

## Nano Computers through Nanotechnology

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### ABSTRACT

Actually nanotechnology is a very broad area of study and research at present. It has been developed by many researchers and includes several fields, extensive use of computer and its applications in modern world have forced the researchers to improve computer manufacture for faster, smaller and more reliable computers, this manufacture a smaller objective can be fulfilled by nanotechnology. In this paper, we explore the development of Nano computer through using nanotechnology.

**Keywords:** - Nanotechnology, Nano computer, Nano computing, DNA Computing

### INTRODUCTION

The ideas and concepts behind Nano science and nanotechnology started with a talk entitled “There is Plenty of Room at the Bottom”, by physicist Richhard Feynman at an American physical Society meeting at the California Institute of Technology on December 29, 1959, long before the term nanotechnology was used, Feynman described a process in which scientists would be able to manipulate and control individual atoms and molecules. Over a decade later, in his explorations of ultra-precision machining, Professor Norio Taniguchi coined the term nanotechnology. It was not until 1981, with the development of the scanning tunneling microscope that could “see” individual atoms that modern nanotechnology began.

### Definitions of Nanotechnology

Nanotechnology defined as the engineering of functional systems at the molecular scale.

OR

Nanotechnology refers to the manipulation of matter on an atomic and molecular scale.

OR

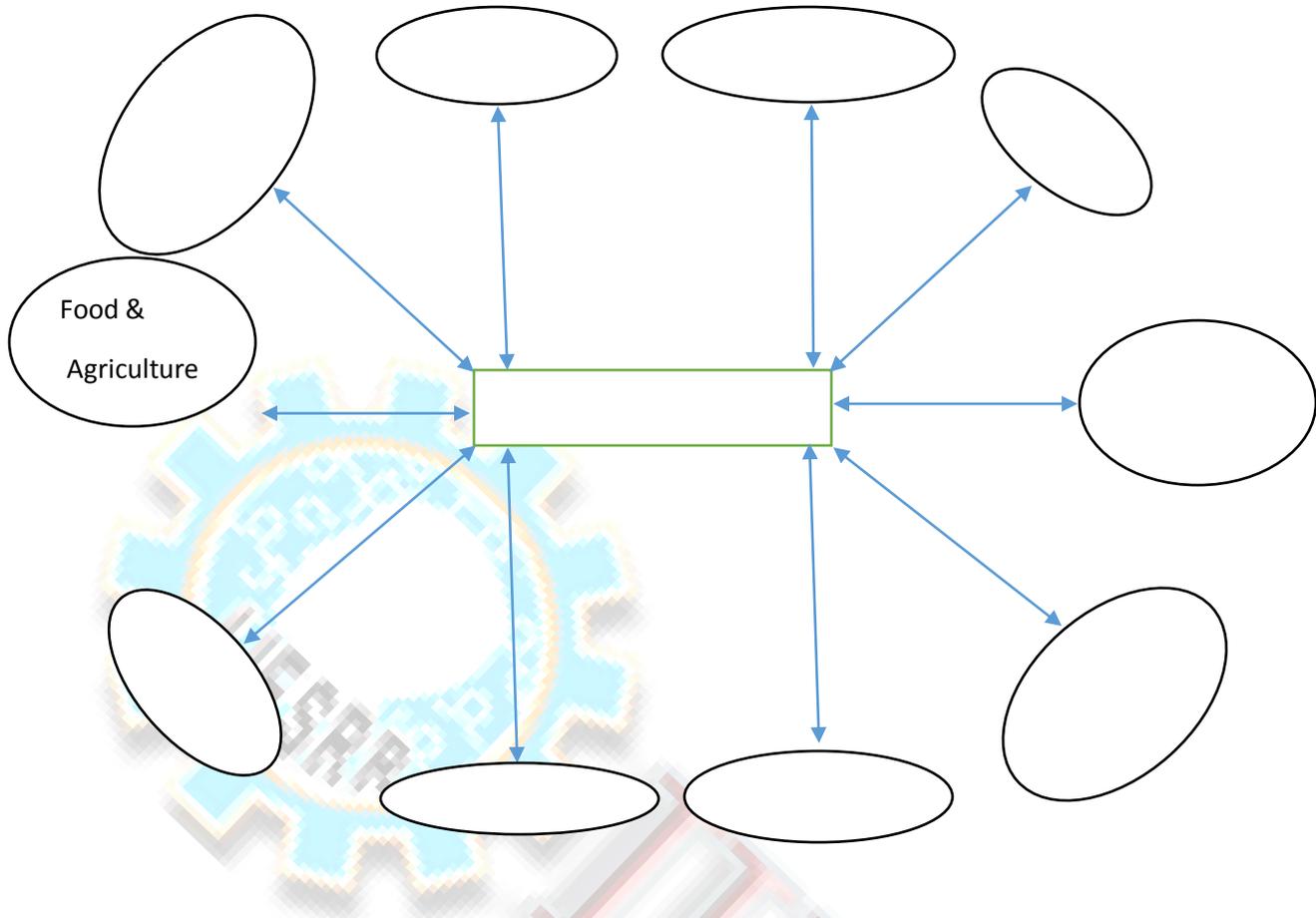
The design, characterization, production and application of structures, devices and systems by controlled manipulation of size and shape at the nanometer scale that produces structures, devices and systems with at least one novel/superior characteristic or property.

OR

The study of the control of matter on an atomic and molecular scale, generally a nanotechnology deal with the structures sized between 1 to 100 nanometer and involves developing or modifying materials or devices within that size.

Having reviewed the above paragraph, we noticed that there is not a unified definition for nanotechnology. However the common point among all the definitions is to produce technology that has very small shape and size.

Actually nanotechnology is a very broad area of study and research and includes several fields, figure 1 showing that nanotechnology pans many areas.



**Figure 1 Nanotechnology Spans Many Areas**

### Why we Want Nanotechnology in our Life

Nanotechnology will increase our standard of living-no ifs, ands, or buts. Done right, it will make our lives more secure, improve healthcare delivery, and optimize our use of limited resources, here we present some fields of nanotechnology:-

A. Security

Security is a broad field, covering everything from the security of our borders to the security of our infrastructure to the security of our computer networks.

B. Healthcare

Hospitals will benefit greatly from nanotechnology with faster, cheaper diagnostic equipment, nanotechnology will aid in the delivery of just the right amount to the exact spots of the body that need it most.

C. Resources

Nanotechnology is set to provide new methods to effectively utilize our current energy resources while also presenting new alternatives, nanotechnology will provide efficient water purification techniques.

D. Computers

Smaller, lighter computers possible with nanotechnology and an end to worries about electrical failures sending hours of on-screen work into an inaccessible limbo mark the potential result of Argonne research on tiny ferroelectric crystals.

**Nanotechnology Advantages and Disadvantages**

The good things of nanotechnology are:-

- i. Nanotechnology can actually revolutionize a lot of electronic products, procedures, and applications.
- ii. Nanotechnology can also benefit the energy sector. The development of more effective energy-producing, energy-absorbing, and energy storage products in smaller and more efficient devices is possible with this technology.
- iii. Manufacturing sector that will need materials like nanotubes, nanoparticles, and other similar items to produce their products with.

While the negative side of nanotechnology is:-

- i. The possible loss of jobs in the traditional farming and manufacturing industry.
- ii. Crash of certain markets due to the lowering of the value of oil and diamonds due to the possibility of developing alternative sources of energy.
- iii. Atomic weapons can now be more accessible and made to be more powerful and more destructive.
- iv. Presently, nanotechnology is very expensive and developing it can cost you a lot of money.

**Nanotechnology and Nano Computers**

A Nano computer is a computer whose physical dimensions are microscope. The field of Nano computing is part of the emerging field of Nanotechnology. We have several types of Nano computers:-

- i. Electronic Nano computers  
Electronic Nano computers would operate in a manner similar to the way present-day microcomputers work. The main differences are one of physical scale, more and more transistors are squeezed into silicon chips with each passing year.
- ii. Chemical Nano computers  
Chemical Nano computers would store and process information in terms of chemical structures and interactions. Biochemical Nano computers already exist in nature, they are manifest in all living things. The development of true chemical Nano computers will likely proceed along lines similar to genetic engineering.
- iii. Quantum Nano computing  
Quantum Nano computing is a computer based on the principles of quantum theory, which explains the nature and behavior of energy and matter on the quantum (atomic and subatomic) level. Development of a quantum computer would make a leap forward in computing capability for greater than that from a supercomputer, with performance gains in the billion-fold realm and beyond.

- iv. Mechanical Nano computing  
Mechanical Nano computers depend on millions of microscopic parts instead of solid-state transistors and other components to push the electrons to perform calculations.
- v. Nano robots  
One vision of a Nano assembler or Nano robots is a device with robotic arms, motors, sensors and computer to control the behavior, all at the scale of nano meters. Even if Nano robots can be realized, they will not be available in the near future.

### **Nanotechnology Leads Improves in Computer Industry**

To build machines on the scale of molecules. Basically, nanotechnology works with materials, devices and other structures with at least one dimension sized from 1 to 100 nanometers. Examples: a few nanometers wide-motor, robot arms, small electronic components, novel semiconductor devices and even whole computer far smaller than a cell. Nanotechnology directed the modern computer in the following fields:-

- I. Nanofabrication  
It is a collection of technology which are utilized in making micro devices. Micro fabrication is the term that describes processes of fabrication of miniature structures, of micrometer sizes and smaller.
- II. Quantum dots  
Quantum dots are crystal that emit only one wavelength of light when the electrons are excited. It is new material made by bottom up method of nanofabrication. In future quantum dots could be used as quantum bits and to form the basis of quantum computers.
- III. Carbon Nanotubes  
It is a tube shaped carbon material that is measured in nanometer scales. With the advancement of nanofabrication technique, researchers used this material to create electronic components like transistor, diodes, relays and logic gates. These electronic components can be directly applied in making advanced computer.
- IV. DNA Computing  
It is an approach to Nano Computers. DNA computing uses method to make DNA molecules and DNA logic gates. Researchers have found that a DNA molecule can store more information than any conventional memory chip and DNA can be used to perform parallel computation.
- V. Nanodesign Software System  
A research group at NASA has been developing a software system called Nanodesign, for investigating fullerene nanotechnology and designing molecular machines. The software architecture of nanotechnology is designed to support and enable their group to develop complex simulated molecular machines. The main purpose behind developing this software system is design and simulation of materials based on nanotechnology.

**Benefits of nanotechnology for computer science**

Nanotechnology has benefited computer science in many ways such as by increasing the efficiency of computer processor, by ensuring the continuity of MOORES LAW etc.

Nanotechnology is already in use in many computing, communications, and other electronic applications to provide faster, smaller, and more portable systems that can manage and store larger and larger amounts of information. These continuously evolving applications include:

- a) Nano scale transistors that are faster, more powerful, and increasingly energy efficient.
- b) Magnetic random access memory(MRAM) enable 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.
- c) Displays for many new TVs, laptop computers, digital cameras, and other devices incorporate nano structured polymer films known as organic light- emitting diodes, or OLEDs, lower power consumption, and longer lifetimes.

**Future Nanotechnology will use Nano computer inside living cells**

Counting miniaturization has moved the semiconductor industry well into the Nano realm with leading chip manufacturers on their way to CMOS using 22nm process technology.

With transistors the size of tens of nanometer, researchers have begun to explore the interface of biology and electronics by integrating nano electronic components and living cells. While researchers have already experimented with integrating living cells into semiconductor materials, other research is exploring the opposite way, i.e. integrating nano electronics into living cells. A typical human cell is the size of about 10 square micrometers which means that hundreds of today's smallest transistors could fit inside a single cell, if the current rate of miniaturization continues, by 2020 approximately 2.500 transistors- equivalent to microprocessors of the first generation of personal computers-could fit into the area of a typical living cell.

**CONCLUSIONS**

As the development of nanotechnology progresses in several fields, the researchers must be aware of their roles and brace themselves for the greater advancement of nanotechnology, as nanotechnology is a truly multidisciplinary field, the cooperation between researchers in all related areas is crucial to success of nanotechnology, computer science has taken important role mostly in research tools. The paper has outlined the definition and the applications of nanotechnology in brief, and the paper is intended to describe the role of nanotechnology in the development of Nano computers. It is hoped that this gentle review will benefit computer scientists who are keen possible to contribute their works to the field of nanotechnology.

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