New 3D Transistor Could Enable Faster, Smaller Chips

Researchers from Purdue and Harvard Universities have created a 3D transistor made from a material that could replace silicon someday.

Engineers could use the transistor, which has stacked circuitry in three dimensions—instead of the typical two—to build faster, smaller, energy-efficient chips that would generate low amounts of heat.

Each transistor contains three nanowires made of indium gallium arsenide. “Stacking the circuitry results in more current and much faster operation for high-speed computing,” said Purdue professor Peide Ye. “It’s a preview of things to come in the semiconductor industry.”

Researchers have been trying to make processors faster by using circuitry with smaller feature sizes. However, feature sizes below 22 nanometers don’t work well in 2D chips. This has encouraged development and release of 3D chips. Engineers hope to develop transistors with feature sizes of 14 nanometers by 2015 and 10 nanometers by 2018.

However, electrons flow more slowly in silicon than other materials now being considered for use in chips, such as indium gallium arsenide, Ye said. Dropping feature sizes below 10 nanometers with better performance is thus unlikely with silicon, he noted.

In addition to using indium gallium arsenide, the new transistor’s nanowires are coated with a 4-nanometer-thick layer of lanthanum aluminate and a half-nanometer-thick layer of aluminum oxide, which is different than the insulating material found in traditional transistors. This coating lets the Purdue and Harvard researchers create indium-gallium-arsenide transistors with 20-nanometer feature sizes, which represents a technical breakthrough, according to Ye.

Current insulating material doesn’t perform properly in transistors with small feature sizes and leaks electrical charge when they shut down.

The US National Science Foundation and Semiconductor Research Corp., a technology research consortium, funded the work, which is led by Purdue doctoral student Jiangjiang Gu and Harvard postdoctoral researcher Xinwei Wang.

Collection of Nanomachines Mimics Muscles

Researchers have developed the first nanomachines that, when grouped together, can coordinate their movements to function like contracting muscles.

This work by France’s Centre National de la Recherche Scientifique (National Center for Scientific Research) could be used in robotics, computer nanostorage, medicine, and nanomechanical applications.

The project validates theories on the use of nanomachines to mimic muscles.

In humans, thousands of units of highly complex protein assemblies coordinate motion to control muscle movements. Each assembly moves about only a nanometer, but in large groups, they magnify their effect to enable larger motions. Researchers have developed such assemblies in the past but have not been able to effectively coordinate their movements.

Now, the CNRS team—led by Université de Strasbourg professor Nicolas Giuseppone and including researchers from the Laboratoire de Matière et Systèmes Complexes (Laboratory of Complex Matter and Systems) at Université Paris Diderot—has overcome this hurdle.

The scientists synthesized long polymer chains incorporating thousands of protein assemblies that can each move about one nanometer. Changing the assemblies’ pH balance produces coordinated contractions and expansions up to 10 micrometers. This could help researchers
The unidentified 35-year-old suspect—who faces felony data-theft charges—had information from identity cards, as well as tax-identification and license-plate numbers and home addresses, according to police.

Investigators haven’t determined yet how the man obtained the data or what he planned to do with it. They say they began looking into the matter when a worker at Greece’s Hellenic Data Protection Authority notified them that someone appeared to have a large number of digital files containing personal information. Police tracked down the suspect via the Internet and then searched his house, seizing computer equipment in the process.

Authorities have not released additional information about the case.

**UN Report: Developing Nations Should Foster Domestic Software Production**

According to a newly released UN report, developing countries should encourage and expand the local creation of software because it would improve their economies, help with to enable more human-like robotic movements, give nanomaterials new mechanical properties, or create artificial muscles.

**Surveillance System Monitors Operators’ Brainwaves to Detect Threats**

Many governments and companies are adopting surveillance systems that involve people watching cameras for signs of enemy or criminal activity.

However, these systems depend on humans understanding what they’re seeing and reacting appropriately. For various reasons, including fatigue, people sometimes don’t consciously recognize what they’re seeing or what it represents.

DARPA—with researchers from HRL Laboratories; Quantum Applied Science and Research; Advanced Brain Monitoring; and the University of California, San Diego—has developed a sensor-based surveillance system that promises to overcome these issues.

The agency has finished testing its Cognitive Technology Threat Warning System (CT2WS), designed primarily to enhance the abilities of individuals to view battlefields and other areas and warn US soldiers about potential problems.

CT2WS uses a 120-megapixel, wide-angle, digital video camera, along with image-processing software and a cap with electroencephalogram equipment that the operator wears. The system scans a 120-degree arc with its digital camera and shows the user 10 images per second. It then monitors the operator for P-300 brain activity, which relates to the processing of images and sounds. Users may not be aware of something that causes a jump in P-300 activity, but CT2WS will flag it for review.

By factoring in human reactions, the surveillance system could recognize events that fully automated systems might not see as possibly troublesome, such as the movement of tall grass in an area where there might be guerrilla activity.

The DARPA scientists have tested CT2WS in desert, tropical, and open settings. Each hour, they used 2,034 “events” to test the image-processing software alone, without P-300 monitoring. The system yielded 810 false alarms.

With P-300 monitoring, CT2WS caused only five false alarms per hour and successfully identified 91 percent of the actual threats simulated in testing. Adding a commercial portable radar improved the threat-identification rate to 100 percent.

**Man Accused of Stealing Personal Data of Most Greeks**

Greek police have arrested a man who allegedly had 9 million personal records of Greece’s citizens, potentially representing most of the country’s population of about 10.8 million.

Authorities say this is Greece’s biggest breach of private information. Some of the stolen records were duplicates, so police were not sure exactly how many people’s records had been taken.

The unidentified 35-year-old suspect—who faces felony data-theft charges—had information from identity cards, as well as tax-identification and license-plate numbers and home addresses, according to police.

Investigators haven’t determined yet how the man obtained the data or what he planned to do with it. They say they began looking into the matter when a worker at Greece’s Hellenic Data Protection Authority notified them that someone appeared to have a large number of digital files containing personal information. Police tracked down the suspect via the Internet and then searched his house, seizing computer equipment in the process.

Authorities have not released additional information about the case.
CONSERVATIONISTS RESTORE EARLY UK DIGITAL COMPUTER

UK conservationists have restored the world’s oldest original working digital computer—often referred to as the WITCH—and have placed it on display at a museum, more than 60 years after it first began operation.

The relay-based computer—known as the Harwell Dekatron or Harwell computer—was originally used by the UK’s atomic-energy research program in the 1950s.

The machine, which sat in a storeroom for 15 years, will now be an exhibit at the National Museum of Computing at Bletchley Park in Buckinghamshire.

Engineers began designing the 2.5-ton computer in 1949 to help officials at the UK’s Atomic Energy Research Establishment (AERE) perform calculations that they used to do with adding machines.

The Harwell Dekatron debuted in 1951 and took up to 10 seconds to multiply two numbers. However, it was useful because it was reliable and ran automatically for long periods of time.

The computer had 480 relays and 828 dekatron tubes for volatile memory. Dekatrons were gas-filled decimal counting tubes that were popular in the 1950s and 1960s. The system used paper tape for input and storage.

In 1957, with the advent of faster, smaller machines, AERE stopped using the Harwell and gave it to the Wolverhampton and Staffordshire Technical College (now the University of Wolverhampton) for use in teaching programming. At that point, it got the name Wolverhampton Instrument for Teaching Computing from Harwell (WITCH).

Conservationists The university donated the Harwell in 1973 to Birmingham’s Museum of Science and Industry, where it stayed on exhibit until 1997, when the museum closed and the machine was placed in storage.

Several years ago, a trustee at the National Museum of Computing saw a photograph of the WITCH in storage and suggested restoration. The computer was then sent to the museum.

The restoration effort was led by Delwyn Holroyd, cofounder and director of Codex Digital Ltd., which designs and makes digital equipment for movie and TV production. The focus was to keep as much original equipment as possible.

More than 60 years after it debuted, the WITCH, originally known as the Harwell Dekatron computer, has been restored and is now on exhibit at the UK’s National Museum of Computing.