RT - RK
COMPUTER BASED SYSTEMS

White paper

High-speed computer based X-ray camera

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Customer

The customer is a world known scientific research facility supporting the life, physical and environmental sciences. The project is developed in cooperation with the University of Sheffield Vision and Information Engineering Research Group.

Project Overview

The goal of the project is a development of a high-speed computer based x-ray camera. The purpose of this camera is exploring high speed phenomena during a pump-probe experiment.

The project deals with development of the next generation high performance x-ray camera platform intended for scientific applications. The camera platform should offer high definition, high speed operation with highly configurable region of interest and frame rate parameters.

The main challenges of the project were:

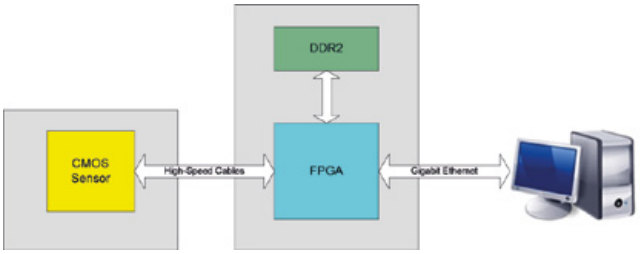
- High speed imaging (500 FPS at full resolution, more than 10000 FPS at reduced resolution)
- Gigabit Ethernet connection
- User selectable region of interest
- Camera PC application API support for existing control applications

The initial concept is developed in close cooperation with the customer's team and the University of Sheffield Vision and Information Engineering Research Group. During that stage, the sensor selection was made based on customer's requirements.

As a next step, a product development project was initiated, targeting development of the camera platform. The RT-RK was to develop the hardware platform together with the corresponding PC application.

The developed device consists of two physical modules: main module and sensor module. The connection between the modules is flexible allowing different physical configurations. With configuration like this it is even possible to change the sensor without the need for the main module platform redesign.

From the functional point of view, the device is based on the latest generation FPGA device. FPGA firmware is developed using highly flexible embedded system approach allowing rapid system customization. Depending on the sensor chosen, various applications are possible.



Structure of the developed device

Interface between the device and the PC is established using dedicated Gigabit Ethernet connection.

On the PC side client/server application is developed. The application is capable of stand-alone operation providing intuitive camera interface to the operator. Beside that, application can act as the camera server, allowing remote control by providing complete command set API to the user client application. This way, the camera control can be included in the experiment control environment.

Control interface scheme

The complete electronic is enclosed by a metal housing designed by the cooperant. The device is tested using custom built optical aperture.

The development lasted one year. It involved a hardware engineer for schematics and PCB design, a FPGA engineer for development of the embedded system, one software engineer for PC application and a concept engineer.

Benefits

The project covered the complete development from the product idea until the industrialized product, consisting of electronics, optical aperture and housing. All development steps were either conducted or organized by RT-RK, in correspondence with our cooperator and the customer. The final solution fulfills the customer requirements both in terms of price and performances. The complete development process was transparent to the customer via regular correspondence and appropriate reports.

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