International Journal of Information & Computation Technology.
ISSN 0974-2239 Volume 4, Number 15 (2014), pp. 1597-1603

http://www. irphouse.com

Nanotechnology in Computers

Sachin Kumar [1], Garima Pant [2], Vibhor Sharma [3], Pooja Bisht [4]

Tula's Institute Engineering and Management College, Uttarakhand
Tula's Institute Engineering and Management College, Uttarakhand
Tula's Institute Engineering and Management College, Uttarakhand
Tula's Institute Engineering and Management College, Uttarakhand

Abstract

Nanotechnology has been developed for being used in many fields of studies including physics, chemistry, biology, material science, engineering, and computer science. In this paper, we identify the nanotechnology development community and needs of nanotechnology in the field of computer science. This paper tells about the benefits of nanotechnology using nano tubes in place of silicon chip that is to be used in the CPU's of computer.

Keywords-Applications, Advantages, Literature survey

Introduction

In 1959, Richard Feynman, a future Nobel Laureate, gave a visionary talk entitled "There's Plenty of Room at the Bottom on miniaturization to nanometre-scales. Later, the work of Drexler [1, 2] also gave futuristic visions of nanotechnology. Feynman and Drexler's visions inspired many researchers in physics, material science, chemistry, biology and engineering to become nanotechnologists. Their visions were fundamental: since our ancestors made flint axes, we have been improving our technology to bring convenience into our everyday life. Today a computer can be carried with one hand – 40 years ago a computer (hundreds of times slower) was the size of a room. Miniaturization of microprocessors is currently in process at nanometre-scales [3]. Yet, the style of our modern technology is still the same as ancient technology that constructed a refined product from bulk materials. This style is referred to as bulk or top-down technology [1]. As conventional methods to miniaturize the size of transistors in silicon microprocessor chips will soon reach its limit2 and the modification of today's top-down technology to produce nano scale structures is difficult and expensive [3], a new generation of computer components will be required. Feynman and Drexler proposed a new style of technology, which assembles individual atoms or molecules into a refined product [1]. This Drexler

terms molecular technology or bottom-up technology [1]. This bottom-up technology could be the answer for the computer industry. Though top-down technology currently remains the choice for constructing mass-produced devices, nanotechnologists are having increasing success in developing bottom-up technology [3]. There are some concerns regarding emergent bottom-up technology. First, the laws of physics do not always apply at nanometre-scales [4]. The properties of matter at nanometre-scales are governed by a complex combination of classical physics and quantum mechanics [4]. Nevertheless, bottom-up fabrication methods have been successfully used to make nanotubes and quantum dots [3]. These methods are not yet suitable for building complex electronic devices such as computer processors, not to mention nanoassemblers that can make copies of them and work together at a task. Furthermore, and significantly, once knowledge of nanotechnology is advanced and real-world nano assemblers are realized, they must be properly controllable to prevent any threats to our world. In this paper we discuss about the development in the field of computer science using nanotechnology. We have focused on how a nano tube can be used in place of silicon chip using nano technology as these are more powerful and energy efficient. We then focus on the needs and benefits of computer science for nanotechnology, as well as existing and future computer science research for nanotechnology.

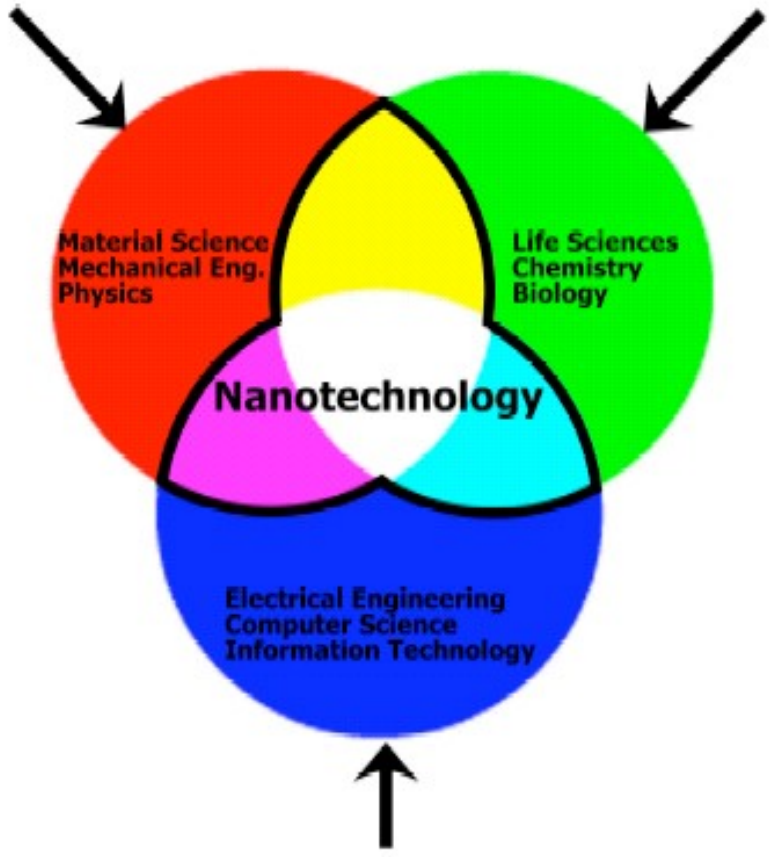
Applications

As of August 21, 2008, the Project on Emerging Nanotechnologies estimates than over 800 manufacturer-identified nanotech products are publicly available, with new ones hitting the market at a pace of 3–4 per week. The project lists all of the products in a publicly accessible online database. Most applications are limited to the use of "first generation" passive nano materials which includes titanium dioxide in sunscreen, cosmetics, surface coatings, and some food products; Carbon allotropes used to produce gecko tape; silver in food packaging, clothing, disinfectants and household appliances; zinc oxide in sunscreens and cosmetics, surface coatings, paints and outdoor furniture varnishes; and cerium oxide as a fuel catalyst.

Further applications allow tennis balls to last longer, golf balls to fly straighter, and even bowling balls to become more durable and have a harder surface. Trousers and socks have been infused with nanotechnology so that they will last longer and keep people cool in the summer. Bandages are being infused with silver nanoparticles to heal cuts faster. Cars are being manufactured with nonmaterial’s so they may need fewer metals and less fuel to operate in the future. Video game consoles and personal computers may become cheaper, faster, and contain more memory thanks to nanotechnology. Nanotechnology may have the ability to make existing medical applications cheaper and easier to use in places like the general practitioner's office and at home. [5]

The National Science Foundation (a major distributor for nanotechnology research in the United States) funded researcher David Berube to study the field of nanotechnology. His findings are published in the monograph Nano-Hype: The Truth behind the Nanotechnology Buzz. This study concludes that much of what is sold as

"nanotechnology" is in fact a recasting of straightforward materials science, which is leading to a "nanotech industry built solely on selling nanotubes, nanowires, and the like" which will "end up with a few suppliers selling low margin products in huge volumes. " Further applications which require actual manipulation or arrangement of nanoscale components await further research. Though technologies branded with the term 'nano' are sometimes little related to and fall far short of the most ambitious and transformative technological goals of the sort in molecular manufacturing proposals, the term still connotes such ideas. To date, nanotechnology has been developed mostly from the basis in physics, chemistry, material science and biology. As nanotechnology is a truly multi-disciplinary field, the cooperation between researchers in all related areas is crucial to the success of nanotechnology. Until now, computer science has taken a role mostly in research tools, for example: a virtual-reality system coupled to scanning probe devices in nanomanipulator project. However, according to M. C. Roco, the third and fourth generation of nanotechnology would rely heavily on research in computer science. [5] In academic centers and government labs, nanotech is fostering new conversations. At Stanford, Duke and many other schools, the new nanotech buildings are physically located at the symbolic hub of the schools of engineering, computer science and medicine.



Nanotech is the nexus of the sciences [8]

Advantages

Nanotechnology is helping to considerably improve, even revolutionize, many technology and industry sectors: information technology, energy, environmental science, medicine, homeland security, food safety, and transportation, among many others. Nanoscale transistors that are faster, more powerful, and increasingly energy-efficient; soon your computer's entire memory may be stored on a single tiny chip.

Magnetic random access memory (MRAM) enabled by nanometer-scale magnetic tunnel junctions that can quickly and effectively save even encrypted data during a system shutdown or crash, enable resume-play features, and gather vehicle accident data.

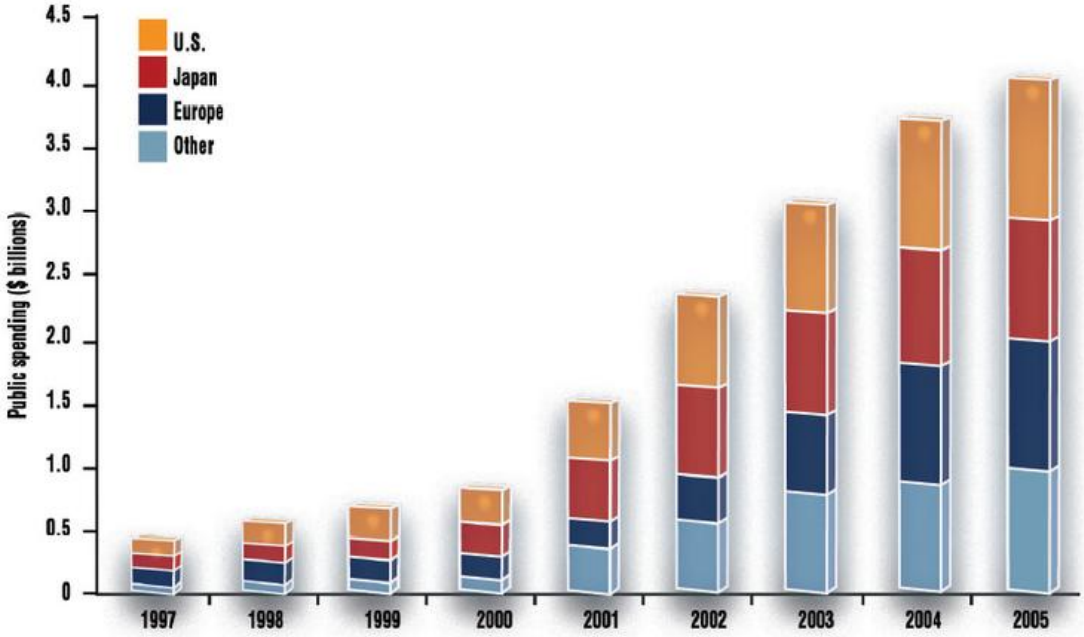
Displays for many new TVs, laptop computers, cell phones, digital cameras, and other devices incorporate nano structured polymer films known as organic light-emitting diodes, or OLEDs. OLED screens offer brighter images in a flat format, as well as wider viewing angles, lighter weight, better picture density, lower power consumption, and longer lifetimes.

Other computing and electronic products include Flash memory chips for iPod nanos; ultraresponsive hearing aids; antimicrobial/antibacterial coatings on mouse/keyboard/cell phone casings; conductive inks for printed electronics for RFID/smart cards/smart packaging; more life-like video games; and flexible displays for e-book readers.

Nanotechnology is improving the efficiency of fuel production from normal and low-grade raw petroleum materials through better catalysis, as well as fuel consumption efficiency in vehicles and power plants.

Researchers are developing wires containing carbon nano tubes to have much lower resistance than the high-tension wires currently used in the electric grid and thus reduce transmission power loss.

- Nanotechnology manufacturing has a promise of producing new materials a hundred times stronger than steel, and more efficient and cheaper to produce as compared to the existing production techniques.
- Molecular manufacturing would greatly reduce water requirements, and also cheaply run greenhouses would be a means of saving water, land, and food.
- The efficient and inexpensive generation of electricity, using solar and thermal power, will make electric power available to basically everyone in the world.
- Faster, cheaper, and more powerful computers will be available that could help improve information and communication systems even in the remotest areas.
- Manufacturing of new technologies will be self-contained and clean, and will have less of an environmental impact. 5.
- Cheap and advanced equipment for medical research and health care will make improved medicine widely available. It will be feasible to restore human organ engineered tissue while simple products will greatly reduce infectious diseases prevailing in many parts of the world.
- Nanotechnology will enhance capabilities in space ventures and operations. [10]



2. Worldwide spending on nanotechnology tallied more than $4 billion last year.
(courtesy of the National Science Foundation and Strategies Unlimited)

Literature survey

One of the most fundamental components in the manufacture of electronic devices, such as a CPU or memory, is a switch. Computers are constructed from thousands to millions of switches connected together. In modern computers, components called transistors act as electronic switches. Transistors act as electronic switches, i. e. they allow information to pass or not to pass under certain conditions. The development of integrated circuits (ICs) allowed the construction of a number of transistors on a single piece of silicon (the material out of which IC's are made). IC's are also called silicon chips or simply chips. According to Johannes Swenson silicon chips are being used in computers. [6]

A silicon chip is an almost pure piece of silicon, usually less than one centimeter square and about half a millimeter thick. It contains hundreds of thousands of micro miniature electronic circuit components, mainly transistors, packed and interconnected in layers beneath the surface. These components can perform control, logic, and/or memory functions.

The reason why silicon is used in computer chips is because it is easier, and consequently less costly, to make complex circuits out of silicon than from any other matter. With silicon, it is easy to make a high-quality insulator by adding some oxygen to create silicon oxide. Computer chips require precise regulation of voltage to manipulate data. According to the Cornell Center for Materials Research, silicon is ideal for this because it can be made into either an effective insulator or a semiconductor, both essential for controlling electrical current. It is also one of the cheapest materials with this ability. [6]

But we think that instead of silicon chips we can use carbon nano tubes.

Silicon is subject to certain limitations, and industry is looking for a replacement. we don't think that it will be cheaper to build transistors from another material than silicon, but carbon nano tubes can be used to produce smaller and faster components. This will also result in computers that consume less energy.

The most common semiconductor material in transistors is silicon, since it is cheap and easy to process. But silicon has its limitations. As the size of the transistors is reduced in order to increase their speed, problems arise that lead to, among other things, increased energy consumption and large variation in the transistor properties.

By exchanging the silicon in the channel for a carbon nanotube, the transistors can be made both smaller and faster than today's transistors. A carbon nanotube is a molecule in form of a hollow cylinder with a diameter of around a nanometer (roughly 1/50, 000 of the width of a human hair) which consists of pure carbon. Some carbon nanotubes are semiconducting, and this means that they can be used in transistors, although there are several problems that must be solved before they can be connected together to form large circuits. [7]

Components made with carbon nanotubes could endure greater heat then conventional metal components, allowing computers to run hotter and reducing the pressure on the cooling systems. graphite can be rolled into a cylinder with a diameter of about 1 nm. These strong but light ‘carbon nanotubes’ are being developed for a raft of uses, such as sensors, fuel cells, computers and televisions.

The applications of nanotubes are set to expand even further now that scientists have found that other materials besides carbon can form nanotubes.

Carbon nanotubes will be proving useful as it:

- Improves conductive, mechanical, and flame barrier properties of plastics and composites
- Optimizes processing fabrication, and reduces shipping costs
- Enables eco-friendly anti-fouling paints, and other new applications
- Enables clean, bulk micromachining and assembly of electronic components
- Improves the true total cost of formulation, processing, and manufacturing

Conclusion

As the development of nanotechnology progresses in several fields including physics, chemistry, biology and material science, computer scientists, medical, military must be aware of their roles and brace themselves for the greater advancement of nanotechnology in the future. This paper has outlined the development of nano technology in the field of computer science by using nano tubes in place of silicon chip. It is hoped that this gentle review will benefit computer scientists who are keen to contribute their works to the field of nanotechnology. We also suggested the possible opportunities that computer science can offer, which can benefit other nanotechnologists from other fields by helping them be aware of the opportunities from computer science. This paper is intended to promote collaboration between computer scientists and other nanotechnologies.

References

[1] http://www. zyvex. com/nanotech/feynman. html.
[2] http://science. howstuffworks. com/nanotechnology2. html
[3] http://www. cs. unc. edu/Research/nano/cismm/nm/index. html.
[4] http://www. nanotec. org. uk/evidence/92aUKCRC. html.
[5] http://www. nanowerk. com/news2/newsid=32466. php
[6] http://www. sciencemediacentre. org/nanotechnology. html.
[7] http://www. intel. com/research/silicon/mooreslaw. html.
[8] http://www. kurzweilai. net/images/Jurvetson%20article%20%28image%206%29. jpg
[9] http://www. kurzweilai. net/transcending-moore-s-law-with-molecular-electronics-and-nanotechnology
[10] http://leboaplac2008. wikispaces. com/Nano+%26+Virus+Technology
[11] http://leboaplac2008. wikispaces. com/file/view/Figure_02. jpg/448900558/747x509/Figure_02. jpg