Applications of Nanorobotics

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ABSTRACT
The purpose of this paper is to review the phenomenon of nanorobotics at a might apply to micro and nano scale robotics is called nanorobotics. These miniature robots have unique advantages such as accessing to unprecedented and small areas, increased flexibility, functionality and robustness, and being low cost), adaptive and distributed. Nanorobotics is the technology of creating machines or robots at or close to the microscopic scale of a nanometer (10^{-9} meters). More specifically,. As no artificial non-biological nanorobots have yet been created, they remain a hypothetical concept. The names nanobots, nanoids, nanites or nanomites have also been used to describe this hypothetical devices.in this paper is to review some applications of the nanorobotics as like: micro rootics, emerging druge delivery application, health care, bio-medical application, cancer therapy, Brain Aneurysm, communication system, and new future nano technologies. Etc.

1. INTRODUCTION
Nanotechnology is the creation of fully mechanical machine with its physical or its components size very close to the nanometre range. This kind is commonly known as nanorobotics. There are only concepts. i.e, if you look at the Nokia that is a new concept of futuristic mobile phone it has built of sensor types or meance nanorobots hat can detect if the food will be safe to eat by checking if there are any impurities. These types mobile are called "Morph". Robotics are generally used on different fields as like: communication, transportation, army, commerce and medicine. [1].currently, robots sizes have from tens of centimeters down to millimeters due to limited nanoscale and integration capabilities of available power sources, communication, control and computation schemes and tools, and coarse to fine motion mechanisms, sensors, manipulators, and actuators.[2].A nanorobot is a computer-controlled robotic device constructed of nanoscale components to molecular precision and is microscopic in size. We can use this technology to creation of new mechanisms and human protective devices. [3].Robotics is the branch of technology that deals with the design, construction, operation, and application of robots, in these technology computer systems for their control, sensory feedback, and information processing. Today, robotics is a rapidly growing field, the nano technological advances and continues, research, design, and creating new robots various practical purposes, whether domestically or militarily. Nanorobotics is the technology of creating machines or robots at or close to the scale of a nanometre (10-9metres). nanorobots. Nanorobots (nanobots or nanoids) are constructed of nanoscale or molecular components. As no artificial non-biological nanorobots have so far been created, they remain a hypothetical concept at this time.[4]

2. HISTORY OF NANOROBOTS
1980's by Nobel Prize laureate Richard Smalley. Smalley has extended his vision to carbon nanotubes, discovered by Sumio Iijima, which he envisions as the next super-interconnection for ultra small electronics. The term nanotechnology has evolved to mean the manipulation of the elements to create unique and hopefully useful structures, [6].

- December 29, 1959: Richard Feynman gives the famous "There's Plenty of Room at the Bottom" talk.

- First use of the concepts of nanotechnology. Describes an individual atoms and molecules can be manipulated.

• 1974: Professor Norio Taniguchi defines nanotechnology as "the processing of, separation, consolidation, and deformation of materials by atom / molecule."

• 1980's: Dr. Eric Drexler publishes several scientific articles promoting nanoscale phenomena and devices.

• 1986: The book Engines of Creation: The Coming Era of Nanotechnology by Dr. Eric Drexler is published. He envisioned nanorobots as self replicating. A first book on nanotechnology. [5]

2.1 BEGINNINGS
• 1981: Gerd Binnig and Heinrich Rohrer of IBM Zürich. Invented of the Scanning Tunneling Microscope (STM).

By Used for imaging surfaces at the atomic level and identifying some properties (i.e. energy).
• 1985: Discovery of fullerenes (molecules composed entirely of carbon). They have many applications in materials science, electronics, and nanotechnology.

• 1991: discovering Carbon nano tubes (cylindrical fullerenes) as direct result of the fullerenes. – Exhibit high tensile strength, unique electrical properties, and efficient thermal conductivity. Their electrical properties make them ideal circuit components (i.e. transistors and ultra capacitors).

• Recently, researched chemical and biomedical engineering have used carbon nano tubes as a vessel for delivering drugs into the body. [5]

2.2. CONTENTS

• 1991: Invented of atomic force microscope (AFM).– it has imaging, measuring and manipulating matter at the nanoscale. It performs its functions by feeling the surface with mechanical probe. – Since interaction with materials on the nanoscale, it is considered a nanorobot.

• 2000: United States national nanotechnology Initiative is founded to coordinate federal research and development in nanotechnology

• 2000: The company nanofactory collaboration is founded.
Developing a research agenda for building a nanofactory capable of building nanorobots for medical purposes.

• Currently, DNA machines (nucleic acid robots) are being developed. Performs mechanical-like movements, such as switching, in response to certain stimuli (inputs).

• Molecular size robots and machines paved the way for nanotechnology by creating smaller and smaller machines and robots. [5].

3. APPLICATION OF NANOROBOTICS

The applications of the nano robotics are more as: micro rootics, emerging druge delivery application, health care, bio-medical application, cancer therapy, Brain Aneurysm, communication system, and new future nano technologies. Etc.

3.1 NANOMEDICINE APPLICATION

The major development of nanomedicine molecular nanotechnology (MNT) or nanorobotics.Just as biotechnology extends the range and efficacy of treatment available from application of nanomaterials, the advent of molecule of nanotechnology will be again expand enormously the effectiveness, precision and speed of future medical treatments while at the same time significantly reducing their risk, cost, and invasiveness. MNT will allow doctors to perform direct in vivo surgery of human cells. [7]. Nanomedicine's that can easily traverse the human body because nanorobots are so tiny. Scientists report that nanorobot constructed of carbon atoms in a diamondoid structure because of its inert properties and strength. Glucose or natural body sugars and oxygen might be a source for propulsion, and it will have other biochemical or a molecular part depends on task. [8]. A large Potential applications for nanorobotics in medicine include early diagnosis and targeted drug delivery with treatmental medicine for cancer biomedical instrumentation, surgery, pharmacokinetics, monitoring of diabetes, and health care. In future medical technology is expected to nanorobots injected into the patient to perform treatment on a cellular level. [9].

3.2 MECHANICAL APPLICATION

The nano technology is given the most convenient bearings and gears. One of the classes' components. Examples are Drexler's overlap-repulsion bearing design. this bearing is constructed of a small shaft that rotates within a ring sleeve of 2.2 nm in diameter, it has 206 no. of atoms of carbon, silicon, oxygen and hydrogen. The arranged of atoms in nano shafts in a 6-folds. Similarly the ring has 14-fold symmetry, this combination is provides low energy barriers to shaft rotation. A 2808-atom strainedshell sleeve bearing designed by Drexler and Merkle 16 using molecular mechanics force fields to ensure that bond lengths, bond angles, van der Waals distances, and strain energies are reasonable. This 4.8-nm diameter bearing features an interlocking-groove interface which derives from a modified diamond (100) surface. [3]. in mechanical application of the nanorobotes in which includes bio-mechanics and nano machines are present. The science of Nanorobotics vital role in the development of the robots, whose structure is built by using nanoscale components and its contants with in the basses of objectives and limitations. The nature of the component being in the nano scale allows the researchers for the engineering of the mimic of human beings. Which constitute the robots has been possible due to nanorobotics nanobotes, nanites, nanoids or nanomites are some of the hypothetical devices created with the knowledge of the nanorobotics. [14].

3.3 NANOROBOTICS USES IN HEALTH CARE

The nanorobotic science in these experiment and research will give the very bright future.the nano robotics is developing da y by day in medical industries. That's increase the human safety and health careing fields are

expanding. They are many senior ill patients and there are living by the use of the nanorobotical treatment method. HIV, cancer and other harmful diseases are also under progress for curing. The nanorobots will treat and find disease, and restore lost tissue at the cellular level. It is useful for monotering, diagnosing and fighting sichness. [10] in the health care field the nanorobotics is perform the good treatment by through biomedical. That is impoveing the technique of treatment methods. In future we will found the decreament of big ills. We are using the many field of the nanorobotics as like medical application, treatment of cancer, nanorobotics in gene therapy, nanorobots for brain aneurysm, nanorobots in dentistry, etc. [11].

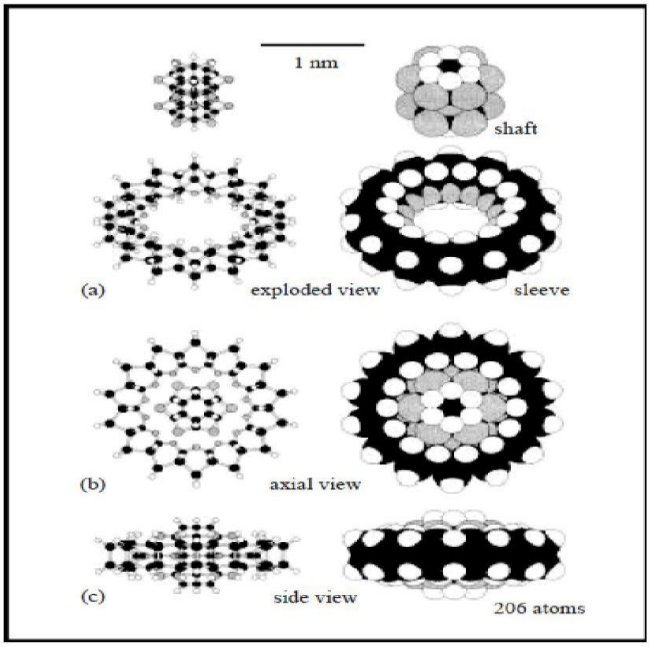

Figure 3.2 Nanogears and nano bearing.[3]

3.4 ANTI HIV USING NANOTECHNOLOGY

The immune system is comprised of two important cell types: the B-cell and the T-cell. The B-cell is responsible for the production of antibodies, and the T-cell is responsible either for helping. The B-cell to make antibodies, or for the killing of damaged or "different" cells within the body. And the T-cells are classified main two types the "helper"T-cell and the cytotoxic T-cell. The T-helper population is further divided into those which help B-cells (Th2) and those which help Cytotoxic T-cells (Th1).through nanorobotics treatment systems immune system and operation of HIV. The immune system is activated. Both B- and T-cell members respond to the threat, which is a result in the elimination of the substance or agent from our bodies. Normally, these actions are wonderfully protective of us. The effect of HIV on the immune system is the result of a gradual elimination of the Th1 and Th2 helper T-cell subpopulation. Remember about the proteins, which envelope HIV. One of these proteins, named gp 120,"recognizes" a protein on helper T-cells named CD4, and physically associates with it. The CD4 protein is a normal part of a helper T-cell's membrane.

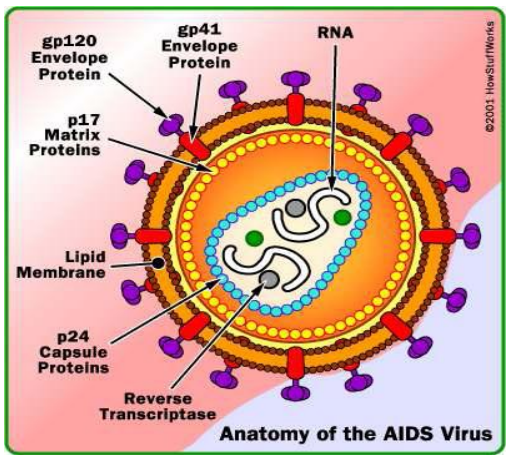

Figure 3.4 (a): structure of aids virus. [8].

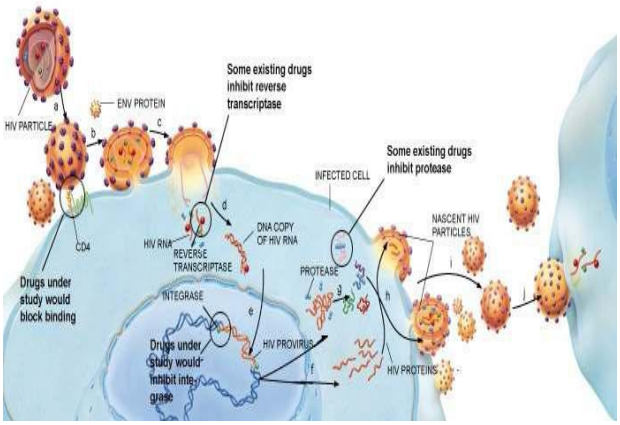

Figure3.4. (b): Interaction of HIV with CD4 [8]

As a consequence of the interaction with CD4 on helper T-cells, HIV specifically infects the very cells necessary to activate both B-cell and cytotoxic T-cell immune responses.. Consequently, the virus can multiply, and kill the helper T-cell in which it lives. The fight between the virus and the immune system for supremacy is continuous until the body eventually

Succumbs, apparently because of the inability to anylonger

Produce T-cells. This results in the complete inability of our body to ward-off even the weakest of the organisms. This acquired condition of immune deficiency is called, AIDS. [8]

3.5 NANO ROBOTS IN CANCER TREATMENT

Cancer can be successfully treated with current stages of medical technologies and therapy tools with the help of the nanorobotics. Determine the decisive factor to chances for a patient with cancer to survive is: how earlier it was diagnosed; another important aspect to achieve a successful treatment for patients is the

development of efficient targeted drug delivery to decrease the side effects from chemotherapy. Considering the properties of nano robots to navigate as blood borne devices, they can help on such extremely important aspects of cancer therapy. Nanorobots with embedded chemical biosensors can be used to perform detection of tumour cells in early stages of development inside the patient's body. Integrated nano sensors can be utilized for such a task in order to find intensity of E-cadherin signals. Therefore a hardware architecture based on nano bioelectronics is described for the application of nanorobots for cancer therapy. [11].

the scientists have genetically modified salmonella bacteria that are drawn to tumors by chemicals secreted by cancers cells. The bacteria carry microscopic robots, about 3 micrometers in size that automatically release capsules filled with drugs when the bacteria reach the tumor. By delivering drugs directly to the tumor, the nanorobot, which the team named bacteriobot, attacks the tumor wile leaving healthy cells alone, sparing the patient from the side effects of chemotherapy. Bactiriobot can only detect tumor forming cancers, such as breast cancers and colorectal, but the nanorobot will aventually be able to treat other cancers as well. [16]. A decisive factor to determine the chances for a patient with cancer to survive is: how earlier it was diagnosed; what means, if possible, a cancer should be detected at least before the metastasis has began. Another important aspect to achieve a successful treatment for patients is the development of efficient targeted drug delivery to decrease the side effects from chemotherapy. Considering the properties of nanorobots to navigate as blood borne devices, they can help on such extremely important aspects of cancer therapy. [15].

3.6 BIOMEDICAL APPLICATIONS OF NANOROBOTS

The enormous potential in the biomedical capabilities of Nano-Robots and the imprecision and less side effects of medical treatments today make Nano- Robots very desirable. But today, we propose for Nanomedical robots, since they will have no difficulty in identifying the target site cells even at the very early stages which cannot be done in the traditional treatment and will ultimately be able to track them down and destroy them wherever they may be growing. [8]

Nanorobots will be applied in chemotherapy to combat cancer through precise chemical dosage administration, and a similar approach could be taken to enable nanorobots to deliver anti-HIV drugs. [12]. the use of SPMs to image and manipulate biological samples has had a tremendous impact on the field of biology in recent years. Studies of single molecules by SPMs are advantageous because they can provide intrinsic properties of the individual molecules themselves as opposed to just the bulk properties of larger samples. SPM technology has become an invaluable tool for the understanding of biological structures and processes at the nanoscale. Examples of AFM applications in imaging and nanomanipulation include the extraction of chromosomal DNA for genetic analysis, the disruption of antibody antigen bonds, the dissection of biological membranes, and the nano-dissection of protein complexes. [13].

3.7 NANO ROBOTS IN GENE THERAPY

Medical nano robots can readily treat genetic diseases by comparing the molecular structures of both DNA and proteins found in the cell to known or desired reference structures. In some cases, chromosomal replacement therapy is more efficient than in CY to repair. Floating inside the nucleus of a human cell, an assembler built repair vessel performs some genetic maintenance. Stretching a super coil of DNA between its lower pair of robot arms, the nano machine gently pulls the unwound strand through an opening in its prow for analysis. Upper arms, meanwhile, detach regulatory proteins from the chain and place them in an intake port. The molecular structures of both DNA and proteins are compared to information Stored in the database of a larger nano computer positioned outside the nucleus and connected to the cell-repair ship by a communications link. Irregularities found in either structure are corrected and the proteins reattached to the DNA chain, which re-coils into its original form with a diameter of only 50 nanometers, the repair vessel would be smaller than most bacteria and viruses, yet capable of therapies and cures well be beyond the reach of present-day physicians. "Internal medicine" would take on new significance. Disease would be attacked

At the molecular level and such maladies as cancer, viral infections and arteriosclerosis could be wiped out.[11] Most human diseases involve a molecular malfunction at the cellular level, and cell function is largely controlled by gene expression and its resulting protein synthesis. One common practice of genetic therapy which has enjoyed only limited success is to supplement existing genetic material by inserting new genetic material into the cell nucleus, commonly using viral bacteriophage bacterial system cell plasmid/phospholipid microbubble cationic liposome, dendrimeric, chemical, nanoparticulate or other appropriate transfer vectors to breach the cell membrane. However, permanent gene replacement using viral carriers has largely failed thus far in human patients due to immune responses to antigens of the viral carrier as well as inflammatory responses, insertional mutagenesis,

and transient effectiveness. Excess gene copies , repeat gene clusters , and partial trisomies and higher polysomies can often cause significant pathologies, sometimes mimicking aging .Attempting to correct excessive expression caused by these errors by implementing antisense transcription silencing on a whole-body, multi-gene, or whole-chromosome basis would be far less desirable than developing more effective therapeutic methods that did not require such extensive remediation.[17].

3.8 NANO ROBOT FOR BRAIN ANEURYSM

The nano robot for brain aneurysm prognosis, they are using computational nanotechnology for medical device prototyping. This is consisting of three main Equipment- (a) prototyping, (b) the manufacturing approach and (c) inside-body transduction. It is the computational nanotechnology provides a key tool for the fast and effective development of nano robots, and that is supports of investigation to address major aspects on medical instrumentation and device prototyping. A similar approach was taken by industry to build racing cars, airplanes, submarines, ICs and medical devices. The bio molecules are too small to be detected reliably: instead the robot relies on chemical nano biosensor contact to detect them. Brain aneurysms are taken for modeling the study of nano robots sensing and interaction within the deformed blood vessel. Intracranial concentrations of NOS are small and some false positives can even occur due to some positive functions of N-oxide with semi carbazone (pNOS). The nano robots must detect protein over expression and the setup for sensing and control activation can be modified for different values, We treat any nano robots not responding while within the workspace as if they did not detect any signal, so they flow with the fluid as it leaves the workspace. If the nano robot's electrochemical sensor detects NOS in low quantities or inside normal gradient it generates a weak signal lower than 50 nA.When activated, the nano robots' sensors also indicate their respective Position at the moment that they detected a high NOS protein Concentration providing useful information about the vessel bulb location and dimensions. [11] To illustrate the proposed approach, the nanorobots must search for protein over expression signals in order to recognize initial stages of aneurysm. An advanced nano mechatromics simulator, using a three- dimensional task-based environment, is implemented to provide an effective tool for device prototyping and medical instrumentation analysis. Thus, based on clinical data and nanobioelectronics, the proposed model offers details about how a nanorobot should help with the early detection of cerebral aneurysm. [19]

3.9 NANOROBOTS TREATMENT OF DIABETES

Glucose carried through the blood stream is the most important role to maintain the human metabolism working for health, and its correct level is a key issue in the diagnosis and treatment of diabetes. Intrinsically related to the glucose molecules, the protein hSGLT3 has an important influence in maintaining proper gastrointestinal cholinergic nerve and skeletal muscle function activities, regulating extracellular glucose concentration. The hSGLT3 molecule can serve to define the glucose levels for diabetes patients. The most interesting aspect of this protein is the fact that it serves as a sensor to identify glucose. At a typical glucose concentration, the nanorobots try to keep the glucose levels ranging around 130 mg/dl as a target for the Blood Glucose Levels (BGLs). A variation of 30mg/dl can be adopted as a displacement range, though this can be changed based on medical prescriptions. In the medical nanorobot architecture, the significant measured data can be then transferred automatically through the RF signals to the mobile phone carried by the patient. At any time, if the glucose achieves critical levels, the nanorobot emits an alarm through the mobile phone. [9].

4. DISADVANTAGES

- The initial design cost is very high.
- The design of the nanorobot is a very complicated one.
- Electrical systems can create stray fields which may activate bioelectric-based molecular recognition systems in biology.
- Electrical nanorobots are susceptible to electrical interference from external sources such as rf or electric fields, EMP pulses, and stray fields from other in vivo electrical devices.
- Hard to Interface, Customize and Design, Complex
- Nanorobots can cause a brutal risk in the field of terrorism. The terrorism and anti groups can make use of nanorobots as a new form of torturing the communities as nanotechnology also has the capability of destructing the human body at the molecular level.
- Privacy is the other potential risk involved with Nanorobots. As Nanorobots deals with the designing of compact and minute devices, there are chances for more eavesdropping than that already exists.[9].

- The nanorobot should be very accurate, otherwise Harmful effects may occur.
- The initial design cost is very high.[8]

5. ADVANTAGES

- Currently there is no permanent vaccine or medicine is available to cure the disease. The currently available drugs can increase the patient's life to a few years only, so the invention of this nanorobot will make the patients to get rid of the disease. And has no side affects.[8].
- As the nanorobot do not generate any harmful activities there is no side effect. It operates at specific site only.[8]

6. CONCLUSIONS

The paper is just a theoretical justification. But the recent advancement in the field of nanotechnology gives the hope of the effective use of this technology in medical field. This paper starts by giving an introduction to nanorobots and its importance as recognized by various other technocrats. Nanotechnology as a diagnostic and treatment tool for patientswith cancer and diabetes showed how actual developments in new.

Manufacturing technologies are enabling innovative works which may help in constructing and employing nano robots most effectively for biomedical problems. Consequently they will change the shape of the industry, broadening the product development and marketing interactions between Pharma, Biotech, Diagnostic and Healthcare industries. Future healthcare will make use of sensitive new diagnostics for an improved personal risk assessment.

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