News and resources for PCB industry professionals

VIEWPOINT:

'Macroelectronics'
08-25-2006

Mike Buetow is Editor-in-Chief of *Circuits Assembly*.

Anyone who has walked the museum at Intel's Santa Clara, CA, campus knows that the microprocessor giant's future lies not only in making chips for PCs and mobile products but also for large-scale form factors such as buildings.

The brains behind those ubiquitous *Intel Inside* ads foresee a day when our homes will "know" when its time for us to rise, wash, warm up, cool down, eat, sleep and just about everything else.

Contrast that with what's going on at the Urbana-Champaign campus of the University of Illinois. The "homes" of tomorrow, as U of I researchers envision them, won't contain computers so much as they will *be* computers.

Indeed, the group of scientists and professors foresee houses in which every component -- from entertainment systems to furniture, walls to windows -- will be constructed from flexible materials laced with microelectronics.

"People have thought about integrated electronics in the homes. Instead of individual, isolated devices placed strategically, under our approach your entire home becomes a site for distributed electronics," U of I materials science and engineering professor. John Rogers told me in a phone interview this week.

Rogers' recent work ranges from stretchable forms of single crystal silicon to GHz-speed flexible transistors on plastic substrates. A subset of the nanotech field, his group is trying out new tools for fabricating structures with micron and nanometer dimensions. Their goal is to develop soft lithographic methods for what he calls "macroelectronics": patterning everything from small molecule semiconductors and polymeric electroluminescent materials to single-wall carbon nanotubes, organic self-assembled monolayers and nanostructures of single crystal inorganics into active electronic components.

Rogers and Osman Ataman, a professor of architecture and design, believe that the day will come when windows will come and go, walls will change colors, and furniture and lighting will all be controlled -- and altered -- by embedded sensors.

"The notion of a digital wallpaper is that you would embed electronic optical components," Rogers explained, that would have the capacity to change as the user defines. "It wouldn't have hinges, of course, but you could change the color, you could make them opaque. The notion would be a type of system mounted on a substrate that [itself] was transparent." If this all sounds like those mood rings of the 60s and 70s, you're not far off.

"We're going to create a habitable computer," Ataman told a local Champaign paper. And while some "smart house" concepts are tied to a central nervous system that would be programmed by the user, Rogers says users wouldn't necessarily need to embed microprocessor systems into those macroelectronics systems. Instead, the data system may be in the basement, for example.

How long until our walls change at will? Rogers admits that his vision is just that -- full of potential but far from commercial realization. He does, however, see other potential commercial applications, such as flexible displays that could be rolled up and put in one's pocket, electronic newspapers and even computing-enabled clothing. Rogers, who has degrees in physics and chemistry from the **University of Texas** and a Ph.D. degree in physical chemistry from **MIT**, worked for a tech startup firm and for **Bell Laboratories** before coming to Illinois in 2003. He says the potential lies in the fab approach, which is decidedly "non-Intel-like."

"Our vision is that conventional printing presses could be used. Our niche in that area, our unique approach, is well-developed inorganic materials to develop those. Instead of polymers, we use silicon ribbons and platelets and print that down on the plastic. The form factor and printing processes are conventional."

The developments are getting noticed. *Scientific American* recognized the technology and its process as one of the top 50 most influential advancements in 2005.

Tomorrow's products must be "smaller, faster, cheaper" than today's, we're always told. Unless we all move into mud huts, however, this is one instance where the field of microelectronics may change our focus from next-gen handhelds and other gadgets to the biggest item most people will ever purchase, their homes.

Macroelectronics, indeed.

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