160W Fanless.
Operative Temp. Range	0-50C°

*(*1) The Module size is 20.32mm, corresponding to the minimum modular panel size*

Ordering Information

Product Name	GEB Code	Description
SCE-ATOM-2G-15K	**121016A1**	Enclosure 19"-2U, CPU ATOM Dual Core Fanless, 2Giga Ram, 16Gbytes SSD, 2xGigabit Ethernet, 4xUSB, 2xRS232, 2xRS232/RS485, LCD 5"" TFT Touch 800x480. I/O Mini-PCIe (GEN1x1), 53 I/O, Fpga 15KLEs
SCE-ATOM-2G-15K-NK	**121016A2**	Naked, CPU ATOM Dual Core Fanless, 2Giga Ram, 16Gbytes SSD, 2xGigabit Ethernet, 4xUSB, 2xRS232, 2xRS232/RS485, LCD 5.7"" TFT Touch 640x480. I/O Mini-PCIe (GEN1x1), 53 I/O, Fpga 15KLEs