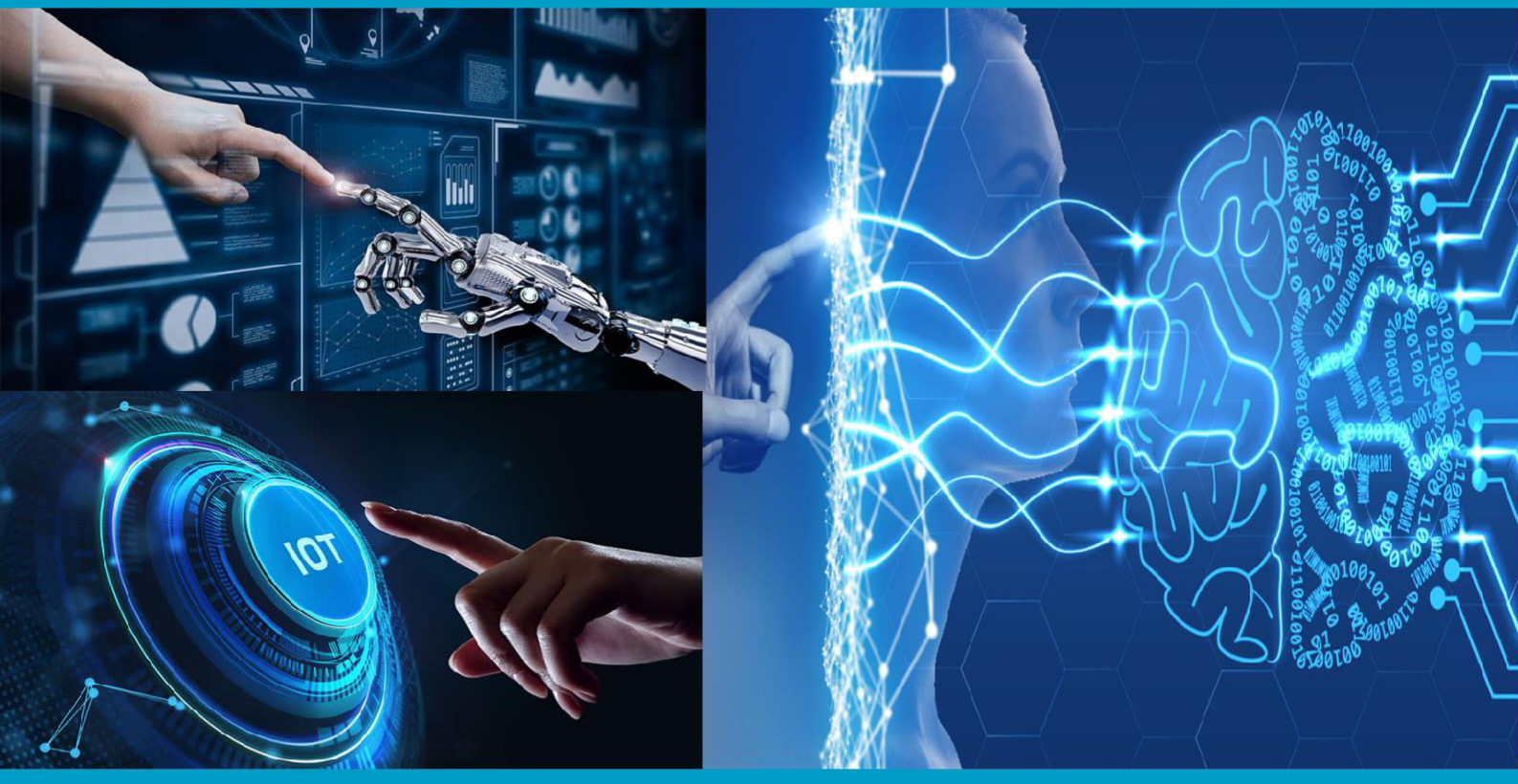
IJMRSETM

e-ISSN: 2395 - 7639



INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH

IN SCIENCE, ENGINEERING, TECHNOLOGY AND MANAGEMENT

Volume 10, Issue 1, January 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.580

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

| ISSN: 2395-7639 | www.ijmrsetm.com | Impact Factor: 7.580| A Monthly Double-Blind Peer Reviewed Journal |

| Volume 10, Issue 1, January 2023 |

| DOI: 10.15680/IJMRSETM.2023.1001015 |

The Systematic Study of Various Basic Assemblers to realize the Designing of Foglets in Nanotechnology

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ABSTRACT: Nanotechnology is much discussed these days as an emerging frontier because human nature is, to live with better and better facilities. On referring dictionary Nanotechnology literally means knowledge use of Mechanical arts and applied Sciences at a level of 10%. An atom is a smallest particle of an element that exist in Universe The goal of Nanotechnology is to build tiny devices called Nanomachines, which are obtained by buildings atoms and molecules.To build a simple molecule bearing with the help of proposed theory of VONNEUMANN and ERIC DREXLER, utility fog and utilizing molecular techniques: MOLECULAR MECHANICS and AB INITIO METHOD, Nanotechnology holds good with the caption" KAR LO UNIVERSE MUTHI MEIN more we think, more surprising results, A single entity that is an atom which holds the Universe and by Nanotechnology. We can play with the Universe.

In this paper, we discussed the methodologies which makes possible to achieve the dream of nanotechnology and its futureapplications. Several typical examples recently worked out by research group are introduced to indicate that these methodologies are actually possible.A single entity that is an atom which holds the universe and by nanotechnology we can play with the Universe.

I. INTRODUCTION

Nanotechnology[1]in the modern world is an emerging frontier. On referring dictionary Nanotechnology literally means a knowledge or use of mechanical arts and applied sciences at a level of scale of 10^{-9}m. In layman language it is equivalent to $1/8000^{th}$ of human hair, one billionth of meter.
An atom is a smallest particle of an element. Everything that exist in this universe is made of atoms, so build this on such a small scale[2]. One has to be able to consider atoms individually and place them preciselyto create the desired structure. The goal[3] of Nanotechnology is to build to tiny devices called Nanomachines, that are achieve by building things atoms by atom, or molecule by molecule. As Nanotechnology is moves on concentrate on molecules or atoms rearrangement therefore Nanotechnology sometimes called molecular manufacturing or molecular manufacturing based on Nanotechnology. Nanotechnology includes study of making molecular assemblers[4]. Nanorobots or Nanorobotic arm (the utility fog)[5], molecular compiler[6], specific chemical reactions[7], modeling tools[8-10].

II. LITERATURE REVIEW

Every existing thing or object or entity made up of an atom. An atom is so small that it is hard to describe on human scale. To get a rough idea of its size, take a baseball and blow it up to the size of the earth. The atoms of the baseball are consider as the size of grapes. Followings are the ways to achieve nanotechnology The major research objectives in molecular Nanotechnology and design. Modeling and fabrications of molecular machines and molecular devices.
To perform such fabrication of machines and manipulating atoms and molecules we require an assembler one very important aspect of Nanotechnology is to produce a nanosized robotic arm capable of producing copies of itself and also manipulate atoms or molecules. So to apply the concept of miniaturization we concern with terms Assembler, Nanorobotic arm and molecular machines.

III. METHODOLOGIES OF SCALING DOWN

A) The Assembler:

Eric Drexler's Assembler[11] is a device which operates in normal 3-D world and can build large atomically precise structures by manipulating atoms and small group of atoms. This device assembles a molecular computer, one or more molecular positioning devices that is nothing but the robotic arms and a set of chemical reactions that take place to

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achieve the fabrication of structures.DREXLER'S Assembler is analogous to universal constructor of VON NEUMANN, who defined a universal constructor in 2-D. this model is a mathematical abstraction. Its approach is same as that of an infinite checkerboard with several type of checkers on each square. The checkers moves or changes its place according to neighboring movements of squares under certain predefined set of rulesVon Neumann used the concept of a universal constructor in conjunction with a universal computer as the core components in a self replicating system. This is all about the proposed concept of assembler.

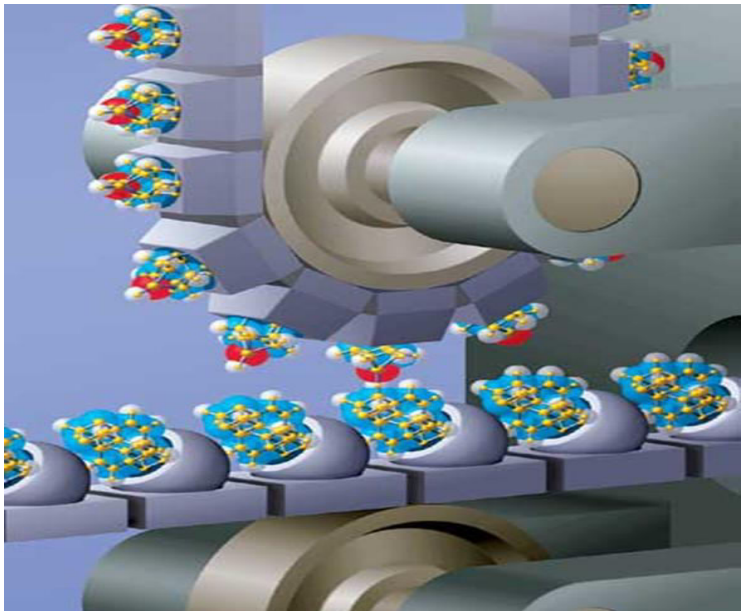

Figure 1. The Molecular Assembler

An assembler consist of nano-size robotic arm and the early goal of Nanotechnnology was to produce the first nanosize robotic arm capable of manipulating atoms and molecules to obtain useful product or to obtain copies of itself. If One Nanoassembler[4] has to work with trillions and trillions of atoms. the assembler would be slow, So we must use a specific property of an assembler robot arm to design and make copies and those copies are capable of making further copies. This results in a situation where objects would be assembled quickly by trillions of such nano super computer controlled assemblers working in parallel.The fundamental purpose of an assembler is to position atoms, to position atoms we work with molecular assembler and modeling techniques. In order to design assembler it must satisfy two conditions:

B) **The building blocks**

These are so stable that small errors in the empirical force fields do not affect the shape or stability of the building block.The combing of building blocks is done by using positionally controlled reactions, Chemical reactions involve a small number of atoms, whose behavior can be modeled with higher order ab initio methods[12].Robotic arm or other positioning devices are basically mechanical in nature and will allow us to position molecular parts during the assembly process. Molecular mechanics provides with an excellent tool for modeling the behavior of such devicesThe second fundamental requirement is the ability to make and break bonds at specific sites. While molecular mechanics provides an excellent tool for telling us where tip of the assembler arm is present, and current force fields are not sufficient to model the specific chemical reactions, these reactions take place at the ap to build atomically precise part for this process higher order ab initio method is sufficient. So we concentrate on two modeling techniques.

C) Molecular Mechanics:

Molecular mechanics, which utilizes empirical force fields to model the forces acting between nuclei. And Second: is higher order ab initio calculations.Molecular mechanics allows computational modeling of positions and trajectories of the nuclei of individual atoms. It also consider the limiting of size with condition of energy minimization. As P.C. can do energy minimizations on system with thousands of atoms, while super computers can handle systems with hundreds of thousands of atoms or more.In molecular mechanics, the individual nuclei are usually treated as point masses. According to quantum mechanics, each nucles is associated with certain degree of uncertainty. The positional uncertainty is significantly smaller than the typical internuclear distance. As nuclei consider as point masses, and the electron cloud deals with quantum-mechanical[13]. If we are interested to know only position and electronics structure,

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we electively eliminate quantum mechanics due to uncertainty principle. For example: - H_2 molecules includes two nuclei while it would be possible to solve Schrodinger's equation to determine the wave function for electrons, if we are interested to know the potential energy associated by the electrons and do not enquire the electron distribution. We need to know the electronics energy as a function of the distance between the nuclei.So potential energy E is related with internuclear distance 'r'. in case of H. E' is a simple function of internuclear distance 'r'. The two hydrogen nuclei will adopt a position that minimizes E (r). As 'r' becomes larger, the potential energy of the system increases and the nuclei experience a restoring force that acts to return at same distance. Similarly as 'r' becomes smaller and the two nuclei are come closer. we find that a restoring force acts to return at same distance.In general.rl.r2.r3..... rn of 'N' nuclei E(r1, r2.....rn) gives the potential energy as a function of nuclear positions. We can determine the forces acting on the individual nuclei and the therefore compute the position. Function 'E' is a Newtonian potential energy function. The particular value of E could be computed from schrodinger's equation.

D) Born-Oppenheimerapproximation:

It allows a great conceptual and practical simplification in the modeling molecular system. In practice it is usual to use available experimental data, to compute the nature and shape of E by interpolation. This is an approach in which empirically derived potentially energy functions are created by use of interpolation techniques from experimental data.

E) **Higher order ab initio methods**

Ab initio is a latin word that literally stands for from the beginning by the first principle.Empirical force fields holds good while working with chemical stable stiff structures. They do not provide accuracy to deal with chemical transitions. Thus if we wish to model the manufacture of a molecular part. Such as the axle or sleeve of the bearing, we must use higher order ab initio method.In the ab initio method, the number of atons that can be modeled either one or two dozen heavy atom depending upon hardware, software and specific type of modeling use. This allows are accuracy sufficient to analyse chemical reactions that must necessarily takes place during synthesis of large atomically precise structures.The higher order ab initio methods[12] are sufficient to analyse the addition or removal of a small number of atoms from a specific site on a work piece. The combining of large objects would consist of repeated site specific applications of a small number of basic operations, where each basic operation changed the chemical structure of only a small number of atoms at a time. Provided that we reject reaction mechanism where the result predicted depends on errors that are smaller than can reasonably be modeled. These basic operations can be satisfactorily carried out with current methods and hardware.

IV. DESIGNING OF FOGLETS

a) <u>Scaling down of micro electronic devices</u>

The most important feature of the nano electronic device, FOGLET[13-14] is its automatic working containing all the global information & possessing of all the senses that enables him to counter with any situation. Since FOGLET is an electronic robot so our work cannot be completed without discussing the scaling down of microelectronicsystems.According to Gordon Moore Law every component of electronic system is reducing half of its original length in approximately 550 days i.e. scaling down of the electronic component is a progressive phenomenon. But there are limits to how far this exponential decrease in device size can go. Let us discuss the case of transistor; at present, we have transistor in 350 nm across. It might still be reduced in size by another factor of 100 i.e. allowing for up to 10.000 transistors in the space taken up by one current transistor above scale satisfies the required molecular scale. But this is a problem associated with a scaling down. Note that once transistor approaches 100 nm, its properties that control the device operation begins to change. Therefore, the seating down problem at 100 nm or 0.1 micron is also called "0.1 micron barrier".

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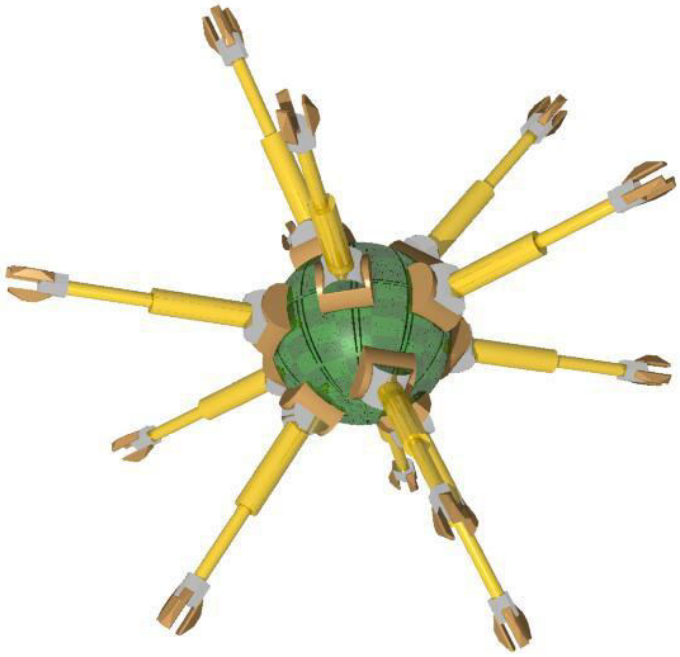

Figure 2. A Foglet Overview

It must be note that on reaching up to molecular scale the bulk properties of materials become quantum mechanical properties of collection of atoms. In case of doped semiconductors. tunneling effect energy quantization will become apparent and these new properties are the only rays of hope for construction of microelectronic devices. The single-electron transistor is the only solution of the above-mentioned problems.

b) SET (Single electron transistors):

SET is a new type of switching device that uses controlled electron tunneling to amplify current. SET is the key to nanotechnology where share a common electrode. A tunnel junction consist of two pieces of metal separateproblemsIt consist of two junctions by a very thin (1 nm) insulator. Now the only way for electrons in one of the metal electrodes to travel to the other electrode i, to tunnel through the insulator since tunneling is a discrete process, the electric charge that flows through the tunnel Junction flows in multiples of the charge "e" (one) of single electron. Note that whenever electrons are constrained to a small region effect of energy quantization need to be taken into account. It must be noted that present capability preclude the manufacture of any but the most rudimentary molecules structures, the design & modeling of molecular machines in however quite feasible with present technology. But after eliminating dead ends we get more promising designs.

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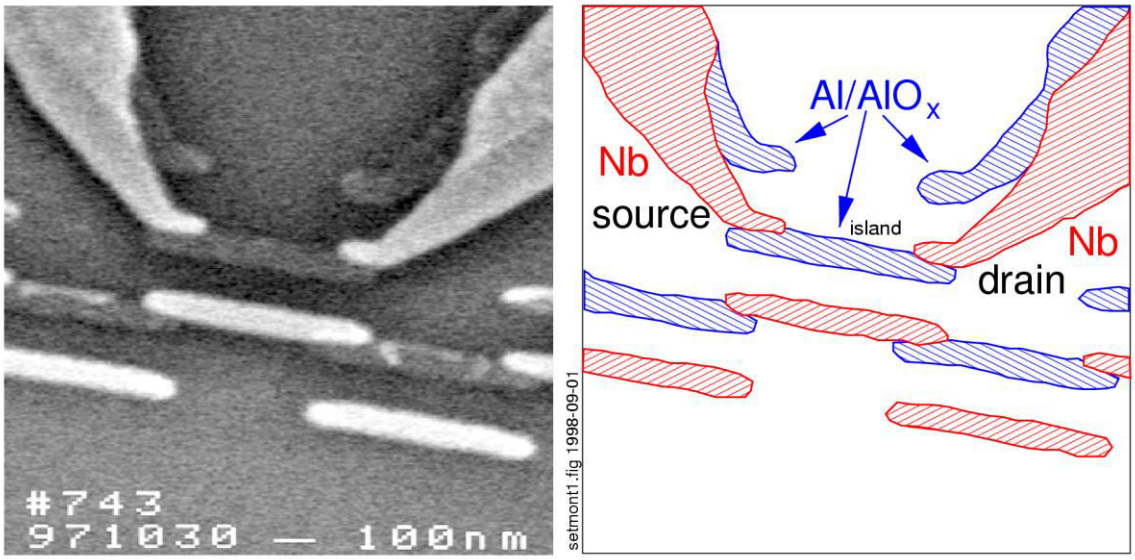

Figure 3. A Single Electron Transistor image

V. APPLICATIONS AND FUTURE ASPECTS

The goal of Nanotechnology is molecular and atomic precision. Nanotechnology has much to learn from nature. Copying, borrowing and learning tricks from nature is one of the primary techniques used by Nanotechnology and has been termed biomimetics[15-16]. As our human body has different cells to perform different functions, each has to do specific function. If we wish to make a nano-robot that has different parts to operate different functions. Then that nanorobots must inspired from human body.Nanotechnology brings us

a) A super computer no bigger than human cells. A spacecraft no larger or more expansive than the family car. Curing cancer by drinking medicine stirred in to your favorite fruit juice. We could make surgical instruments of such precision and accuracy that they could operate on the cells on molecules from which we are made. We could inexpensively make very strong and very light in weight materials.
b) A piece of coal can be converted in to diamond.
c) The main aim of early nanotechnology was to producethenanosized robotic arm capable of manipulating atoms and molecules either in to useful products or copies of itself. To builds nanorobots programmed to attacks and reconstructs the molecular structure of the cancer cells and viruses to make them harmless. It helps in pollution preventions. treatments and remediation. Include detections andsensing, removal of the financed contaminants from air, water and soil.
d) Our dependence on nonrenewable resources would diminish with Nanotechnology. Nanomachines could construct many resources. Cutting down trees, mining coal or drilling for oil and other petroleum products may no longer be necessary.
e) Global industrialization requires rapid development of clean energy. To preservethe clean air we all breathe and global energy catalyst markets are huge.
f) AUS based company NANOSTELAR[16] that is currently using Nanotechnology to development highly efficient Platinum nano-composite catalyst solutions to increase the efficiency of automobile catalytic converters and it dramatically reduced the cost.According to them. is the first in the series of nano- composite catalyst products to: address the energy catalyst, hydrogen fuel cell. solar power and battery markets.

VI. THE FLIP SIDE

Nanotechnology could also lead to serious environmental problems. It is largely unknown how nano-structured materials, nanoparticles and the other related Nanotechnologies would interact with other entities already presents in the environment. As the use of Nanotechnology is sealed up. emissions to the environment may also increase and perhaps a new class of toxins or other environmental problems may be created. Nano weapons can be made which are very cheap and easily available to common man.

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