Internet of Things Transforms Connected Health Applications

Connected medicine relies on embedded computing systems with low power consumption, high processing power and good graphics capabilities. Designers are tapping processor advancements, pre-validated building blocks and manufacturer expertise to ensure the interoperability required by the Internet of Things, and to meet time-to-market with optimized price and performance.

by Maria Hansson, Kontron

Medical OEMs and developers have an opportunity within the growing connected health market, designing low power systems focused on graphics-rich computing. Module-based designs add value with their ability to be used across a product family, covering a broad range of medical applications. The market is transforming rapidly, driven by the Internet of Things (IoT) and its focus on connectivity, security, scalability and sustainability. Applications range from IoT endpoint devices to infrastructure systems, moving well beyond just data collection and now enabling insight for smart, practical applications that add value to patient care by providing real-time data

Integrated solutions based on standards such as SMARC and COM Express are paving the way for this type of medical design innovation. Designers have new competitive options including processors that increase performance, security and flexibility; and low power, open architectures that allow pre-validation of hardware. Standard, readily available modules and motherboards also simplify development, along with custom and semi-custom solutions designed to fit customer requirements on connectivity and performance. Designers must balance price, performance, product lifecycle and time-to-market to compete in the complex market of intelligent healthcare applications.

Price and Performance Balance with Advancements in Power Consumption

Advancements in modules and boards providing reduced power consumption and better graphics are at the heart of these connected care systems—enabling secure, highly scalable designs. Low power design has been dominated by ARM-based platforms such as COMe and SMARC (Figure 1), fueled primarily by rapid advancements of smartphones, tablets and HMIs. Based on the ARM Cortex A9 technology, they enable an efficient development of smart devices in an extremely compact, fanless design with balanced processor and graphics performance.

ARM technologies are also optimized for medical design, providing industry impact due to performance per watt and interface configuration advantages (Figure 2). For example, ARM-based modules, as well as selected SMARC modules, feature cost-effective Parallel TFT display bus and MIPI display interfaces, which are not typically found on COM Express.

ARM modules also support advanced graphical user interfaces that include graphics acceleration capabilities. Along with broad Ethernet and Wi-Fi network connectivity, ARM interface options include CAN, USB, SDIO, LCD I/F, I^2C, SATA and PWM. These native features and broad range of interfaces supported by ARM technology contribute to shorter time-to-market. Further, low power consumption makes ARM modules attractive for mobile applications or scenarios where a battery-backed solution is necessary.

SMARC covers two module footprints to offer flexibility for different mechanical requirements, including a short module measuring 82 x 50 mm and a full size module measuring 82 x 80 mm. The

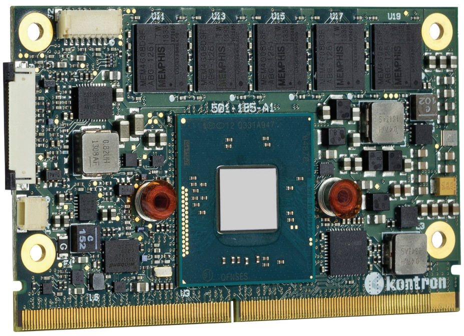

FIGURE 1

Kontron's SMARC-sAMX6i, an ultra-low-power ARM and SoC-based SMARC module, incorporates the Freescale i.MX6 family of solo, dual and quad core processors. The highly scalable Kontron SMARC-sAMX6i modules with single, dual or quad core Freescale i MX6 processors cover an extremely wide performance range.

SMARC short module is comparable to the COM Express mini form factor (55 x 84mm), and both standards rely on carrier boards to add customization to a design, with the exception of custom BIOS requirements that are executed on the module itself. SMARC was originally developed as a COM standard for ARM-based processors, but is also well-suited for x86-based processors. New SMARC modules include the Intel Atom E3800 processor series in the 82 x 50 mm format, combining low power consumption of 5 to 10 watts with a mobile feature set tailored for the smallest portable handheld devices (Figure 3). There is still enough space for up to 64 Gbyte onboard SSD to store OS and application data. Intel Gen 7 Graphics are carried out via HDMI 1.4 and LVDS (optional eDP) with up to 2560x1600 and 60 Hz to the display. Customer-specific extensions can be implemented via 2 SDIO and 3 PCIe x1 lanes with 5 GT/s.

Medical OEMs can deploy SMARC-based modules in any application where power consumption has to be kept at just a few watts but high-level computing and graphics performance are required. Like COM Express, modules can be upgraded for long-term performance without replacing the carrier board, thereby extending the life of the system. Customization contained in the carrier board can remain, allowing long-term scalability and improved performance for next generation versions of an existing medical product or device.

Access to patient data such as test results and diagnostic images is a compelling reason for connectivity in healthcare. For medical OEMs, the E3800's low power consumption is an essential part of the connected care equation, particularly when coupled with its built-in security features. For example, modules such as the Atom E3800-based SMARC and COM Express are increasing performance, security and flexibility in modern healthcare applications that rely on slim graphics-rich tablets, handheld PCs and stationary HMIs. Hardware-assisted capabilities, such as Secure Boot and Intel Advanced Encryption Standard New Instructions (Intel AES-NI), help secure endpoints, encrypt and decrypt data, and allow only trusted software to run on the device.

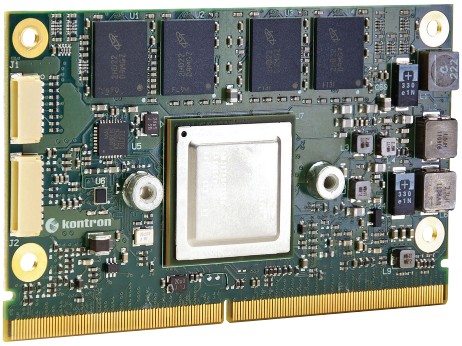

FIGURE 2

Kontron's ULP ARM and SoC-based SMARC module sA3874i incorporates TI's AM3874 up to 800 MHz and is based on Cortex A8 technology, enabling low power consumption and rugged construction to withstand harsh medical environments.

ARM Platforms Drive Low Power, Pre-Validated Solutions

Open architecture ARM platforms offer an optional building block solution approach used by medical designers. This building block approach helps minimize the time from evaluation to deployment, and provides value in terms of design flexibility, interoperability and smooth design migration. By leveraging the advantages of verified modules and boards, OEMs can avoid the long delay of validating hardware and gain a critical time-to-market advantage. These pre-validated building blocks are tested to deliver the required interoperability and functionality; the customer would only need to focus on the system IP.

With pre-validated building blocks, medical OEMs are assured of compatibility, interoperability and high reliability—so their full focus can remain on application development and OEMs can readily reuse their "library" of application-specific software and install it on their new hardware. By using a modular approach, there is also the ability to incorporate hardware monitoring. Similar to a smart home usage model, the large and costly machines used in medical treatment can communicate via IoT and minimize system downtime. The real-time data they share helps ensure systems are operating properly, identifying potential failures in advance so that routine scheduled maintenance can take place.

Purpose-Built x86 Platforms Add Value to Medical Deployments

Standard, mass-produced components are also part of reducing time-to-market for connected, medical products. For instance, Kontron's KTQ67/Flex-MED is a dedicated medical motherboard manufactured in series production and featuring an EN 60601-1-compliant LAN (Figure 4). It connects two independent displays via DVI, has two isolated Gigabit Ethernet interfaces and 12 USB 2.0 interfaces, and its unique multi-purpose Feature Connector supports up to 160 GPIOs. Intel's Active Management Technology 8.0 is supported for remote management and easy maintenance, resulting in higher system availability and lower overall costs.

With extensive, built-in connectivity and interface options, standardized, high-performance medical motherboards tar-

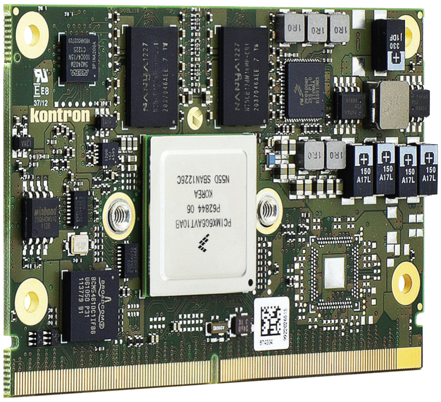

FIGURE 3

Kontron's SMARC-sXBTi Computer-on-Modules have been developed to comply with the SGET specification and are equipped with the Intel Atom processor E3800 series and up to 8 Gbytes of RAM, optional with ECC. They support the extended temperature range of -40° to +85°C, measure only 82 mm x 50 mm and have an especially low-profile design thanks to the use of edge card connectors.

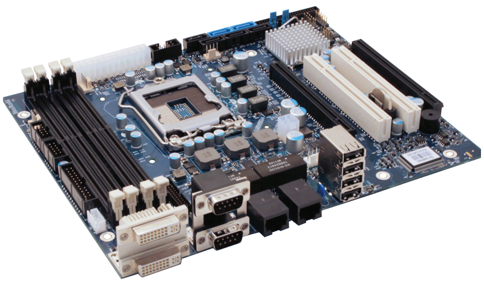

FIGURE 4

Kontron's KTQ67/Flex-MED is a medical motherboard based on the Intel Q67 System Controller Hub and offers up to 32 Gbytes DDR3 RAM.

get graphics and/or processing-intensive medical applications. Today, this level of performance is required in nearly all healthcare environments, ranging from bedside applications and diagnostic work stations to computers in operating theatres, at nursing stations and in consulting rooms. These intelligent systems are often connected to hospital information systems (HIS), requiring non-stop connectivity and data sharing.

In OEM equipment, this type of motherboard would be deployed as a back-end processing block and as a GUI controller for a variety of medical devices including stationary and semi-mobile ultrasound scanners, MRI and CT. Widely available boards simplify system development and advance connected healthcare applications, as medical OEMs, VARs and medical end users benefit from a broad customer base, improved support and better economies of scale. Another key advantage to using embedded motherboards is long lifecycle and revision control, enabling a stable platform for long-term deployment.

Solving Design Challenges with Customization

A notoriously fast-changing market, medical electronics follow a development path similar to that of consumer electronics; smaller, faster, more powerful devices are paving the way for advancements in smarter, more connected patient care. This includes the realm of low-cost connected healthcare strategies based on systems targeted to inexpensive, high volume production of in-home devices. Time-to-market is a primary challenge, with lengthy development and testing schedules, and regulatory review and certification that can mean anywhere from 24 to 36 months from project inception to volume shipment date. During this time, critical attention has to be given to managing the research and development cycle as well as costly and time-consuming efforts behind FDA review. At the same time, designers must be innovative, achieving a successful design by focusing on their core competencies to build products that stand out among the competition.

Manufacturing partnerships can provide a significant competitive advantage in these efforts. In fact, "manufacturers as engineering resources" are integral to an effective design process—adding an understanding of fast-changing technology needs and how they relate to new IoT low power deployments. The COM platform, for example, can be heavily supported with customization tools and "perfect fit" custom baseboards within both x86 and ARM architectures.

Embracing the Internet of Things in Medical Design

Greater emphasis has been placed on connected healthcare that provides the ability to seamlessly link patients, clinicians and patient care organizations. Real-time patient monitoring is an essential service in the healthcare industry. Connected systems are used to share data locally or remotely. By gaining access to real-time data, doctors can make more informed decisions and more closely monitor the progress of the treatment.

The new need is for systems that fit into the Internet of Things and connected healthcare. With manufacturer support, developers are capitalizing on new x86 processors that enable cost-efficient, low power designs, as well the SMARC standard's recent support of x86 options in addition to ARM-based processors. Long-term availability of computing platforms based on both x86 and ARM-based processors is essential in meeting product lifetime demands, with service life often exceeding seven years.

Standardized embedded form factors such as the latest SMARC and COM Express modules are key components in extended system lifecycles. These design options simplify electrical design and system development in general, and also act as scalable building blocks that ensure complete solution functionality over the course of an application's life. With available standard modules and motherboards, as well as custom or semi-custom solutions that simplify connectivity and interoperability, designers have a rich opportunity to enable intelligent systems for smart, connected care.

Kontron, Poway, CA.
(888) 294-4558. http://www.kontron.com