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Small, smaller, smallest?

Professors create new 'smart skin' technology

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Scientists first created computer technology, then began to build things smaller and smaller. Like in "Alice in Wonderland," the world's span expanded as everything physically associated with it began to shrink in size.

Forty-one years ago, the Univac made its debut as the first modern computer. Its components were installed in a series of floor-to-ceiling cabinets that filled a building and operated by reading data from punched paper cards.

On a good day the Univac could read 300 cards worth of data in a minute and could retain up to 36 megabytes of information in the hard drive at one time.

This is miniscule when compared to current personal computers that can fit in a notebook, have hard drives of 200 gigabytes and buffers in excess of 128 megabytes. Modern computers are three times larger than the first hard drives.

The hard drives in modern computers are

DC Photo by De'Borah Bankston

Zeynep Celik-Butler and Don Butler with old and new technologies created at SMU.

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almost a thousand times larger than those in the older systems. This is possible because of microtechnology - technology built on a miniature scale.

SMU Short Takes

There is a new term in the computer industry today: nanotechnology. That means that things are being built even smaller still. In many cases, circuits and parts are the same size as a follicle of hair.

"People have been building things to the nano scale for some time," said Don Butler, associate professor of electrical engineering. "The difference is now we have a name for it."

Chips for current computers are usually constructed on discs made of silicon called wafers. The wafers are printed on with special chemicals in a process known as lithography. Then the circuits are etched or "grown" on the wafer in layers. Wafers are break easily, are bulky and expensive.

The new technology created by Butler, electrical engineering professor Zeynep Celik-Butler and chemistry professor Patty Wisian-Neilson allows circuits, components or computer chips to be grown onto a thin layer of a flexible plasticine film that is flexible, thin and inexpensive. The plasticine film, called a polymer, can be bought in rolls and is etched like the wafers.

Tiny sensors are embedded in the polymer and send data back to a computer that interprets the information. This new polymer with sensors is called "smart skin."

Depending on the types of sensors used, the material can be used for a variety of applications. It can be utilized to make suits to warn people when they have entered an area of toxic gases, monitor insulin and glucose problems based on body

temperature, detect pressure applied to a surface or detect hazardous temperatures.

Wisian-Neilson estimates that the polymer can withstand temperatures up to 350 degrees Celsius and as low as 40 C below zero. This makes it ideal for applications in space, geology, medicine, the military and other areas.

"We are presently using inorganic polymers to make this," Wisian-Neilson said. "The disadvantage to this is that they become brittle in UV light and disintegrate, but not completely. We hope to incorporate more organic materials into the polymers to reduce the cost and to make this more compatible with the human body."

Smart skin evolved from previous research projects on infrared detectors that the Butlers performed. IR detectors measure heat. It was through experimenting and trying to find a way to make the sensors smaller and the mounting surfaces more versatile that the ideas began to form.

The original research was funded by the Army Research Office and the National Science Foundation.

The Butlers and Wisian-Neilson have received a three-year, $300,000 grant from the National Science Foundation to further develop this new technology. They already have a prototype sample.

"This could open up a whole world of flexible electronic devices based on distributed sensors," Celik-Butler said.


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