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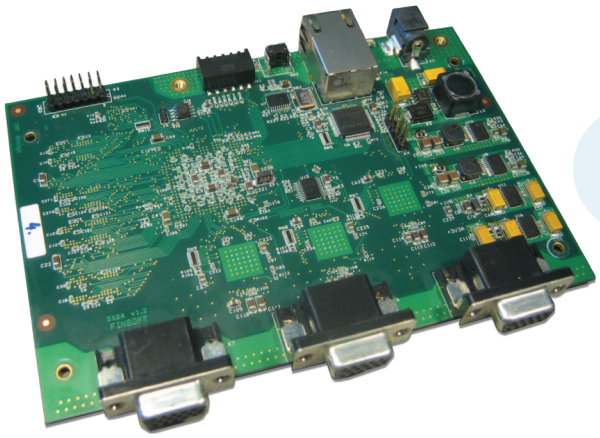
STOS 3XGA
Custom Development Project

Customer: Finsoft Limited, London, UK
Project completed in 2008

IMPT, a spin-off company of Michael Pupin Institute leverages a long-term experience in design and development of custom embedded systems. The company of 42 employees, located in Belgrade, Serbia, is specialized in digital signal processing, physical level communications, multimedia, high-speed hardware design and embedded software. This case study presents development and manufacture of a high-tech electronic device done on behalf of Finsoft Limited, a London-based company later acquired by GTECH Group from Rhode Island, USA.

When Finsoft conceived an advanced Ethernet video display device for its new STOS (Stream to Screen) digital signage system it began a search for companies able to meet requirements of such development. STOS system was envisioned as most versatile and cost effective information and digital signage system on the market, enabling customer to drive over a thousand screens from one computer. Ethernet video display device for such system must be robust, simple, and able to drive as many screens as possible. Primary function of such device would be to display still graphics and video received over LAN network. Optionally, the device should include a web client in order to get graphics from servers on the Internet, and it should be able to generate legacy NTSC/PAL video output. However, the key requirement was to cut down the price as much as possible, without compromising performance.



Following initial discussions on device requirements and various architectural solutions, Finsoft recognized IMPT as a reliable and competent partner and awarded it a custom development contract.

The first task for IMPT design team was to choose the right set of components and to devise suitable system architecture. State-of-the-art Texas Instruments' TMS320DM642 multimedia DSP processor proved to be the right choice for central processing unit. Its high-performance fixed-point DSP core, Ethernet MAC, SDRAM controller and three independent video channels in one package enabled design team to greatly simplify hardware architecture. That solution also guaranteed lowest price per video channel, enabling device to attain best price/performance ratio on the market. In addition to DSP processor, the device incorporated a power supply, Ethernet physical layer transceiver, 64 MB of 133 MHz SDRAM, and three high-performance video DACs. Video outputs was designed to provide full XGA resolution (1024x768) each, thus the device gets its trademark - STOS 3XGA.

The key requirement on the software part of the design was to provide full independence of video channels and to enable efficient sharing of hardware resources. That goal was pursued by strictly following object oriented modeling paradigms and best industry practices. To enable such software architecture to run in real time, development team decided to utilize Texas Instruments' DSP/BIOS with Reference Framework 5, a proven multitasking RTOS solution for DSP-intensive applications. Some of DSP algorithms, such as image resize and image rotate were coded in assembly language to further boost performance. Off-the-shelf software components Network Development Kit (NDK) and JPEG decoder purchased from TI helped to significantly cut development time. PAL/NTSC encoding was implemented in software, enabling re-usage of three RGB video DACs to generate total of six independent SDTV signals.

Paying close attention to software architecture design and performance optimization resulted in record-breaking utilization of hardware resources. When decoding three 512x384 video streams received over network, with resize and rotate functions on three full XGA video outputs, the software consumes about 95 percent of CPU running at 600 MHz.

The STOS 3XGA device was designed and developed from scratch in just six months. The development process included thorough analysis of the requirements, development of device architecture, detailed design, hardware and software development, optimizations regarding to price and manufacturability, mechanical design, prototype production and testing. Well established quality control procedures were enforced throughout entire design cycle, resulting in single development cycle and high-quality product. Final testing of the device included EMC tests in independent laboratory which demonstrated conformance to relevant European and US standards, enabling it to carry CE and FCC marks.

Finsoft was ultimately very satisfied with IMPT's performance on STOS 3XGA development project. IMPT's proven expertise, technical excellence and availability of high-tech assets led to Finsoft's decision to offer a manufacturing agreement between two companies. This agreement included adaption of STOS 3XGA hardware to better suite mass production, development of quality assurance procedures, procurement of production materials and initial small-scale manufacturing. To fulfill requirements of this agreement, IMPT established cooperation with two other Serbian companies: IRITEL and SV-Line, both based in Belgrade. IRITEL offered its expertise in electronics manufacturing services, while SV-Line produced fully customized metal cases for the device. Cooperation with these two companies was very successful and finally led to trouble-free production process.

In just four months after signing a manufacturing agreement, IMPT succeeded in redesigning 3XGA device, including optimization for price and manufacturability, devising specific automated test procedures, establishing production line and delivering first batch of devices to the customer. Production was done by applying highest quality control standards in terms of manufacturing procedures and working environment. Fully automated test bench was developed by using custom bed-of-nails fixture and National Instruments' PXI equipment. Automated testing in production enabled rapid and reliable quality assurance with automatic report generation. Each device was subjected to final 48-hour burn-in test before delivery. Special attention was devoted to ensure that no hazardous materials were used during manufacturing process, making final product compliant to European RoHS directive.

Complete initial batch of 1,000 STOS 3XGA devices was exported to Finsoft in United Kingdom. The final proof of customer's satisfaction is definitely an ongoing partnership between Finsoft and IMPT through new custom development and manufacturing agreements.

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