Simplifying computer power behind phones, medical devices

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From smart phones to medical equipment, embedded processors are everywhere and getting increasingly more powerful. One University of Houston (UH) professor's work with Texas Instruments (TI) is making it easier to develop these types of systems.

Barbara Chapman, a UH professor of computer science, and her team have been collaborating with design engineers at TI for two years and, for the second time, received a $100,000 grant from TI to further this research. In addition to the now $200,000 received from TI, the company also donated 20 BeagleBoard development platforms to Chapman. The BeagleBoard is a high-performance, low-power development platform that can be put into students' hands and allows them to learn by doing.

At the center of the TI grant for Chapman's research are embedded multicore processors. Embedded processors can be found in cars, phones, toys, power tools, video equipment, medical imaging devices and other types of computerized equipment across a variety of markets. In fact, all consumer, industrial, communication and medical electronic devices have some type of embedded processor, requiring them to be much more diverse and specialized for different applications than the processors found in standard desktop computers, for example.

To achieve the speed and performance required by embedded application software, it has become necessary to build multicore processors - also called parallel processors - that are computer chips

containing more than one central processing unit (CPU). TI has many different multicore devices that deliver the high performance and power efficiency that designers use across a broad range of applications and end markets.

A UH alum with both a master's degree and Ph.D. in computer science, Eric Stotzer works for TI on this collaborative effort.

"While working on my Ph.D., I became aware of Dr. Chapman's expertise in parallel programming models, and I realized there was an opportunity to collaborate with her," Stotzer said. "At that time, TI was developing multicore processors and improving the tools used to program them. Embedded heterogeneous multicore processors can help the specialization and, therefore, cost effectiveness and power consumption of systems. This is different from PC-based homogeneous multicore systems, such as the x86 or Intel family of processors."

Stotzer explained that without the proper programming languages, it is extremely tedious, error-prone and time-intensive to develop software for embedded multicore processors.

Ultimately, UH and TI are collaborating on technology that enables the development of ubiquitous computing embedded in the devices that touch our daily lives, from our homes and cars to the doctor's office. With this grant and the UH/TI collaboration, the researchers' goal is to simplify the development of new portable applications.

"Our research makes it simpler for medical equipment manufacturers, for instance, to develop advanced software for TI's embedded multicore processors," Chapman said. "The combination of the tools we're developing and TI's new and extremely powerful multicore processors will enable the creation of medical applications that were previously not possible."

Chapman and her team are leaders in technologies for programming multicore processors. Together with TI colleagues, they have developed a graduate course that introduces UH students to the principles and practice of this field, with a special focus on the requirements of embedded computing. UH computer science students who participated in the Spring 2010 pilot course were able to complement their theoretical study with hands-on experience using the BeagleBoards supplied by TI. This joint effort ensures that UH students are able to acquire skills in embedded systems programming and multicore programming that give them a competitive advantage in today's workforce. Moreover, the combined team is cementing their leadership role in the teaching of technologies for developing heterogeneous multicore embedded systems by creating open-source training material.

In addition to Chapman and Stotzer, this team effort involves UH researchers Lei Huang and Tony Curtis; Ph.D. students Bhargav Patel, Jae-Chang Hong, Hangjun Yi and Dunni Aribuki; and Eric Biscondi, Ashish Shrivastava and Cody Addison from TI. Addison also is a UH graduate, one of a number of UH students TI has hired over the years.

With this most recent gift, TI has provided more than $1 million in grants to UH since the 1980s.

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