BioSpectrum
the business of Bio & Health Sciences
ASIA EDITION

Healthcare evolution is fuelled by silicon tech

February 25, 2013 | Opinion | By BioSpectrum Bureau



To get an idea of how much silicon technology will impact healthcare and wellness, we just need to look at how semiconductor advancements have shaped the evolution of other industries such as telecommunications and consumer electronics. Not only have the physical dimensions been reduced drastically (weight, width, height) but they have become easier to use, feature-rich, and their power consumption has improved tremendously.

This evolution has been pretty amazing. And the same technologies that facilitated these changes are being used to empower similar amazing changes in healthcare and wellness devices. Diagnostic machines that once filled entire rooms in hospitals continue to become smaller and lighter. Many other devices, once only available in doctor's offices or hospitals, can now be used at home or worn inconspicuously. Like our game consoles and phones, they can be used 24/7, providing a life-saving link to the hospital or personal physician monitoring our health. And by employing the same advancing technologies as those of the telecommunications and game industries, these devices are becoming smarter and more intuitive, very necessary features for out-of-hospital diagnostic and therapy applications.

Enabling technologies, societal needs

Aside from the pervasive availability of advanced silicon technology, there are societal factors involved in this evolution, such as the need to make healthcare more affordable and accessible and the rapidly growing interest in personal health and fitness.

Semiconductor technology is enabling this evolution on two broad fronts. The first is the continual improvement in traditional "medical equipment," ranging from fairly low-tech motorized hospital beds to the most sophisticated MRI machine. Like all industrial applications, these benefit from the universal "win-win-win-win" effect of semiconductor technology where we see a continuous improvement of price, performance, power consumption, and physical size.

However, it is on the second front where semiconductor technology is essentially redefining the healthcare industry, promoting and facilitating a dramatic evolution from a hospital or clinic-based approach to a cloud-based system that provides access to medical care potentially anytime and anywhere. In this new world, hospitals, clinics, and medical experts will continue to

provide state-of-the-art diagnostic and surgical expertise while individuals and their local healthcare professionals will take on more responsibility for the day-to-day management of personal health and wellbeing, using a proliferation of "consumer" health and wellness products.

Semiconductors have been used in medical equipment for over four decades but, until recently, this use represented only a small part of the medical electronics sector, mainly dedicated to equipment solely for use in hospitals and clinics. Thanks to the ever-increasing pervasion of microelectronics technology, in many parts of the world, the traditional medical electronics market is evolving towards a broader, fast-growing health and wellness market, in which people can exercise more responsibility for their personal health and fitness.

The sleep apnoea breathing management device by ResMed is a great example of technology that is life enhancing. What was once a washing machine-sized behemoth has evolved, with the benefit of silicon technology, into an easy-to-use portable bedside unit.

Sense, power and connectivity

The silicon technologies that have been driving the latest evolutions in smartphones, tablets, and video games are the same ones that will drive consumer healthcare and wellness.

Many of the new wave "consumer" health and wellness products are based on a key set of silicon building blocks, mainly MEMS (micro-electro-mechanical systems) sensors or actuators, low-power microcontrollers, and wireless transceivers. MEMS sensors and actuators cover the "smart" function of most devices - sensing or movement. Low-power MCUs allow portability by controlling the devices using very low power, while wireless transceivers allow them to be connected.

STMicroelectronics is uniquely positioned in this nexus of technologies and is a leader in all three areas, MEMS, MCUs, and wireless transceivers. In collaboration with partners in the healthcare and wellness industries, ST has adapted and optimized its proven technologies for smart phones, consumer electronics and IT gadgets into the building blocks for medical and fitness related applications.

Access to medical care anytime and anywhere through feature-rich, personal wearable and portable wellness applications is only possible with the advantages of extremely low power consumption. ST's STM32L low power microcontrollers have enabled powerful, flexible features to be designed into unobtrusive, discreet devices.

The BodyGuardian, developed by Preventice, remotely monitors individuals with cardiac arrhythmias. This healthcare device combines a sensor, a low power MCU and connectivity technologies as its key building blocks.

Also driving consumer healthcare are the twin sensor and actuator technologies of MEMS. Sensors in all permutations, motion, direction, geomagnetic, pressure, temperature and microphones, are universally applicable for healthcare. Apart from the means to sense and measure, they provide the smart intuitiveness and the seamless interaction that syncs with the end user.

Actuators are adapted as miniaturized devices that can administer minute amounts of drugs on a continuous basis. ST has also tailored its actuator technology into a self-contained lab-on-a-chip capable of multiple, fast, and simple molecular diagnostic testing. It has been successfully developed as a diagnostic kit to detect influenza, biohazards, food-borne pathogens and tuberculosis.

ST's Lab-on-Chip platform has been successfully developed into molecular diagnostic kits to test for influenza, bio-hazards, food-borne pathogens and tuberculosis. The Lab-on-Chip platform was adapted from the microfluidic MEMS actuator technology originally used in inkjet print-heads.

Communication flexibility, ranging from short range ultra-low power RFID to high-speed broadband Wi-Fi, has added more versatility to medical electronics. In the case of a smart contact lens developed to detect glaucoma, the sensor device is extremely miniaturized, and a tiny, dedicated processor transmits to a data logging device worn like a pendant around the neck of the patient. Ultra-low power short range RFID best suits this application.

The Triggerfish smart contact lens, developed by Sensimed, incorporates a MEMS sensor by STMicroelectronics to detect increased pressure in the eye which can lead to glaucoma. Communications with a data logging device is powered not by

batteries but rather by a minute amount of power generated by received radio waves.

But in a device such as remote cardiac monitor that logs more data and needs long-term communication with a hospital, Bluetooth wireless technology in combination with mobile broadband would be the appropriate solution. There is the enormous and life-enhancing potential for any medical device to be connected today, just like any consumer electronics device.

A needs-driven market without cyclical volatility

Medical electronics is a "needs" driven market largely unaffected by the cyclical volatility that defines many other addressable markets for the semiconductor industry. The global medical electronics market was $3.6 billion in 2011 and is expected to grow another $1 billion in five years, according to iSuppli Application Market Forecast Tool 2012. Although not yet in the league of smartphones or tablets, medical electronics is nonetheless a small but fast-growing market worth addressing for the next five-to-ten years.