TECHNOLOGY DEVELOPMENT
Intelligence Plus Connectivity

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.

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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 HMI’s. 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, FC, 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

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.

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 car-
rier boards to add customization to a de-
sign, 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 replac-
ing the carrier board, thereby extending
the life of the system. Customization con-
tained in the carrier board can remain, al-
lowing long-term scalability and improved
performance for next generation versions
of an existing medical product or device.

Access to patient data such as test re-
sults 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 applica-
tions that rely on slim graphics-rich tab-
lets, handheld PCs and stationary HMIs.
Hardware-assisted capabilities, such as Se-
cure 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.

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 ad-
vantages of verified modules and boards,
OEMs can avoid the long delay of validat-
ing hardware and gain a critical time-to-
market advantage. These pre-validated
building blocks are tested to deliver the
required interoperability and functional-
ity; the customer would only need to focus
on the system IP.

With pre-validated building blocks,
medical OEMs are assured of compatibil-
ity, interoperability and high reliability—
so their full focus can remain on applica-
tion development and OEMs can readily
reuse their “library” of application-spe-
cific 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 sys-
 tem downtime. The real-time data they
share helps ensure systems are operating
properly, identifying potential failures in
advance so that routine scheduled mainte-
nance can take place.

Purpose-Built x86 Platforms Add
Value to Medical Deployments

Standard, mass-produced compo-
nents 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 inter-
faces, and its unique multi-purpose Fea-
ture 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-
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.


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.


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.