Embedded Communications Processor at Core of Videophone's Success

The Project: To develop an interactive videophone with a digital stethoscope and support for various medical peripherals.
The Solution: Use a highly integrated embedded processor that handles numerous communications protocols and minimizes the need for expensive interface logic.

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(click the image to enlarge)

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By Stuart Ross and Chris Hale

The escalating cost of healthcare, the rising tide of an aging population, and the expansion of cost-effective, reliable consumer broadband connections have set the stage for a revolution in home healthcare. With such a set of conditions, the healthcare industry is raising the curtain on innovative and interactive solutions that will substantially reduce the cost of patient care.

Many distinct approaches have evolved with each promising to increase the quality of patient care. These approaches include platforms that provide both real-time interactive home healthcare and automated medical data aggregation. All share the need to integrate effective patient interaction and automated data collection into an agile communications platform while hitting a cost target that provides a suitable return on investment.

Multimedia platforms offer affordable and compelling solutions for telehealth, putting a new face on interactive in-home monitoring and patient care. They can be used in many telehealth applications including pediatrics, geriatrics, mental health, rehabilitation, and cardiology. They also are valuable tools for reaching out to patients who live in remote areas or who may not have access to health care. These

unique devices help decrease nurse workload, nurse/patient home visits, and patient hospitalizations. With the attachment of medical peripherals, the devices also allow for accurate and reliable monitoring of vital signs and help patients stay in compliance with doctor's orders for disease management and control.

The CareStation platform from Motion Media Technology Inc. is one example of a multimedia appliance for the telehealth industry. Central to the CareStation platform is the CS156S videophone, which is built around a ColdFire communications processor from Freescale Semiconductor Inc.

The videophone provides a high level of patient interaction via two-way audio and video as well as the capture of medical telemetry and patient response, thereby extending the care provider-patient relationship remotely. This appliance goes beyond the basic videophone by integrating a digital stethoscope and support for a variety of external medical peripherals into a standalone system that works over both PSTN and IP networks.

Thanks to the multifaceted capabilities of the embedded communications processor, patient data on blood pressure, pulse rate, blood glucose, weight, temperature, blood hemoglobin saturation, and fetal vital signs can be transmitted to the care provider and captured as an integral part of disease management.

The selection of this highly integrated embedded processor as the core control processor was critical to the successful design of the CareStation. It provides affordable high-core performance, versatile and comprehensive on-board peripherals, and integrated communications features. These enable the appliance to minimize the need for additional and expensive interface logic. The result is a clean, simple design that allows the CareStation to support numerous communications protocols such as USB, Fast Ethernet, and RS232 links. It also enables the CareStation to adapt dynamically its operational modes and functions to meet the demands of many different classes of patient care.

The capabilities and flexibility of the embedded processor help create appliances and platforms that can be targeted toward a particular application purely through software development efforts instead of iteration of the hardware design, which would mean utilizing expensive FPGAs, off-board peripheral ICs, or other glue logic.

Currently, embedded processors are available with multiple serial ports, built-in (up to 256 Kbytes) flash memory, large arrays of SRAM, and integrated broadband options. They will continue to shrink in geometries&#151from 0.25 micron to 90 nanometers&#151and usher in a myriad of on-chip peripherals at little or no cost.

The future of cost-effective multimedia appliances depends on advancements in new technology such as magnetoresistive random access memory, also known as MRAM. It combines the best attributes of three memories on a single chip with the density of DRAM, the speed of SRAM, and the non-volatility of Flash memory, which will enable larger arrays of on-chip memory. Imagine a patient's entire medical history stored in a single encrypted device for instant recall, replacing the traditional forms and charts stuffed in file folders. This technology will allow caregivers and patients to refer to data regardless of time or space, thus lowering the cost of managed care, and provide the advantage of portability. Taking a page from their cell phone cousins, these new appliances also will search for the most efficient venue to connect with other devices in the network. Their built-in cameras will capture the mood of a conversation in full motion video while recording every movement thanks to a built-in GPS module, accelerometers, and special sensors.

In conclusion, smaller, faster, and cheaper embedded processors will support faster broadband options. Advances in broadband technology such as VoIP and wireless technology, including ZigBee, WiFi, and ultimately Ultra-Wideband technology, will create a seamless transfer for data-intensive information. Products such as the CareStation are prime examples of how cost-effective multimedia appliances and the emerging consumer broadband network will revolutionize home healthcare. These platforms, which are based on agile embedded processors, will bring the patient and care provider together and integrate automated medical data collection and personal interaction in order to improve the quality of patient care.

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