Personal Heart Monitor

Introduction

The average age of the population in the developed world is steadily rising and, with it, the demands on the healthcare system. This is driving a shift in healthcare policy from the treatment of illness to a greater focus on wellness, in which members of the public take more active responsibility for their overall health levels.

Personal Health Monitors

Electronics devices such as personal health monitors will make it easier for people to gauge their health levels, adopt better lifestyles, and prevent the majority of serious illnesses. They will also make it possible to have better long-term management of existing conditions outside the hospital environment. Wearable devices can stay in long-term contact with the treatment center, warning of problems before they become serious.

Portability and the ability to run for long periods on a battery charge are prime requirements for this new generation of health monitors, as well as effective data security to ensure that third parties cannot intercept personally identifiable medical data. Take, for example, a wearable heart monitor for long-term. It can consist of a control unit that links wirelessly to a transmitter that relays heart-rate signals and other measurements such as skin temperature from a chest band or patch.

Microsemi FPGAs for Health Monitors

IGLOO® and SmartFusion™ have the low power performance needed to put health monitoring systems into action and make it possible for healthcare systems providers to support a wide array of use cases with similar hardware. For example, the same basic hardware design can be used for units sold directly to consumers and for those supplied by a healthcare provider.

Device Customization

Customized devices may add dedicated features such as digital signal processing (DSP) algorithms to monitor certain conditions: the electrical profile of each heartbeat can provide vital information on the progress of a condition and give early warnings of potential problems. To minimize the time it takes for treatment to arrive if the telltale signs of a heart attack are seen, the device can automatically feed encrypted data back to a healthcare center using a cellular modem or using a Bluetooth or similar low-power radio on a nearby computer.

The sensor unit will use ultra-low power RF communication to relay measurements to the control unit and can include its own internal processing to filter out unnecessary readings and compress the data stream. As RF transmission power is a significant proportion of the overall power budget for a wearable sensor unit, minimizing this time can make an important contribution to overall battery life. Digital processing can take much less power than would be used if unconditioned data were to be sent directly to the control unit.

Putting the analog capture and preprocessing into FPGA hardware makes it possible to have the sensor unit's microcontroller run at a very low duty cycle, sleeping until it needs to activate the RF transmitter and send a packet of data to the control unit. The functions can be implemented in user logic in the case of the IGLOO devices. However, SmartFusion devices provide a higher integration solution, complete with an advanced 32-bit microprocessor core.

Analog Features in SmartFusion Devices

The analog compute engine (ACE) in SmartFusion devices performs the role of initializing and controlling analog I/O ports supported by the device. The ACE provides a sample sequencing engine (SSE) that can capture data automatically from the analog inputs and then pass it to a hardware post-processing engine (PPE), which can perform functions such as low-pass filtering before putting the data into a buffer for processing by the ARM® Cortex™-M3 processor.

The Cortex-M3 processor need only be woken when the buffer has reached a certain limit and may devolve some further processing to custom logic in the SmartFusion device.

In the control unit, an IGLOO FPGA can minimize the power needed and ensure long battery life by putting the LCD to sleep whenever it is not needed. An IGLOO FPGA can take over functions, such as listening for wireless data packets, that would otherwise be implemented on a more power-hungry microcontroller.

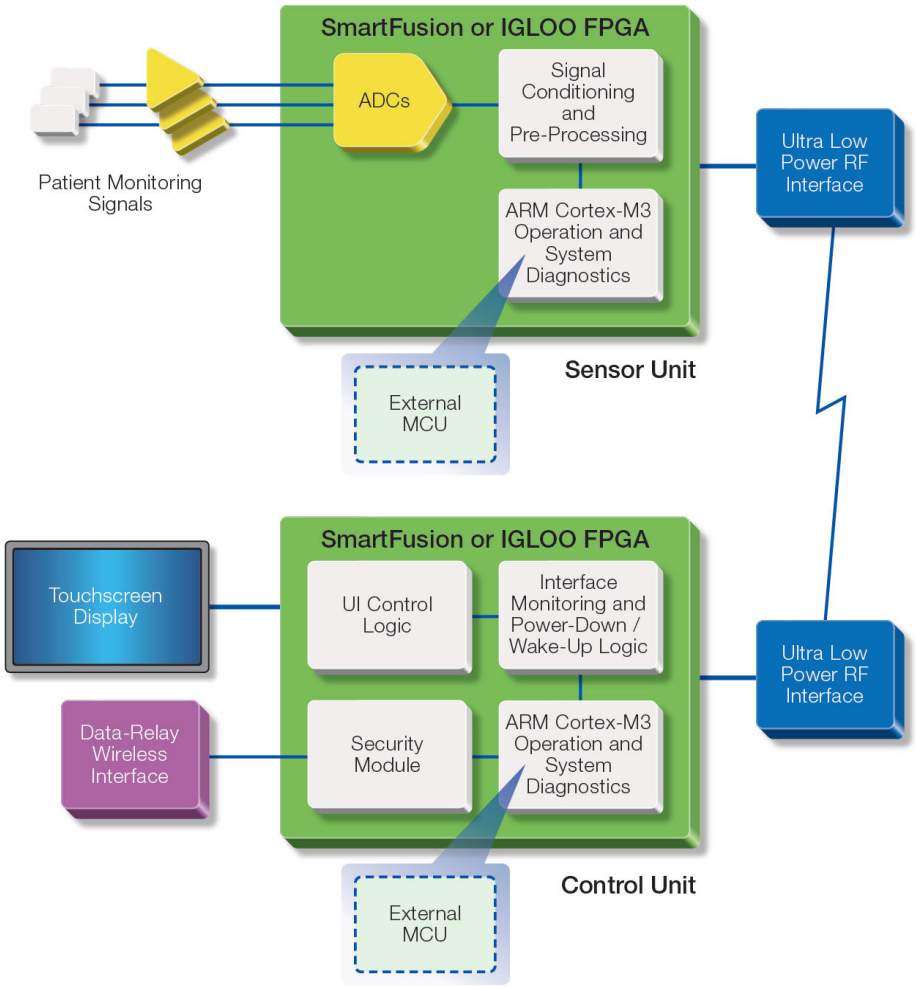

Figure 1 • **Block Diagram of a Personal Heart Monitor**

Summary

Supporting low power operation but still providing high hardware adaptability, Microsemi's IGLOO and SmartFusion devices provide ideal support for manufacturers who need to deliver flexible personal heart monitoring and similar healthcare.

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