ABSTRACT

The use of real-time video processing has experienced an enourmous growth during recent years. Applications that involve real-time video processing can be found in many application areas, such as industrial processing, surveillance and home entertainment. The work in this thesis is related to two different application areas for real-time video processing. The first application area considers an FPGA based machine vision system for industrial applications while the second application area considers FPGA based video enabled computers for industrial and automotive applications.

Video processing functionality can generally be implemented either as software, using general purpose processors or digital signal processors, or as hardware, using field programmable gate arrays or application specific integrated circuits. Of these alternative implementation platforms the FPGA offers a unique combination of performance, flexibility and the possibility for rapid system development. For data intensive processing tasks such as real-time video processing, hardware implementation provides a great performance advantage when compared to the software alternatives.

In this thesis an FPGA based camera architecture for range imaging is presented. The architecture enables high speed three dimensional size characterization of objects using a low cost FPGA device. The performance of the presented architecture exceeds that of a high cost commercial range imaging camera.

The reconfigurable nature of the FPGA provides the possibility to design flexible system platforms that avoid obsolescence caused by changing product requirements or the end-of-life for system components. These system platforms also make it possible to design customer specific systems based on the same platform.

In this thesis FPGA based architectures for real-time video processing in FPGA based video enabled computers are presented. The presented architectures enable resource efficient implementations of video processing function that are required in many industrial and automotive applications. A resource efficient implementation reduces cost and increases flexibility as more resources are available for implementing customer specific functionality