

Design and Development of PCI card for FPGA Demonstration for DERA

Background

The former Defence Evaluation and Research Agency (DERA), at Great Malvern, required the design and development of a special purpose PCI card and of software to facilitate access to and control of the card.

The purpose of the card was to serve as a research, test and demonstration vehicle designed around a family of Xilinx Field Programmable Gate Arrays (FPGAs) with the aim of implementing very high performance Digital Signal Processing (DSP) functions. The card was to house a total of seven FPGAs, four for the DSP functions, and three to implement the PCI Target Interface and routing of resources, and eight RAM chips.

Project Details

The successfully completed project involved:

- An initial design study, consisting of the matching of a range of typical image processing and other DSP functions to the capabilities of the FPGA chips, leading to the design of the card's architecture
- Design of extensive 'back end interface' logic (within one of the FPGAs) to connect the basic PCI functions to the body of the circuitry
- Schematic design and PCB layout of a complex, high density 8-layer PCB to meet the PCI standards

- Card manufacture and test
- Creation of a C software DLL to handle all communication with the card (accessing of its onboard RAM, downloading configurations to the various FPGAs, and all timing, control and status interrogation functions)
- Creation of a Visual Basic user interface, interfacing to the card through the DLL.

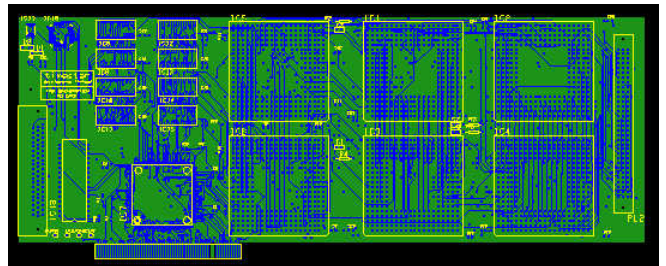


Figure 1: PCI card layout

Success in Service

Following successful completion of the first project, DERA asked us to carry out a further project to demonstrate the abilities of the new card. This required the design of an implementation to carry out multiscale convolution image processing on a 512 x 512 x 8 bit image. The successfully completed project involved design and development of logic to carry out filtering, sub-sampling and decoding on an image, and the facility to store the original image downloaded from the PC to on-board memory, and also to save the intermediate and final images for uploading to the PC.