

Next-Generation SoC: Video & Control Processing for Action Camera

Introduction

The customer is a well-known technology company that manufactures action cameras and creates its individual mobile apps and video-editing software.

The customer's goal was to advance a specific camera model to the next generation. This required a custom-built processor with unique features with a higher power-performance ratio. A prototyping platform to test different use-cases against the proposed architecture for the new processor was necessary. To accomplish this, Mirabilis Design Inc. was engaged to create a virtual model of the camera's processor.

Apart from providing consulting services for this venture, Mirabilis Design Inc.'s flagship product VisualSim with its tools and extensive library, was deployed to construct this virtual processor.

Customer's Story before Mirabilis Design and VisualSim

The camera's model in question, was till then, running on an off-the-shelf processor. This meant that other companies could also make use of the same processor, thus reducing the competitive advantage.



In this scenario, the customer wanted to include several new features for the next generation of the camera. This would require a custom-built processor. Since a full custom-built processor calls for a high level of investment, it was important for the customer to understand completely the new features to be incorporated, and the usage of different resources and their impact, for all possible combinations of use cases.

In other words, the new features needed to undergo a requirements validation on a virtual, collaborative specifications platform.

This platform was made available by Mirabilis Design Inc.



Why the Customer Chose Mirabilis Design Inc. and VisualSim VisualSim's technology has been built for rapid product exploration, system validation and design space experimentation. The pre-built modelling library, applicationspecific templates, detailed technical support and extensive reports provided instantaneous feedback on the customer's system feasibility, performance, energy-efficiency and quality.

Before building the actual processor, it was critical for the customer to test out all features and parameters. Mirabilis Design helped to significantly reduce all risk through the dynamic system simulation, a key feature of VisualSim.

Various use cases were run and verified and in the process, system performance barriers like high power consumption were reduced. Product specification confidence was also increased using the modeling library and analysis tools in VisualSim.

Project Scope

- Key requirement 2:20 hours of recording time and 4k recording facility
- Higher power-performance ratio
- Prototyping platform needed to test several use cases against a proposed architecture for the proposed processor.
 - Examples included overlapping 360i, dual lens 720p, and 4K
- Achieve timing deadlines for existing software on the proposed processor

Challenges

- Pipeline and memory accesses were concurrent and dynamically scheduled, requiring detailed analysis to measure the power, memory bandwidth and timing
- H.264 and H.265 algorithms spanned multiple stages of the pipeline
- There was limited power optimization for the video pipeline and memory access, areas that consumed most of the camera battery. For instance, the current battery life for the 4K recording was only 45 minutes
- The electronics board in the camera could not accommodate an FPGA; which was required to add new features and an accelerator for key video functions.
- The area needed to be minimized by reducing the buffers, bus structures, system width, clock speed and memory
- Achieve timing deadlines for existing software on the proposed processor



Mirabilis Design's Solution

- A model of the entire SoC was developed using the block and flow diagrams provided
- Information template developed by Mirabilis Design was used to populate the list of devices, the tasks on each core, use-cases, traffic, sensor activity and configuration of each device
- Latency across the pipeline was measured
- Buffer overflows and incorrect sequence of memory data were corrected.
- Power management algorithms were created and tested for various use-cases.
- Specifications provided to the semiconductor vendor was optimized
- Examples include overlapping 360i, dual lens 720p, and 4K

Technology

AMBA AXI, Arm Cortex A53 and A77, GPU, DMA, HDMI, LPDDR and Light Sensor

Results

- The model was ready in three months, much ahead of schedule.
- A vastly improved end-to-end latency and throughput was achieved, along with reduced power consumption.
- The new processor enabled battery life of three hours for 4K recording, compared to the earlier time of a mere 45 minutes.
- New use-cases and boundary conditions were identified before the actual product development.
- An enhanced quality of the customer's final product design was accomplished.

Mirabilis Design Inc. was the single source provider of both the virtual prototype and consulting services. The customer had various components to be integrated on to the proposed processor. Mirabilis Design was able to effectively ensure all of that to speed up the development process, apart from providing the tools and the existing library.

If you would like similar results, reach out to us!



