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Next-Generation Firewall

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IT managers in corporate and mid-size businesses have to balance both network performance and network security concerns. While security requirements are critical to the enterprise, organizations should not have to sacrifice throughput and productivity for security. Next-generation firewalls (NGFWs) have emerged as the solution to this thorny problem.

Can our firewall tell you ...?

“Something came in over port 80. Do you know what it is?”

“What is your social media presence/exposure?”

“What are you allowing outbound from your network?”

“What portion of your bandwidth is consumed by video?”

“Is anyone playing social or other browser games?”

“Is there P2P traffic on your network?”



Earlier-generation firewalls pose a serious security risk to organizations today. Their technology has effectively become obsolete as they fail to inspect the data payload of network packets circulated by today's Internet criminals.

Legacy firewall technologies alone provide little protection against many of the latest threats. These technologies with stateful protocol filtering and minimal application visibility were simply not designed to address newer threats originating from areas such as Web 2.0 and cloud computing environments

Using separate firewalls, intrusion prevention systems (IPS), intrusion detection systems (IDS), anti-virus, anti-spyware, and content-filtering appliances result in higher operational costs and strain companies that lack the time, resources and expertise required to manage and maintain multiple security technologies.

What exactly Next-Generation Firewalls (NGFWs) means?

Next Generation Firewalls (NGFWs) provides a single, integrated solution that manages multiple layers of network security defenses. An NGFW device simplifies the simultaneous orchestration of various security tools and allows for a more granular approach to application security.

In basic terms, a next-generation firewall applies deep packet inspection (DPI) firewall technology by integrating intrusion prevention systems (IPS), and application intelligence and control to visualize the content of the data being accessed and processed.

An NGFW is “a wire-speed integrated network platform that performs deep inspection of traffic and blocking of attacks”.

An NGFW is an enterprise-class, high-performance gateway security appliance that provides top-of-the-line firewalling, intrusion prevention, and application control.

NGFW FEATURES

- Stateful Inspection
- Intrusion Prevention
- Application Control
- SSL(Secure Sockets Layer) Decryption/Inspection

An NGFW should provide:

- Standard first-generation firewall capabilities, e.g., network-address translation (NAT), stateful protocol inspection (SPI) and virtual private networking (VPN), etc.
- Integrated signature based IPS engine
- Application awareness, full stack visibility and granular control
- Capability to incorporate information from outside the firewall, e.g., directory-based policy, blacklists, white lists, etc.
- Upgrade path to include future information feeds and security threats
- SSL decryption to enable identifying undesirable encrypted applications

The evolution of Next-Generation Firewalls:

The SPI generation of firewalls addressed security in a world where malware was not a major issue and web pages were just documents to be read. Ports, IP addresses, and protocols were the key factors to be managed. However, as the Internet evolved the ability to deliver dynamic content from the server and client browsers introduced a wealth of applications we now call Web 2.0.

Today, applications from Salesforce.com to SharePoint to Farmville all run over TCP port 80 as well as encrypted SSL (TCP port 443). A next-generation firewall inspects the payload of packets and matches signatures for nefarious activities such as known vulnerabilities, exploit attacks, viruses and malware all on the fly. DPI also means that administrators can create very granular permit and deny rules for controlling specific applications and web sites. Since the contents of packets are inspected, exporting all sorts of statistical information is also possible, meaning administrators can now easily mine the traffic analytics to perform capacity planning, troubleshoot problems or monitor what individual employees are doing throughout the day. Today's firewalls operate at layers, 2, 3, 4, 5, 6 and 7 of the OSI model.

What Enterprises Require:

Organizations are suffering from application chaos. Network communications no longer rely simply on store-and-forward applications like email, but have expanded to include real-time collaboration tools, Web 2.0 applications, instant messenger (IM), and peer-to-peer applications, Voice over IP (VoIP), streaming media and teleconferencing, each presenting conduits for potential attacks.

Any delays in firewall or network performance can degrade quality in latency-sensitive and collaborative applications, which in turn can negatively affect service levels and productivity.

Organizations large and small, in both the public and private sector, face new threats from vulnerabilities in commonly used applications. It is the dirty little secret of the beautiful world of social networks and interconnectedness: they are a breeding ground for malware and Internet criminals prey on every corner for their unsuspecting victims. Meanwhile, workers use business and home office computers for online blogging, socializing, messaging, videos, music, games, shopping, and email. Applications such as streaming video, peer-to-peer (P2P), and hosted or cloud-based applications expose organizations to potential infiltration, data leakage and downtime.

NGFWs benefits:

Next-generation firewalls can deliver application intelligence and control, intrusion prevention, malware protection and SSL inspection at multi-gigabit speeds, scalable to support the highest-performance networks.

NGFWs can apply all security and application control technologies to SSL encrypted traffic, ensuring that this does not become a new malware vector into the network.

Vendors participating in the NGFW market include Astaro, Check Point, Cisco Systems, Fortinet, Juniper Networks, McAfee, Palo Alto Networks, and Sonic Wall etc.

Conclusion:

NGFWs promise to help companies regain control over their networks through the integration of intrusion prevention, stateful inspection and deep packet inspection capabilities. However, vendors' offerings vary widely in their approach to scanning network traffic.

Artificial Leaf

(A leaf that makes fuel)

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Researchers led by MIT professor Daniel Nocera have produced something they are calling an “artificial leaf”: Like living leaves, the device can turn the energy of sunlight directly into a chemical fuel that can be stored and used later as an energy source.

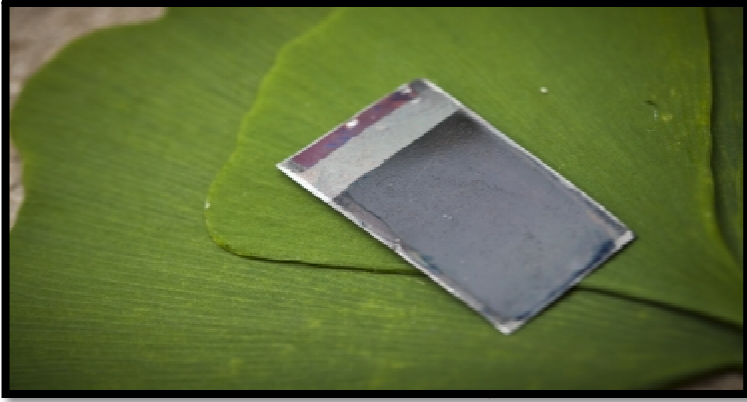
The artificial leaf — a silicon solar cell with different catalytic materials bonded onto its two sides — needs no external wires or control circuits to operate. Simply placed in a container of water and exposed to sunlight, it quickly begins to generate streams of bubbles: oxygen bubbles from one-side and hydrogen bubbles from the other. If placed in a container that has a barrier to separate the two sides, the two streams of bubbles can be collected and stored, and used later to deliver power: for example, by feeding them into a fuel cell that combines them once again into water while delivering an electric current.

The device, Nocera explains, is made entirely of earth-abundant, inexpensive materials — mostly silicon, cobalt and nickel — and works in ordinary water. Other attempts to produce devices that could use sunlight to split water have relied on corrosive solutions or on relatively rare and expensive materials such as platinum.

The artificial leaf is a thin sheet of semiconducting silicon — the material most solar cells are made of — which turns the energy of sunlight into a flow of wireless electricity within the sheet. Bound onto the silicon is a layer of a cobalt-based catalyst, which releases oxygen, a material whose potential for generating fuel from sunlight. The other side of the silicon sheet is coated with a layer of a nickel-molybdenum-zinc alloy, which releases hydrogen from the water molecules.

Since now, the water-splitting reaction is powered entirely by visible light using tightly coupled systems comparable with that used in natural photosynthesis. This is a major achievement, which is one more step toward developing cheap and robust technology to harvest solar energy as chemical fuel.

There will be much work required to optimize the system, particularly in relation to the basic problem of efficiently using protons generated from the water-splitting reaction for hydrogen production. Their achievement is a major breakthrough, which will have a significant impact on the work of others dedicated to constructing light-driven catalytic systems to produce hydrogen and other solar fuels from water. This technology will advance side by side with new initiatives to improve and lower the cost of photovoltaics.



The leaf can redirect about 2.5 percent of the energy of sunlight into hydrogen production in its wireless form; a variation using wires to connect the catalysts to the solar cell rather than bonding them together has attained 4.7 percent efficiency.

3-D Printing of Human Organs!

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3-D Printing:

3D printing, also known as additive manufacturing, is a process of making three dimensional solid objects from a digital model. 3D printing is achieved using additive processes, in which a solid object of virtually any shape is created by laying down successive layers of material such as plastic, ceramics, glass or metal to print an object.

Will we one day be able to print anything and everything we need.

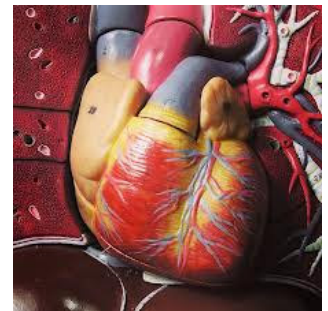
Lots of people use 3D printers to sculpt plastic. 3D printers have also been used in architectural schools for quite some time already. A 3D food printer is under development, and now several sources are working on **3D bio-printers**- machines that will “print” organs so patients will no longer have to wait for transplant donations!!

Printing off a kidney or another human organ may sound like something out of a science fiction novel, but with the advancements in 3D printing technology, the idea may not be so far-fetched.

Bio Printing:

While 3D printing has been successfully used in the health care sector to make prosthetic limbs, custom hearing aids and dental fixtures, the technology is now being used to create more complex structures — particularly human tissue.

Bioprinters, use a "bio-ink" made of living cell mixtures to form human tissue. Basically, the bio-ink is used to build a 3D structure of cells, layer by layer, to form tissue and thus developing the organs.



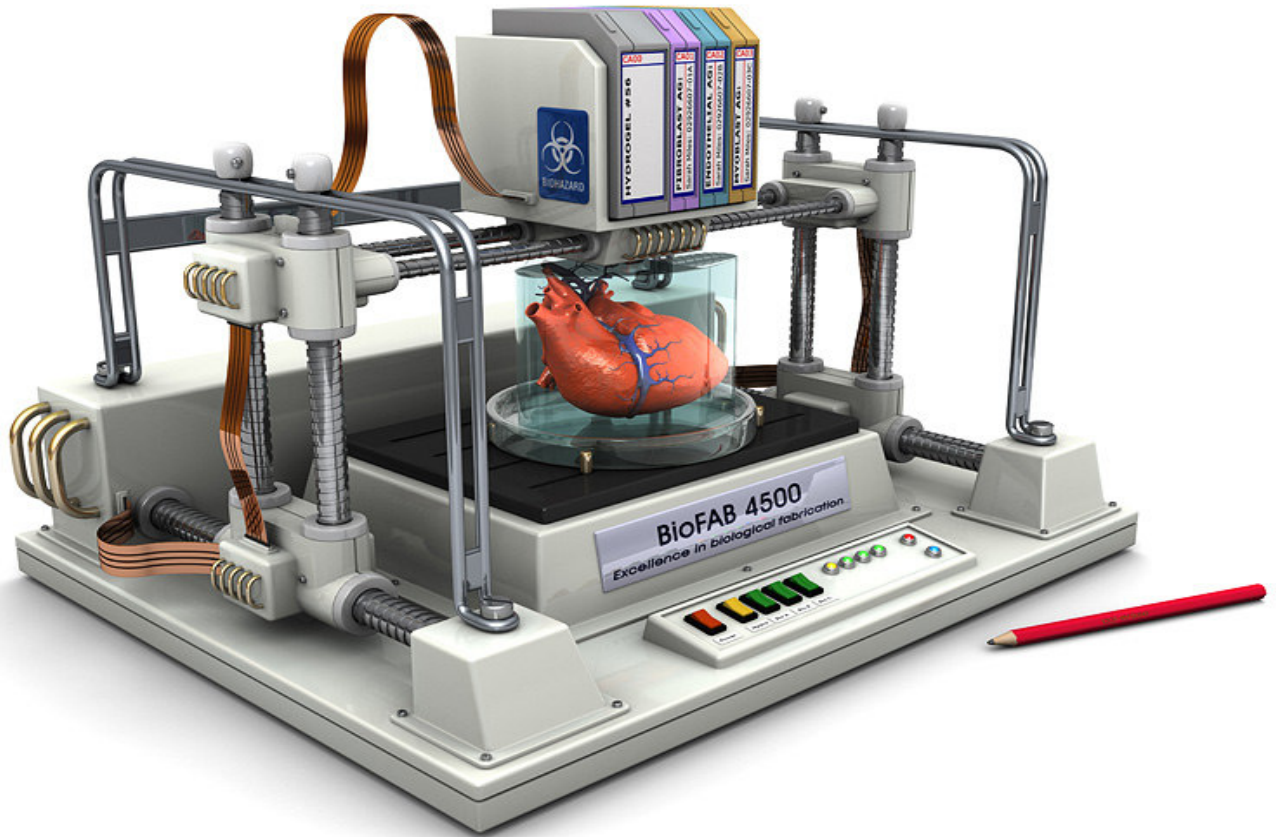
A team of researchers at Heriot-Watt University in Scotland, led by Will Shu, has built a printer that can lay down human stem cells in tiny spheres. Printing human cells has been done before, with bone marrow or skin. Those types of cells, however, are resilient compared to the more delicate embryonic stem cells.

Printing people parts: world's first human organ bio-printer

Recently, the first commercial organ printer was built by biomedical company Invetech and delivered to Organovo, a company that has pioneered the bioprinting technology.

The printer is already capable of producing arteries, which doctors will be able to use in bypass surgeries in as little as five years. Other, more complex body parts should be possible within ten years: bones and hearts, for example. The printer works by using two print heads. One lays down a scaffold and the other places human cells into the shape of whatever organ is being formed.

There's little threat of the new organ being rejected since it's made of the patient's own cells. The machines could represent a breakthrough in medicine, since the wait time for new organs would be significantly shortened and the risk of organ rejection nearly eliminated.

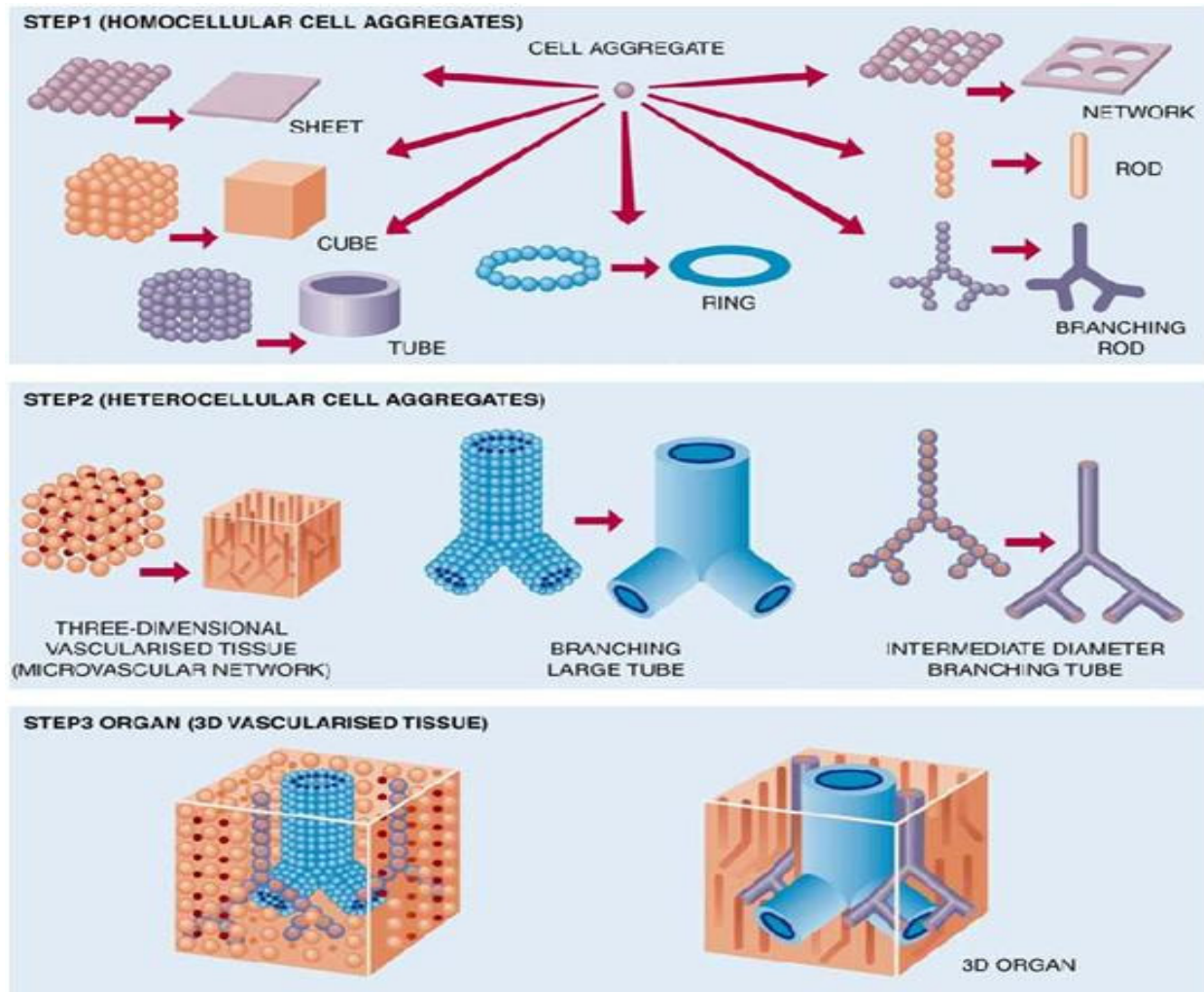


Bioengineers at Cornell University have printed experimental knee cartilage, heart valves and bone implants. And the non-medical start-up Modern Meadow is using bioprinting technology to develop a way to print meat.

Process of Bio Printing:

Stem cells are the building blocks of organs and tissues; they are “generic” cells that can become specific kinds when exposed to the right conditions. The 3D printing technology relies on an adjustable "micro valve", which builds up layers of human embryonic stem cells. Such cells, which originate from early stage embryos, are blank slates with the potential to become any type of tissue in the body.

The scientists built a printer that forms the cells into tiny spheres, while keeping them alive. It is found that the valve-based printing is gentle enough to maintain high stem cell viability.



The printer has specialized valves, which are adjustable and control the rate at which the cells are released. That allowed them to put the stem cells where they are needed and keep them intact.

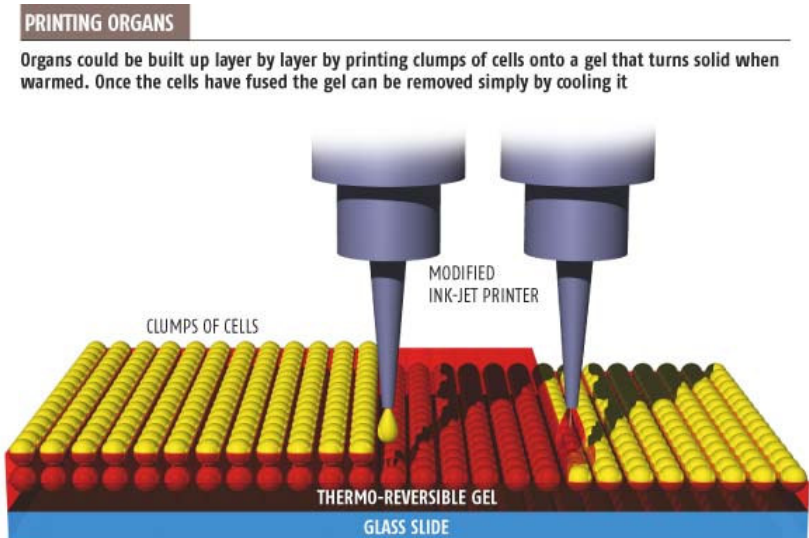
In the longer term, the printer could help build organs for transplants or repair. Since the printer can put stem cells in a three-dimensional pattern, it could build a small “patch” for a heart or kidney that would be made from stem cells cloned from the patient.

In the long term, the new printing technique could pave the way for those cells to be incorporated into transplant-ready laboratory-made organs and tissues, researchers at Heriot-Watt University in Edinburgh said.

The technique's breakthrough is in its gentle handling of the delicate cells which gives them a greater chance to thrive. Taking a cell from a patient and using it in the 3D printing process should enable scientists to implant the generated tissue back into the patient without triggering an immune response.

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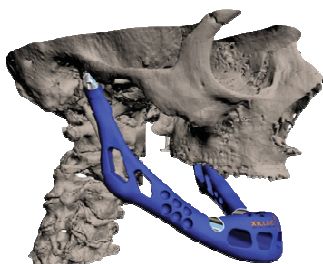
"This is a scientific development which scientists hope and believe will have immensely valuable long-term implications for reliable, animal-free drug-testing and, in the longer term, to provide organs for transplant on demand, without the need for donation and without the problems of immune suppression and potential organ rejection,"



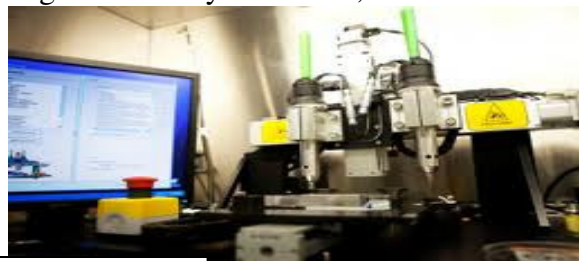
How 3D Printers Are Reshaping Medicine:

Medical researchers and others are using bioprinting technology to make advancements in other ways.

- **Use human cells as ink:** Take some stem cells, load them into a cartridge, and print them onto a gel-like substance called “bio-paper.” The cells will basically bind with the paper, and turn into an all-purpose liquid sludge called “bio-ink”—an all-purpose agent that can be used to create new human organs.
- **Duplicate your kidney:** Last year, surgeon Anthony Atala gave one of the craziest TED talks ever—right on stage, he printed out a human kidney using a tissue sample from an existing kidney. The printed organ was nearly identical to the original, thus bypassing the risk of organ rejection during a transplant.
- Researchers in regenerative medicine at Wake Forest University in North Carolina partnered with the Armed Forces Institute for Regenerative Medicine to **make a 3-D skin printer that deposits cells directly on a wound to help it heal quicker.**
- Researchers in the pharmaceutical industry, until lately, have used two-dimensional cell cultures to test drugs during the early stages of development. However, the 2D cell cultures do not reflect human tissue as accurately as 3D printed tissue.
- The scientists behind the breakthrough estimate that the 3D printing technology could lead to a "production line" of artificial organs in 10 years' time, at the earliest.



3-D PRINTED HUMAN JAW



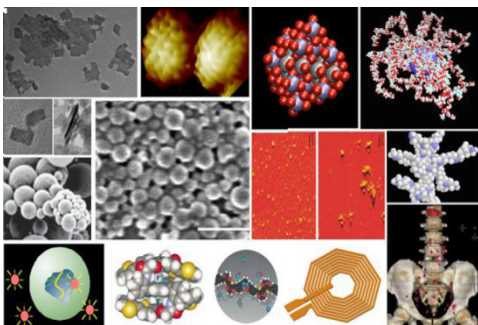
Nanobot

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Current medicine is limited both by its understanding and by its tools. In many ways, it is still more an art than a science. Today's drug therapies can target some specific molecules, but only some, and only on the basis of type. Doctors today cannot affect molecules in one cell while leaving identical molecules in a neighbouring cell untouched because medicine today cannot apply surgical control to the molecular level.

To understand what nanotechnology can do for medicine, we need a picture of the body from a molecular perspective. There are opportunities to design nanosized, bio responsive systems able to diagnose and then deliver drugs, and Systems able to promote tissue regeneration and repair



circumventing chemotherapy. The long-term goal is the development of novel and revolutionary bimolecular machine components that can be assembled and form multi-degree-of freedom nano devices that will apply forces and manipulate objects in the nanoworld, transfer information from the nano to the macro world, and travel in the nano environment. These machines are expected to be highly efficient, controllable, economical in mass production, and fully operational with minimal supervision. The emerging field of medical nanorobotics

is aimed at overcoming these shortcomings. Molecular manufacturing can construct a range of medical instruments and devices with greater abilities. Ongoing developments in molecular fabrication, computation, sensors and motors will enable the manufacturing of nanobots. These are theoretical nanoscale bio molecular machine systems within a size range of 0.5 to 3 microns with 1-100 nm parts. Work in this area is still largely theoretical, and no artificial non-biological nanobots have yet been built. These ultra miniature robotic systems and nano-mechanical devices will be the bio molecular electro-mechanical hardware of future biomedical applications.

An Introduction to Nanotechnology:

Nanotechnology refers to field of applied science whose theme is to control the matter on atomic and molecular scale. The notion of nanotechnology has evolved since its inception as a fantastic conceptual idea to its current position as a mainstream research initiative with broad applications among all divisions of science. Materials nanotechnologically enhanced will enable a weight reduction accompanied by increase in stability and improved functionality. One of the most promising applications of nanotechnology is that of drug delivery, and in particular the targeted delivery of drugs using nano structures. In recent years, the interest in micron and sub-micron systems (*i.e.* nanosystems) in pharmacy has surged. This is in part due to the advantages these systems may provide over existing systems.

Nanobots:

Nanobots are theoretical microscopic devices assembled from nanoscale parts. These parts could range in size from 1-100 nm (1 nm = 10^{-9} meter), and might be fitted together to make a working machine measuring perhaps 0.5-3 microns (1micron = 10^{-6} meter) in diameter. Three microns is about the maximum size for blood borne medical nanobots, due to the capillary passage requirement. When fully realized from the hypothetical stage, they would work at the atomic, molecular and cellular level to perform tasks in both the medical and industrial fields.

Nanomedicine's nanobots are so tiny that they can easily traverse the human body. Scientists report the exterior of a nanorobot will likely be constructed of carbon atoms in a diamondoid structure because of its inert properties and strength. Supersmooth surfaces will lessen the likelihood of triggering the body's immune system, allowing the nanobots to go about their business unimpeded. Glucose or natural body sugars and oxygen might be a source for propulsion and the nanorobot will have other biochemical or molecular parts depending on its task. Nanomachines are largely in the research and development phase, but some primitive molecular machines had been tested. The first useful applications of nanomachines, if such are ever built, might be in medical technology, where they might be used to identify cancer cells and destroy them. Another potential application is the detection of toxic chemicals, and the measurement of their concentrations, in the environment.

Properties of Medical Nanobots

- Nanobots will typically be .5 to 3 microns large with 1-100 nm parts. Three microns is the upper limit of any nanorobot because nanobots of larger size will block capillary flow.
- The nanorobot's structure will have two spaces that will consist of an interior and exterior. The exterior of the nanorobot will be subjected to the various chemical liquids in our bodies but the interior of the nanorobot will be a closed, vacuum environment into which liquids from the outside cannot normally enter unless it is needed for chemical analysis.
- A nanorobot will prevent itself, from being attacked by the immune system by having a passive, diamond exterior.
- When the nanobots are finished with their jobs, they will be disposed from the body to prevent them from breaking down and malfunctioning.
- Replication is a crucial basic capability for molecular manufacturing.
- When the task of the nanorobots is completed, they can be retrieved by allowing them to effuse themselves by active scavenger systems.

Communication with the Machines as they do their work

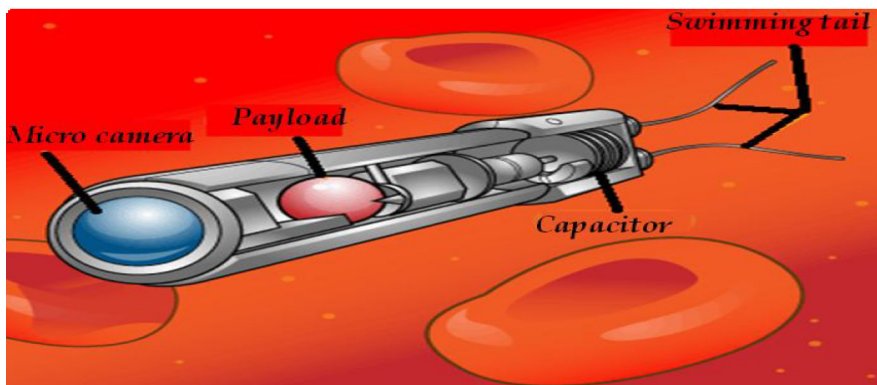
There are many different ways to do this. One of the simplest ways to send broadcast-type messages into the body, to be received by *in vivo* nanobots, is acoustic messaging. A device similar to an ultrasound probe would encode messages on acoustic carrier waves at frequencies between 1-10 MHz. Thus the supervising physician can easily send new commands or parameters to nanobots already at work inside the body. Each nanorobot has its own power supply, computer, and sensorium, thus can receive the physician's messages via acoustic sensors, then compute and implement the appropriate response. The other half of the process is getting messages back out of the body, from the working nanodevices out to the physician. This can also be done acoustically. However, onboard power requirements for micron-scale acoustic wave generators in water dictate a maximum practical transmission range of at most a few hundred microns for each individual nanorobot. Therefore, it is convenient to establish an internal communications network that can collect local messages and pass them along to a central location, which the physician can then monitor, using sensitive ultrasound detectors to receive the messages.

Components of Medical Nanobot

It is impossible to say exactly what a generic nanorobot would look like. Nanobots intended to travel through the bloodstream to their target will probably be 500-3000 nanometres (1 nanometre = 10^{-9} meter) in characteristic dimension. Non-bloodborne tissue-traversing nanobots might be as large as 50-100 microns, and alimentary or bronchial-travelling nanobots may be even larger still. Each species of medical nanorobot will be designed to accomplish a specific task, and many shapes and sizes are possible. The main components of medical nanobot are:

□ **Skeleton:** Carbon will likely be the principal element comprising the bulk of a medical nanorobot, probably in the form of diamond. Many other light elements such as hydrogen, sulphur, oxygen, nitrogen, fluorine, silicon, etc. will be used for special purposes in nanoscale gears and other components.

□ **Micro camera:** Nanorobots might include a miniature television camera. An operator at a console will be able to steer the device while watching a live video feed, navigating it through the body manually.



□ **Payload:** A nanorobot with mounted electrodes could form a battery using the electrolytes found in blood. Another option is to create chemical reactions with blood to burn it for energy.

□ **Capacitor:** A capacitor is a little like a

battery. Capacitors are used to generate magnetic fields that would pull conductive fluids through one end of an electromagnetic pump and shoot it out the back end.

□ **Swimming tail:** A nanobot will need a means of propulsion to get around the body. Because it may have to travel against the flow of blood, the propulsion system has to be relatively strong for its size.

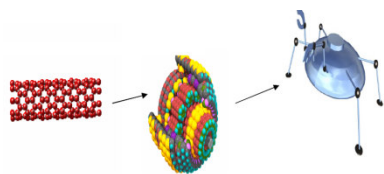
Approaches for Construction of Nanobots

There are two main approaches to building at the nanometre scale: positional assembly and self-assembly.

□ **Positional Assembly:** In positional assembly, investigators employ some devices such as the arm of a miniature robot or a microscopic set to pick up molecules one by one and assemble them manually.

□ **Self Assembly:** It takes advantage of the natural tendency of certain molecules to seek one another out. With self-assembling components, all that investigators have to do is put billions of them into a beaker and let their natural affinities join them automatically into the desired configurations. Making complex nanorobotic systems requires manufacturing techniques that can build a molecular structure via computational models of diamond mechanosynthesis (DMS).

Medical Nanorobotic Applications:



Applications of nanobots are expected to provide remarkable possibilities. Such drug-delivery nanobots have been termed “pharmacytes”. Nanobots could be used to process specific chemical reactions in the human body as ancillary devices for injured organs. Nanobots might be used to seek and break kidney stones. Significant applications of nanobots are Targeted Drug Delivery, cancer therapy, as surgical tools etc.

Conclusion:

In this manner, Nanobots have become the boon to the medical regions and diagnosis. They will provide personalised treatment with high efficacy and no side effects that are not available these days. Although the research into the nanobots is in the preliminary stage, the promise of such technology is endless.

CAPTCHA

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What is CAPTCHA?

CAPTCHA stands for “completely automated public truing test to tell computers and humans apart” and is a way for you to try and ensure that the visitor submitting a form on your website is actually a person.

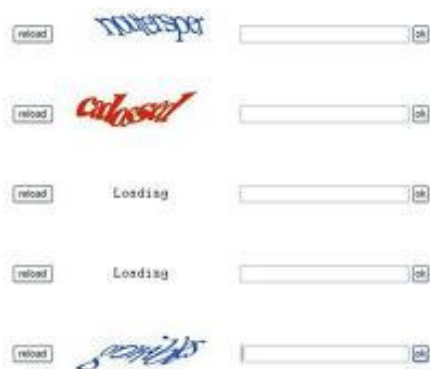
Why use CAPTCHA?

The most common use of CAPTCHA on the web today is to try and prevent the automatic submission of forms by programs which is designed to submit a form repeatedly, which is called a bot, usually for the purpose of spam. By adding a CAPTCHA to your form, you can cut down on the amount of spam you receive via a contact form or can prevent bots from signing up for accounts on your website.

CAPTCHAs were a solution in easily identifying whether an entity was a real, living person or some kind of bot or not. However, CAPTCHAs get much more difficult to solve over the years, almost requiring some kind of computer analysis to complete. The security protocol usually comes equipped with an audio option, but not only do those take a while to actually listen to, but they're often actually quite difficult to decipher.

Depending on your security needs, different kinds of CAPTCHA may be preferable

Pre-built CAPTCHA:



If there is a reason why someone would want to create multiple accounts on your page or frequently access some of your restricted information, you will want CAPTCHA which is harder to defeat.

There are a number of pre-built CAPTCHA suites designed for just such circumstances, and many have a multitude of designs so that you can find one that fits with your site's overall motif.

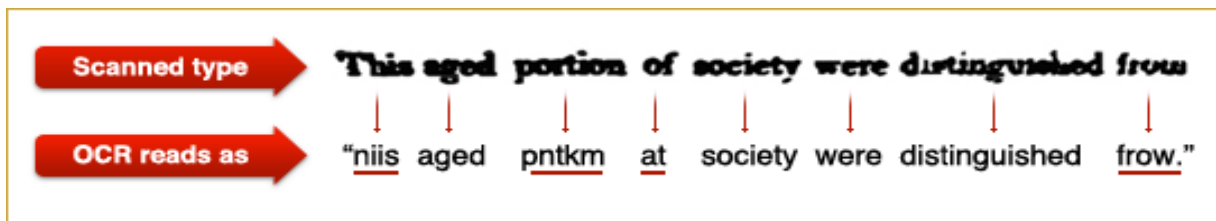
Before investing in a pre-built CAPTCHA, you should conduct a web search to confirm that it cannot yet be reliably bypassed.

Re-CAPTCHA



To archive human knowledge and to make information more accessible to the world, multiple projects are currently digitizing physical books that were written before the computer age. The book pages are being photographically scanned, and then transformed into text using "Optical Character Recognition" (OCR).

The transformation into text is useful because scanning a book produces images, which are difficult to store on small devices, expensive to download, and cannot be searched. The problem is that OCR is not perfect.



All the words that appear as part of a Re-CAPTCHA site protection system have already defeated the current generation of text recognition software. However, just to be sure, Project Gutenberg adds additional bending to the words to make them harder for computers to recognize.

Advantages:

- Distinguishes between a human and a machine
- Makes online polls more legitimate(justified)
- Reduces spam and viruses
- Makes online shopping safer
- Diminishes abuse of free email account services

Disadvantages:

- Sometimes very difficult to read
- Are not compatible with users with disabilities
- Time-consuming to decipher
- Technical difficulties with certain internet browser
- May greatly enhance Artificial Intelligence

Wind Turbine at our Home

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When used for charging batteries. A **wind turbine** is a device that converts kinetic energy from the wind, also called wind energy, into mechanical energy; a process known as wind power. If the mechanical energy is used to produce electricity, the device may be called a wind turbine or **wind power plant**. If the mechanical energy is used to drive machinery, such as for grinding grain or pumping water, the device is called a windmill or wind pump. Similarly, it may be referred to as a **wind charger**.



Theoretical power captured by a wind turbine

Total wind power could be captured only if the wind velocity is reduced to zero. In a realistic wind turbine this is impossible, as the captured air must also leave the turbine. A relation between the input and output wind velocity must be considered. Using the concept of stream tube, the maximal achievable extraction of wind power by a wind turbine is 59% of the total theoretical wind power¹ (Betz' law).

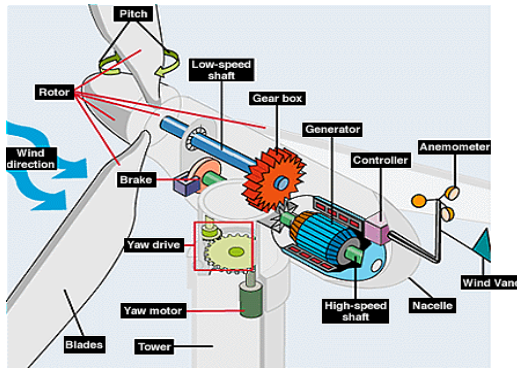
Wind turbines can rotate about either a horizontal or a vertical axis, the former being both older and more common

Wind turbines convert wind energy directly into electrical energy. Individual wind turbines can be installed for the domestic purpose, while for the commercial purposes a number of them can be installed in what is called wind farm or wind power plant.

- Wind energy is one of the most popular types of renewable energy being explored. It has huge potential to fulfill our future power requirements. A wind turbine is the device that converts wind energy directly to the electrical energy. When a large number of wind turbines are installed in one area it is called as wind farm, which can also be considered a wind power plant. Learn a little bit more about how wind turbines work in this article.

- Parts of Wind Turbine and its Working

- 1) **Fan blades:** The wind turbines comprises of the large fan blades which are connected to the hub.
- 2) **Shaft:** The hub is mounted on the shaft. When the atmospheric wind blows over the fan blades they start rotating, due to this the shaft also starts rotating. If the wind blows very fast the brakes are applied to control the speed of rotation of fan blades and the shaft.
- 3) **Transmission gearbox:** The speed of rotation of the shaft is very slow and it is not sufficient to produce the electricity. To increase the output speed the shaft is connected to the gear box.



4) **Output from the gearbox:** The input is given to large gear of the gearbox rotating at slow speed and output is obtained from the small gear hence the speed of the output shaft increases.

5) **Electricity from the generator:** The high speed output shaft from the gearbox is connected to the generator and it rotates inside the generator. It is here that the electricity is produced.

Principle:

The Windmill extracts energy from moving air by slowing down the wind, and transferring this harvested energy into a spinning shaft, which usually turns an alternator or generator to produce electricity. The power available in the wind that can be harvested depends on two factors i.e. wind speed and the area swept by the propeller blades.

Power available in wind (in Watts) is as follows:

$P = \frac{1}{2} \times J \times A \times V^3$, where J =air density= 1.23 kgm^3 at sea level, A = swept area in square meters
 $A = \pi \times r^2$ where r is the length of the propeller blade and V =wind velocity in meters per second (m/s)

If we work out the calculations for a 5-feet diameter windmill in a 10 mph wind:
 5 feet = 1.524 m. Therefore Swept Area $A = \pi \times r^2 = 3.141 \times (1.524 / 2)^2 = 1.8241 \text{ m}^2$
 Wind Speed $V=10$ miles per hr (mph)= 4.47 m/s . So Power available (Watts)
 $= \frac{1}{2} \times 1.23 \times 1.8241 \times 4.47043 = 100.22 \text{ Watts}$

As evident from the above calculation, there is very little power available in low winds. Firstly, as seen from the above formula, when the wind speed doubles, the power available increases 8 times. Suppose the Wind Speed is increased (doubled) for this 5-foot rotor from 10 mph to 20 mph(4.47 to 8.94 m/s),

The Power available (Watts) = $\frac{1}{2} \times 1.23 \times 1.8241 \times 8.94083 = 802 \text{ Watts}$

Thus, the only way to increase the available power in low winds is by sweeping a larger area with the blades. The Power available increases by a factor of 4 when the diameter of the blades is doubled. Hence if we use a 10-foot (3.048 m) diameter rotor for a 7.30 m^2 swept area in a 10 mph wind,

Power available $P = \frac{1}{2} \times 1.23 \times 7.30 \times 4.47043 = 401 \text{ Watts}$

But, in a 20 mph wind condition, $P = \frac{1}{2} \times 1.23 \times 7.30 \times 8.94083 = 3209 \text{ Watts}$

However, there's no way to harvest ALL of this available energy and turn it into electricity. As per Betz Law, 59.26% is the absolute maximum limit that can be extracted from the available power.

Conclusion:

If we install the individual wind turbine for our domestic use, the generated electricity can be used directly for our home for lighting and appliances. Electricity can also be stored in the battery and it can be used whenever required. The individual wind turbines can also be installed

at the remote places to fulfill the power requirements of the local areas where there is no other source of electricity.

For the commercial purposes, large numbers of wind turbines are installed in the wind farm or wind power plant. At wind farms, power generated from all the individual wind turbines is collected and the wind farm can be connected to the national grid.

Municipal Solid Waste To Energy By Using Plasma Gasification (Zero Waste Philosophy)

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Introduction:

Energy is one of the most essentials of human life. The energy needs of the world are increasing day by day. We have been very much dependent on fossil fuels but, apart from doing harm to the nature, the fossil fuels are fast depleting .This perspective presents an overview of waste-to-energy (WTE) from municipal solid waste by using Plasma Gasification, outlining the demand for municipal solid waste (MSW), the development of waste-to-energy, plasma gasification, treatment of wastes in plasma Find the best way to use **waste as a clean, reliable source of energy**. Eliminate the "waste problem" by **converting 100% of the waste** into a usable product. Make significant **reductions on the world's dependence on fossil fuels**.

The recycling of all materials back into nature or the marketplace in a manner that protects human health and the environment is called zero philosophy. In our opinion, the waste "problem" is the solution to our energy needs. We like to think of waste as an asset rather than a liability. Current technologies using plasma gasification and pyrolysis processes can convert almost any waste material into usable products such as electricity, ethanol, and vitrified glass.

Conversion of Waste to Energy:

Waste can be gasified to produce synthesis gas (syngas), which can be used to produce electricity. Gasification technology is well proven. There are more than 100 plasma gasification plants around the world and a similar number of gasification plants.

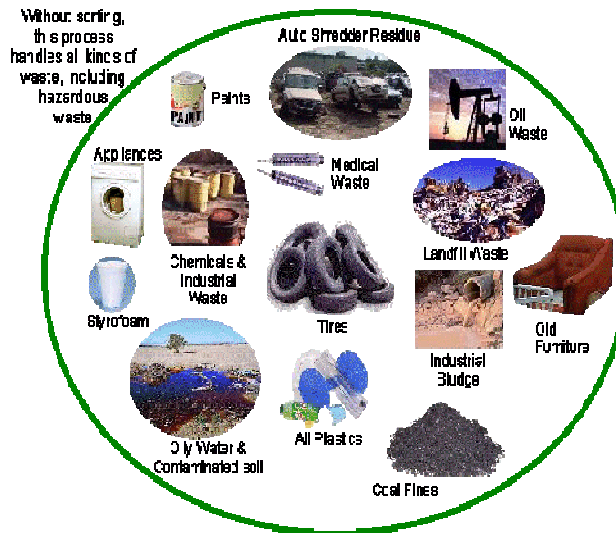
Industrial non-hazardous waste added another 7.6 billion tons. For a plant processing 126 tons of waste per hour, more than 135 megawatts per hour of "green" power will be produced. After powering its own needs this plant would export 1 megawatt for each ton of waste processed process for transforming Municipal Solid Waste (MSW) and other waste

materials into energy and useable by-products. The process can be broken down into four sub-systems.

- Material handling
- Thermal transformation or plasma gasification
- Gas clean up
- Steam and energy production

- **Material Handling:**

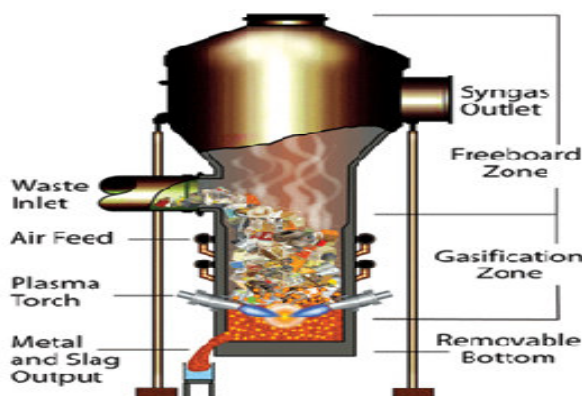
The incoming waste is weighed in and then deposited on the tipping floor from any of the trucks currently in use that pick-up and or transfer MSW. No tedious sorting or handling is needed. The only separation that is required will be large oversized pieces that won't fit into the shredder, heavy metal items like engines that may slow down the shredder or items that need special pre-processing, such as refrigerators, freezers and AC units that need the Freon removed.



Plasma Gasification:

Plasma gasification is the gasification of matter in an oxygen-starved environment to decompose waste material into its basic molecular structure. Plasma gasification does not combust the waste as incinerators do. It converts the organic waste into a fuel gas that still

contains all the chemical and heat energy from the waste. It converts the inorganic waste into an inert vitrified glass.



The high temperatures from the plasma torches liquefy all inorganic materials such as metals, soil, glass, silica, etc. All matter, other than the metals, becomes “vitrified or molten glass”. The vitrified glass has many commercial applications including road base, floor tiles, roof tiles, insulation, land scraping blocks, etc.

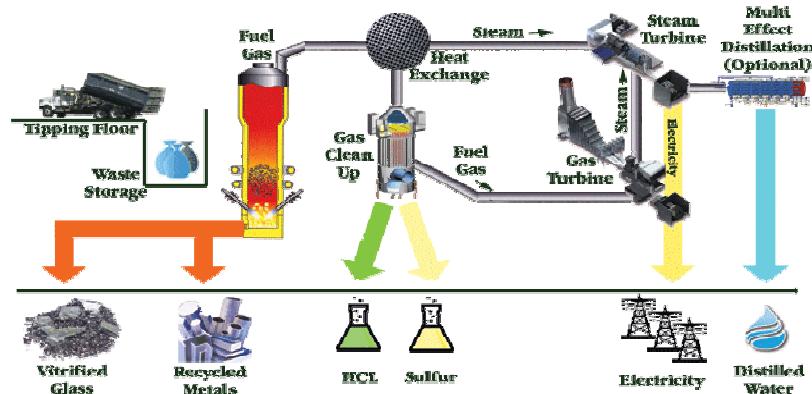
GAS CLEANUP:

After the fuel gas has left the heat exchanger, approximately 85% of the particulates are removed in a cyclone. A smaller percentage of the metals are also removed with the particulate. The

recovered particulate and metals are then injected into the molten glass. The components of the glass are locked into the glass matrix and cannot leach out. The vitrified glass material passes EPA leach ability tests.

Steam and Power Generation:

High-pressure steam from the primary heat exchanger goes to a steam turbine where it is converted to electricity. The electricity generated with this steam source provides most of the power needed for internal power requirements. The system is capable of generating all its own internal requirements.



Advantages:

a) Local advantages:

- Reduces costs and risks associated with landfills.
- Reduces petroleum dependence

b) Environmental advantages:

- **Elimination of landfills:** This process does not generate residual waste, thereby eliminating the need for new landfills
- **Ground water:** The risk of contaminated ground water is eliminated. .
- **Recovered energy:** The energy produced by the process (electricity or ethanol) is recovered from discarded materials.

Conclusion:

The time is becoming ripe for waste gasification. The world is facing profound problems in the search for new sources of energy, in addition to facing ongoing environmental degradation.

Plasma gasification of waste can be part of the solution to both problems. Using toxic waste materials, as feed stocks for producing renewable fuels, transforms liabilities into assets.

Energy production from syngas can be done profitably today by producing electricity, and it is hoped that ethanol will soon be economical. Hydrogen and synthetic natural gas are also in the wings, waiting for the right time to emerge. It is entirely possible that a decade from now, society could be producing significant quantities of renewable fuels by using landfill waste, and in doing so, clean up the environment at the same time.

Process Intensification

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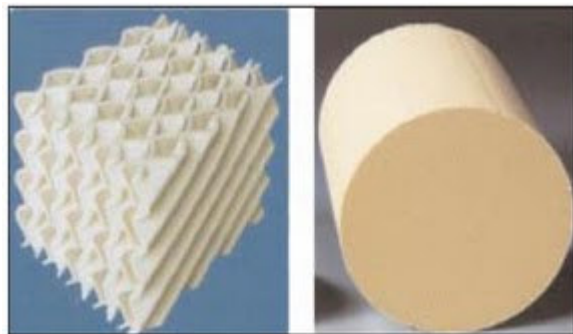
Process Intensification (PI) is a revolutionary approach to process and plant design, development and implementation. It presents significant scientific challenges to chemists, biologists and chemical engineers while developing innovative systems and practices which can offer drastic reduction in chemical and energy consumptions, improvements in process safety, decreased equipment volume and waste formation and increased conversions and selectivity towards desired product(s). In addition they can offer relatively cheaper and sustainable process option.

Here one must note that development of a new chemical route or a change in composition of a catalyst, no matter how dramatic the improvements they bring to existing technology, do not qualify as process intensification.

Process Intensification can be broadly divided into two areas:

1. Process Intensifying Equipment
2. Process Intensifying Methods (Unit Operations)

Process Intensifying Equipment

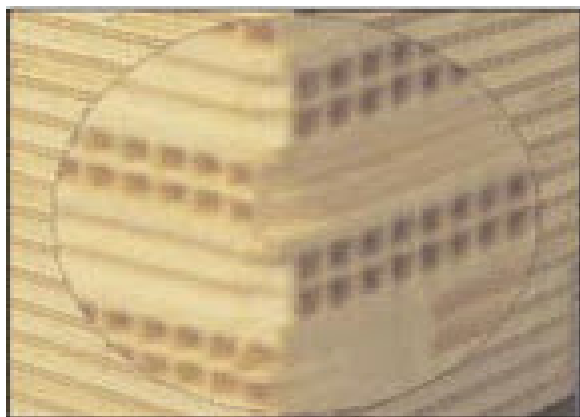


Monolithic Catalytic Reactor-

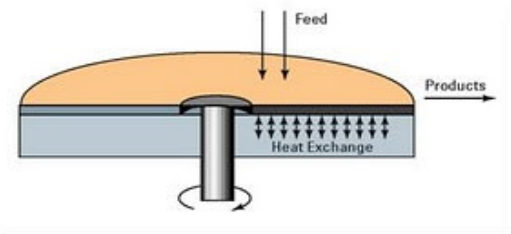
Monolithic substrate used today for catalytic applications are metallic or non metallic bodies providing a multitude of straight narrow channels of defined uniform cross sectional shapes. To ensure sufficient porosity and enhance the catalytically active surface, the inner walls of the monolith channels usually are covered with a thin layer of wash coat, which acts as the support for the catalytically active species.

Micro-Reactors

Micro-reactors are chemical reactors of extremely small dimensions that usually have a sandwich-like structure consisting of a number of slices (layers) with micro-machined channels (10-100 micron in dia.). The layers perform various functions, from mixing to catalytic reaction, heat exchange,



or separation. Hence highly exothermic reactions can be easily carried out. This is very useful for toxic or explosive reactants / products.

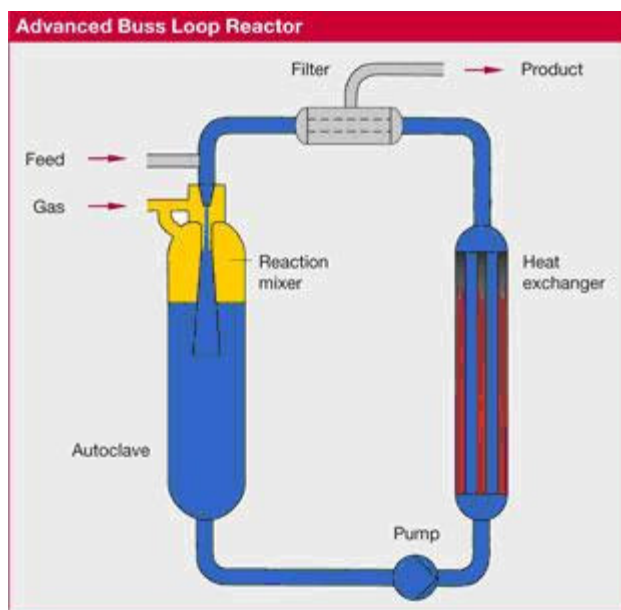


on the surface of a disk spinning at up to approximately 1,000 rpm. At very short residence times (typically 0.1 s), heat is efficiently removed from the reacting liquid at heat-transfer rates reaching 10,000 W/m²K. SDRs currently are being commercialized.



Static Mixer Reactors: Static Mixers are not only used for physical mixing of Gas-Gas, Liquid-Liquid and Gas-Liquid applications but used in reactions also. Use of structured packing reduces the pressure drop considerably. When static mixers are placed in heat exchanger tubes, better mixing as well as heat transfer can be achieved.

A Norwegian company has intensified manufacturing of Hydrogen Peroxide by using static mixers extensively to combine oxidation and extraction.



Buss Loop Reactor: This type of reactor is suitable for gas-liquid systems and can be used for Amination, Alkylation, Carbonylation, Chlorination, Ethoxylation, Hydrogenation, Nitrilation, Oxidation, Phosgenation etc. The Buss loop reactor has been successfully used for hydrogenation, amination and sulphonation.

Process Intensifying Methods (Unit Operations)

- Several Process Intensifying methods listed as follows :

- a) Multifunctional Reactors
- b) Hybrid Separators
- c) Alternative source of energy
- d) Other methods

a) **Multifunctional Reactors:** Examples of multi- functional reactors are:

- **Reverse Flow Reactor** :The reactor concept aims to achieve an indirect coupling of energy necessary for endothermic reactions and energy released by exothermic reactions, without mixing of the endothermic and exothermic reactants, in closed-loop reverse flow operation. Periodic gas flow reversal incorporates regenerative heat exchange inside the reactor. This reactor is used for SO₂ oxidation, total oxidation of hydrocarbons in off-gases, and NO_x reduction.
- **Reactive Distillation** : It is a distillation column filled with catalytically active packing. In the column, chemicals are converted on the catalyst while reaction products are continuously separated by fractionation (thus overcoming equilibrium limitations). The catalyst used for reactive distillation usually is incorporated into a fibreglass and wire-mesh supporting structure, which also provides liquid redistribution and disengagement of vapour.

b.) **Hybrid Separation**

- **Membrane Absorption and Stripping:** Here the membrane serves as a permeable barrier between the gas and liquid phases. By using hollow-fibre membrane modules, large mass-transfer areas can be created.
- **Membrane Distillation:** This offers operation independent of gas and liquid flow rates, without entrainment, flooding, channelling, or foaming. The technique is widely considered as an alternative to reverse osmosis and evaporation. Membrane distillation basically consists of bringing a volatile component of a liquid feed stream through a porous membrane as a vapour and condensing it on the other side into a permeate liquid. Temperature difference is the driving force of the process. Main advantages of membrane distillation are:
 - 1.) 100% rejection of ions, macro-molecules, colloids, cells, and other non-volatiles;
Lower operating pressure, hence lower risk and low equipment cost
 - 2.) less membrane fouling, due to larger pore size;
 - 3.) Lower operating temperatures enable processing of temperature-sensitive materials.
- **Adsorptive Distillation:** Here a selective adsorbent is added to a distillation mixture. This increases separation ability and may present an attractive option in the separation of

azeotropes or close-boiling components. Adsorptive distillation can be used, for the removal of trace impurities in the manufacturing of fine chemicals; it may allow switching some fine-chemical processes from batch wise to continuous operation.

c.) Alternative Forms and Source of Energy

- **Ultrasound:** Ultrasound is used as a source of energy for formation of micro- bubbles in the liquid medium of reaction. These cavities can be thought of as high energy micro-reactors. Their collapse creates micro-implosions with very high local energy release (temperature rises of up to 5,000 K and negative pressures of up to 10,000 atm are reported). This may have various effects on the reacting species, from homolytic bond breakage with free radicals formation, to fragmentation of polymer chains by the shockwave in the liquid surrounding the collapsing bubble. This is still at development stage.
- **Solar Energy:** A novel high-temperature reactor in which solar energy is absorbed by a cloud of reacting particles to supply heat directly to the reaction site has been studied. Experiments with two small-scale solar chemical reactors in which thermal reduction of MnO₂ took place also are reported. Other studies describe, the cyclo-addition reaction of a carbonyl compound to an olefin carried out in a solar furnace reactor and oxidation of 4-chlorophenol in a solar-powered fiber-optic cable reactor.
- **Microwave:** Microwave heating can make some organic syntheses proceed up to 1,240 times faster than by conventional techniques. Microwave heating also can enable energy-efficient in-situ desorption of hydrocarbons from zeolites used to remove volatile organic compounds.
- **Electric Field:** Electric fields can augment process rates and control droplet size for a range of processes, including painting, coating, and crop spraying. In these processes, the electrically charged droplets exhibit much better adhesion properties. In boiling heat transfer, electric fields have been successfully used to control nucleation rates. Electric fields also can enhance processes involving liquid/liquid mixtures, in particular liquid/liquid extraction where rate enhancements of 200-300% have been reported.
- **Plasma Technology:** Gliding Arc technology, that is, plasma generated by formation of gliding electric discharges. These discharges are produced between electrodes placed in fast gas flow, and offer a low-energy alternative for conventional high-energy-consumption high-temperature processes. Example include: methane transformation to acetylene and hydrogen, destruction of N₂O, reforming of heavy petroleum residues, CO₂ dissociation, activation of organic fibers, destruction of volatile organic compounds in air, natural gas conversion to synthesis gas, and SO₂ reduction to elemental sulphur.

d.) Other Methods:

- **Supercritical Fluid (SCF):** SCF is any substance at a temperature and pressure above its critical point. It can diffuse through solids like a gas, and dissolve materials like a liquid. In addition, close to the critical point, small changes in pressure or temperature result in

large changes in density, allowing many properties of a supercritical fluid to be "fine-tuned". Many of the physical and transport properties of a SCF are intermediate between those of a liquid and a gas. Diffusivity in an SCF, falls between that in a liquid and a gas; this suggests that reactions that are diffusion limited in the liquid phase could become faster in a SCF phase. Also Compounds that are largely insoluble in a fluid at ambient conditions can become soluble in the fluid at supercritical conditions. Conversely, some compounds that are soluble at ambient conditions can become less soluble at supercritical conditions. SCFs have been investigated for systems, including enzyme reactions, Diels-Alder reactions, organo-metallic reactions, heterogeneously catalyzed reactions, oxidations, and polymerizations.

- **Cryogenic Techniques:** Cryogenic techniques involving distillation or distillation combined with adsorption, today are used almost exclusively for production of industrial gases, may in the future prove attractive for some specific separations in manufacturing bulk or fine chemicals.
- **Dynamic Reactor Operations:** The intentional pulsing of flows or concentrations has led to a clear improvement of product yields or selectivities at lab scale. Yet, commercial-scale applications are scarce.

Advantages /benefits of Process Intensification:

- **Safety** - As per Cell for Industrial Safety and Risk Analysis (CISRA) the major cause of accident is STORAGE. When size of the process equipment is reduced , operating inventory will be reduced.
- **Health** - The fugitive emissions will be reduced due to smaller equipment size. This will improve the health of the society in general. Environment Better efficiency /yield lead to less rejection to environment hence less pollution.
- **Quality** - It is possible to get desired quality of products
- **Energy** - Due to higher energy efficiency, leads to enhanced production
- **Cost** - Less due to fewer raw materials, catalyst, labour, utility and space requirement.

Information Technology Tools towards Optimizing Energy Conservation and Environmental Protection Initiatives

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Abstract

Energy companies to stay ahead of the developments have to pay constant attention to building and maintaining their networks and are constantly looking for cost-saving possibilities. This paper attempts to highlight the importance of information technology applications towards optimizing energy conservation and environment protection initiatives. This paper also recommends some areas of effective training and development programs.

Introduction

At present, energy-saving technology is a feasible and an effective way to achieve energy and environmental sustainable development, although renewable energy may be final solution to environmental issues. Information and communications technology is helping for responding to these challenges. The right operational information and knowledge are necessary for making better decisions, and they are also indispensable for increasing production and reducing costs. Geographic information systems support electricity and gas companies business processes in following way:--

- integral management of assets and networks (grids)
- planning, design, realization and maintenance of networks
- planning and marketing
- tracking and tracing
- finding gas leaks
- implementation of the company-wide use of geographic information
- integration of GIS and ERP, CRM, SCADA and other IT systems
- restructuring processes and process support using geographical information
- implementation of mobile and Internet solutions

Objectives of Implementing it Applications

Industry application of GIS solutions offers efficiency and effectiveness for Telecom, Transport, Energy, Financial, Manufacturing or Government sector. GIS services and solutions offer rapid and efficient deployment; substantially lower total cost of ownership and higher levels of ROI.

It helps in achieving following **objectives**:--

- ** Plan better services and infrastructure through analysis of patterns and trend in spatial information.
- ** Analyze performance spatially and manage property assets data
- ** Identify risks for buildings, improve assessor practices, track stolen vehicles and target customers by locating others in the locality in the Insurance Sector.
- ** Provide Location Based Services (LBS) to consumers based on cell location, monitor network statistics e.g. coverage conditions, aid customer relations by speedy fault repair and relating customers quickly to affected network in the Telecom Sector.

** Provide access to large volumes of current and historic data e.g. through GIS- enabled document management systems, permit field-based data editing and recording of survey information to streamline the process and make the information more accurate and timely.



Possible Areas of Development

Possible areas and actions for the development of general knowledge programs should include:

** Developing market mechanisms to connect accessible and affordable capital with energy consumers to enhance the effectiveness of a provincial strategy.

** Ensuring inefficient, older appliances are taken out of the market, their materials recycled and any toxic components managed.

** Engaging community organizations, non-governmental organizations and public interests groups in culture change, communication, education and implementation of conservation.

** Establishing accessible and understandable means of benchmarking energy use, planning and implementing conservation projects, accessing resources and technologies.

** Ensuring publicly funded institutions establish and maintain management reporting systems which cover energy use, costs and savings potential,

** Facilitating energy auditing and benchmarking of existing buildings and providing access to resources to implement retrofits.

** Increasing conservation related training in colleges, universities and apprenticeship programs to cover all facets of energy management for industry and buildings. Incorporating Energy Guide for Homes ratings in real estate profiles.

** Producing audio-visual materials that illustrate existing solar installations, as well as future prospects for these technologies. Publishing information, in the form of study articles and comprehensive, well documented reports, on solar energy and its prospects.

** Produce and broadcast programs and documentary films for television. Using web-based systems to allow comparison of energy use with comparable buildings and estimation of potential savings.

Latest Developments in Energy Conservation and Environment Protection Initiatives:

***** American Association of State Colleges and Universities (AASCU) highlighting roles of institutions:***

AASCU devoted its July/August 2006 Public Purpose magazine to cover the issues related to sustainability at public higher education institutions. The issue highlighted role of various institutions implementing sustainability policies on its campuses, in its classrooms and bridging them to the business world.

***** Bedford College in Southern England providing training***

Bedford College in Southern England is a centre for excellence in green energy, providing training for small businesses in installing and maintaining solar panels, wind turbines and bio-mass technology.

***** Canadian Industry Program For Energy Conservation (CIPEC) developing comprehensive projects***

The Canadian Industry Program for Energy Conservation (CIPEC) with representation of 294 companies, and 24 sector task forces is active in developing comprehensive projects to improve conservation in their municipal operations. Non-governmental organizations are implementing community-wide programs for improving the conservation in existing and new buildings, and at developing integrated, fuel efficient transportation schemes.

Conclusions:

The Government of India is planning to deploy a Geographic Information System-based mapping of energy-intensive industries and large buildings. The mapping tool is proposed to be interfaced with Google Earth to offer a spatial distribution of the energy-intensive industrial consumers and ensure geographically-referenced data generation for beefing up the energy conservation efforts. GIS and GPS have a significant role in supporting the development and expansion of the renewable energy sector involving biomass, geothermal, solar, wind and hydro/wave types. In GIS environment, geospatial data are better maintained in a standard format, revision and updating, search, analysis and representation of information becomes easier. The information from satellite data interpretation and other descriptive data can be merged into GIS, thus generating a unique database for hydropower project.

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Does the Universe Made of Strings??

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An Introduction to String Theory

We live in a wonderfully complex universe, and we are curious about it by nature. Sometimes we wonder that how and why we are here and where the world has come from. How the universe has been created. There are many theories and assumptions about the origin of universe. One of the latest theory is the “string theory”. String theory is our most recent attempt to answer many of the questions about the universe. Before going deep into the topic let’s have a glance on the universe.

The world is made up of matter. Forms of matter exert force on each other and they move under the influence of each other. Matter comes in millions of different forms. All this diversity comes from only a few hundred atoms. Each atom has mass and size. Atoms in turn are divided into three basic components. They are electrons, protons and neutrons. This is accepted for many decades but the scientists came to know that these fundamental particles are further divided into many other smaller particles. Protons and Neutrons are divided as “Quarks”. They are called with strange names. They are up, down, strange, charm, bottom, and top. They have different colours i.e., red, green, blue.

The electrons are divided as 6 LEPTONS they are electron(e), electron- neutrino(ν_e), muon (μ), muon- neutrino(ν_μ), tau(τ), tau- neutrino(ν_τ). The idea of the string theory is that this diversity of quarks and leptons comes from one string. The other major thing is the Force. There are four fundamental forces in the universe: gravity, electromagnetism, and the weak and strong nuclear forces. Each of these is produced by fundamental particles that act as carriers of the force. The most familiar of these is the “Photon”, a particle of light, which is the mediator of electromagnetic forces. (This means that, for instance, a magnet attracts a nail because both objects exchange photons.) The “graviton” is the particle associated with gravity. The strong force is carried by eight particles known as gluons. Finally, the weak force is transmitted by three particles, the W^+ , the W^- , and the Z . String theory combines all the matter and forces.



Fig 1: strings

Strings can vibrate in different ways. In ordinary circumstances, we can understand the world by applying different forces according to the problem at hand. Going back in time, matter was crunched up in a very energetic state within a short distance. Under these conditions all forces were equally important. All Hence String Theory becomes necessary for us to understand what happened at 10^{-42} s after the Big Bang.

The basic definition of string theory is that, even thing in the universe is linked with other things through strings. According to many scientists all the planets in the universe are connected through strings. Some of the information is transferred through strings also. Think of a guitar string that has been tuned by stretching the string under tension across the guitar. Depending on how the string is plucked and how much tension is in the string, different musical notes will be created by the string. These musical notes could be said to be **excitation modes** of that guitar string under tension. In a similar manner, in string theory, the elementary particles we observe in particle accelerators could be thought of as the "musical notes" or excitation modes of elementary strings.

In string theory, as in guitar playing, the string must be stretched under tension in order to become excited. However, the strings in string theory are floating in space time, they aren't tied down to a guitar. Nonetheless, they have tension. The string tension in string theory is denoted by the quantity $1/(2\pi\alpha')$, where α' is pronounced "alpha prime" and is equal to the square of the string length scale.

If string theory is to be a theory of quantum gravity, then the average size of a string should be somewhere near the length scale of quantum gravity, called the **Planck length**, which is about 10^{-33} centimetres, or about a millionth of a billionth of a billionth of a billionth of a centimetre. Unfortunately, this means that strings are way too small to see by current or expected particle physics technology.

String theories are classified according to whether or not the strings are required to be closed loops, and whether or not the particle spectrum includes fermions. In order to include fermions in string theory, there must be a special kind of symmetry called **super symmetry**, which means for every boson (particle that transmits a force) there is a corresponding fermion (particle that makes up matter). So super symmetry relates the particles that transmit forces to the particles that make up matter.

Super symmetric partners to currently known particles have not been observed in particle experiments, but theorists believe this is because super symmetric particles are too massive to be detected at current accelerators. Particle accelerators could be on the verge of finding evidence for high energy super symmetry in the next decade. Evidence for super symmetry at high energy would be compelling evidence that string theory was a good mathematical model for Nature at the smallest distance scales.

In the last few decades, string theory has emerged as the most promising candidate for a microscopic theory of gravity. And it is infinitely more ambitious than that: it attempts to provide a complete, unified, and consistent description of the fundamental structure of our universe. (For this reason it is sometimes, quite arrogantly, called a 'Theory of Everything').

The essential idea behind string theory is this: all of the different 'fundamental' particles of the Standard Model are really just different manifestations of one basic object: a string. How can that be? Well, we would ordinarily picture an electron, for instance, as a point with no internal structure. A point cannot do anything but move. But, according to string theory under an extremely powerful 'microscope' we would realize that the electron is not really a point, but a

tiny loop of string. A string can do something aside from moving--- it can oscillate in different ways. If it oscillates a certain way, then from a distance, unable to tell it is really a string, we see an electron. But if it oscillates some other way, well, then we call it a photon, or a quark, or a ... you get the idea. So according to string theory, the entire world is made of strings!

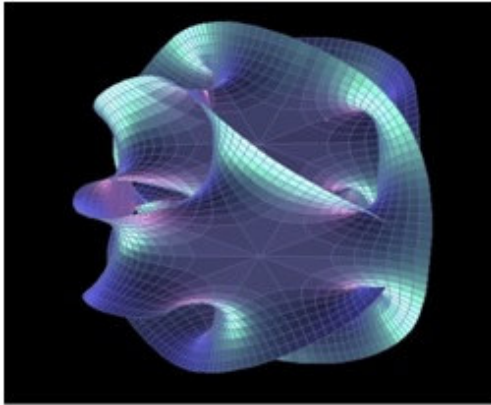


Fig 2: Higher Dimensions from String Theory

One of the most important property and the latest development in string theory is the mirror symmetry. Although a circle of radius R is obviously drastically different from one of radius $1/R$, the physics they yield is identical. This led physicists to ask the next logical question: are there geometrical forms in the universe that yield the same physics but differ in shape instead of size? Based on symmetry principles, some physicists argued that two completely

distinct Calabi-Yau shapes chosen as the curled-up dimensions might give rise to the same physical properties. Later, the technique of orbifolding to produce the Calabi-Yaus was introduced. Orbifolding is a procedure by which points on a Calabi-Yau are systematically connected so that a new Calabi-Yau with the same number of holes as the original is produced. After research into the procedure, it was found that orbifolding in a particular manner yielded an interesting result: the number of odd-dimensional holes in the revised shape (recall that Calabi-Yau holes can have many dimensions) equaled the number of even-dimensional holes in the original and vice versa. The result was that, even though the shape of the Calabi-Yau had been fundamentally changed, it would yield the same number of particle families - one step toward the idea of separate Calabi-Yaus generating identical physics. When the two Calabi-Yaus' physical implications were analyzed, it was found that they produced not only the same number of families, but also the same physical properties. Two Calabi-Yaus differing in the way described above but yielding the same physics are called mirror manifolds, and this property of string theory is called mirror symmetry, although the holes are not reflected in the ordinary manner. . Mirror symmetry allows the difficult calculation to be rephrased in terms of the Calabi-Yau's mirror partner.

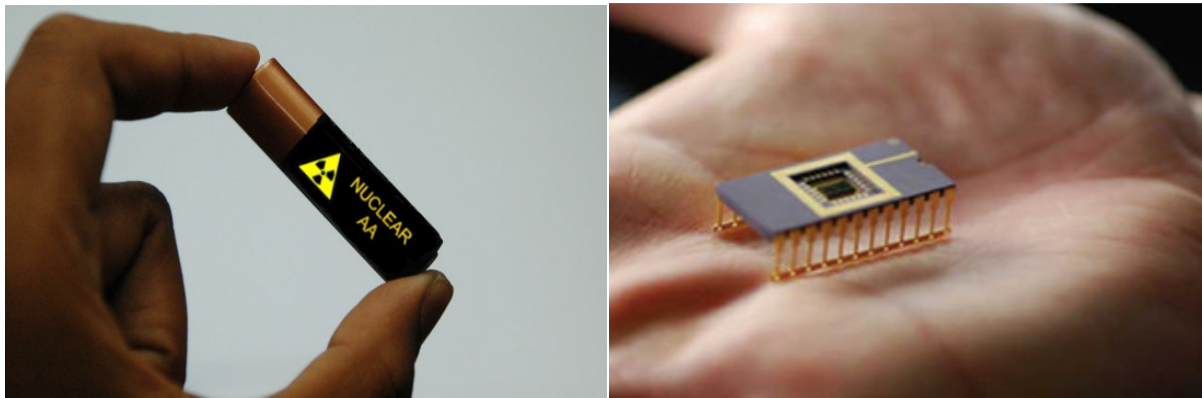
Nuclear Battery

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Introduction

Nuclear batteries run off of the continuous radioactive decay of certain elements. These incredibly long-lasting batteries are still in the theoretical and developmental stage of existence, but they promise to provide clean, safe, almost endless energy. They have been designed for personal use as well as for space research, aeronautics, and medical treatments. Nuclear batteries use the incredible amount of energy released naturally by tiny bits of radioactive material without any fission or fusion taking place inside the battery. These devices use thin radioactive films that pack in energy at densities thousands of times greater than those of lithium-ion batteries. Because of the high energy density nuclear batteries are extremely small in size. Considering the small size and shape of the battery the scientists who developed the battery fancifully call it as “DAINTIEST DYNAMO” the word ‘dainty’ means ‘pretty’.



Working:

As the Ni-63 decays it emits beta particles, which are high-energy electrons that spontaneously fly out of the radioisotopes unstable nucleus. The emitted beta particles ionized the diode atoms, exciting unpaired electrons and holes streamed at the vicinity of the p-n interface. These separated electrons and holes streamed away from the junction, producing current.

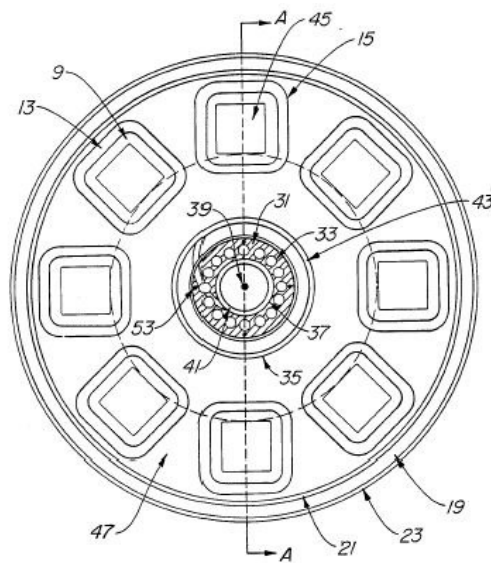
It has been found that the beta particles with energies below 250Kev do not cause substantial damage in Si. The maximum and average energies(66.9KeV and 17.4KeV respectively) of the beta particles emitted by Ni-63 are well below the threshold energy, where damage is observing silicon, the long half-life period(100 years) makes Ni-63 very attractive for remote long life applications such as power of spacecraft instrumentation. In the addition, the emitted beta particles of Ni-63 travel a maximum of 21 micrometer in silicon before disintegrating; if the

particles were more energetic they would travel longer distances, this escaping. These entire things make Ni-63 ideally suitable in nuclear batteries.

First the beta particles, which are high-energy electrons, fly spontaneously from the radioactive source. These electrons get collected on the copper sheet. Copper sheet becomes negatively charged. Thus an electrostatic force of attraction is established between the silicon cantilever and radioactive source. Due to this force the cantilever bends down.

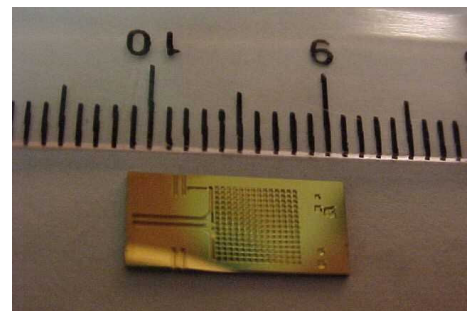
The piece of piezoelectric material bonded to the top of the silicon cantilever bends along with it. The mechanical stress of the bend unbalances the charge distribution inside the piezoelectric crystal structure, producing a voltage in electrodes attached to the top and bottom of the crystal.

After period – whose length depends on the shape and material of the cantilever and the initial size of the gap the cantilever come close enough to the source of discharge the accumulated electrons by direct contact. The discharge can also take place through tunneling or gas breakdown. At that moment, electrons flow back to the source, and the electrostatic attractive force vanishes. The cantilever then springs back and oscillates like a diving board after a diver jumps, and the recurring mechanical deformation of the piezoelectric plate produces a series of electric pulses.



How a Nuclear Micro Generator Converts Radioactivity into Electricity

- Beta particles (high-energy electrons) fly spontaneously from the radioactive source and hit the copper sheet, where they accumulate.
- Electrostatic attraction between the copper sheet and the radioactive source bends the silicon cantilever and the piezoelectric plate on top of it.
- When the cantilever bends to the point where the copper



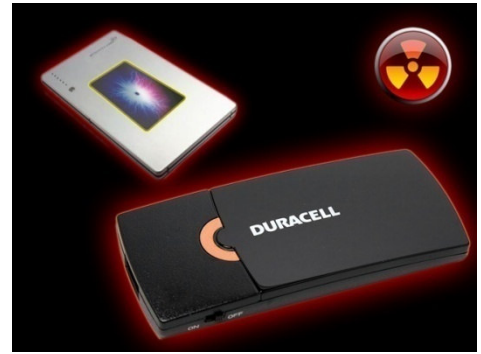
sheet touches the radioactive source, the electrons flow back to it, and the attractive force ceases

- The cantilever then oscillates, and the mechanical stress in the piezoelectric plate creates an imbalance in its charge distribution, resulting an electric current.

Why not Lithium-Ion Battery

The average consumer of throw-away batteries uses 30-50 batteries a year. In the U.S. alone, 2.9 billion batteries are thrown away each year. Alkaline batteries are the largest segment of the battery market, with extremely high levels of purchases. In fact, the average household buys as many as 90 alkaline batteries a year.

As advances in batteries become available, manufactures design well and more power hungry products to match – *at no additional manufacturing cost!* But the consumer and the environment ultimately pay the price.



- As by using these kind of batteries there will be a heavy damage to the environment
- By using these batteries there is heavy loss to the iron core, lithium, and many other metallic elements.
- Chance of getting rust.
- Sometimes damage to the equipment like blasting or blowing for example
 1. Using our mobile battery after some days it gets blown it means some damage to the battery.
- Will not live long time.
- If not properly cared for, batteries pose a danger to unsuspecting consumers. If left unused in a product for an extended period, batteries can leak and ruin expensive products.
- Consumers are certainly aware of and frustrated with these problems, but to date there has not been a practical alternative. Consequently consumers would rather not look at the details when there is no hope in sight for an alternative.



Advantages of Nuclear Battery

- The life span of a nuclear battery can be hundreds of years. However, if they are produced for domestic appliances, their life is likely to be restricted to around ten years. That means that you can keep your laptop turned on constantly for ten years without having headed for charge it up. Scientists have been testing the Xcell-N battery on laptops in the last couple of years with some success.
- These batteries will live for long time.
- There will be no damage of the equipment.
- These batteries can be used in the space shuttles which will supply 30 years power needed at a time.
- Eco friendly.
- Will not have any damages like leaking of electro chemical juice.
- A nuclear battery can able to make all the home appliances work at a time.
- It will bring a revolution in all the technical fields.
- These batteries can be used in Radioisotope thermoelectric generators (RTGs)
- These are used on deep space satellites, arctic bases and military installments.



Challenges in Developing and Deploying 3G Technologies

N.Saiganesh, T.P.Venkatesh, II B.Tech Information Technology,

Abstract:

Development of third Generation Cellular Wireless (3G) Technologies is well underway within Network Equipment Manufacturers. Most major wireless Service Providers are beginning technology trials, but production networks will not be rolled out until 2001 at the earliest. This paper introduces 3G Wireless technology, standards and protocols. The main components of a UMTS W-CDMA System are explained and a five stage testing strategy is defined. This testing strategy is specifically designed to help accelerate the development and deployment of 3G Radio Access Network (RAN) equipment. 3G systems will provide much greater levels of functionality and flexibility than any predecessors will. This of course means that such systems will be significantly more complex in design, and correspondingly more difficult to get right.

Introduction:

In their 3G umbrella standard known as IMT-2000, the International Tele communications Union (ITU) has endorsed five different modes of RF interface, and three major types of terrestrial infrastructure (known as the "Radio Access Network", or "RAN"). Multi-mode phones will be technically and economically feasible, hence enabling true global roaming. The three major types of RAN are based on 2nd generation systems. Terminology is still evolving, and varies somewhat between countries but they are generally referred to as UMTS W-CDMA and IS-2000 (previously cdma2000). UMTS W-CDMA is based on an evolution of the GSM (MAP) RAN, and is the most common system deployed globally, supported by the largest number of NEMs and SPs. The body known as 3G Partnership Project (3GPP) has been chartered by the ITU to develop the UMTS W-CDMA specifications. UMTS W-CDMA uses Asynchronous Transfer Mode (ATM) to connect the network components in the RAN, and ATM Adaptation. Layer Type 2 (AAL-2) to transport the voice and data. IS-2000 is based on an evolution of the ANSI-41 RAN used by CDMA. One systems, and is defined by the 3G Partnership Project 2 (3GPP2).

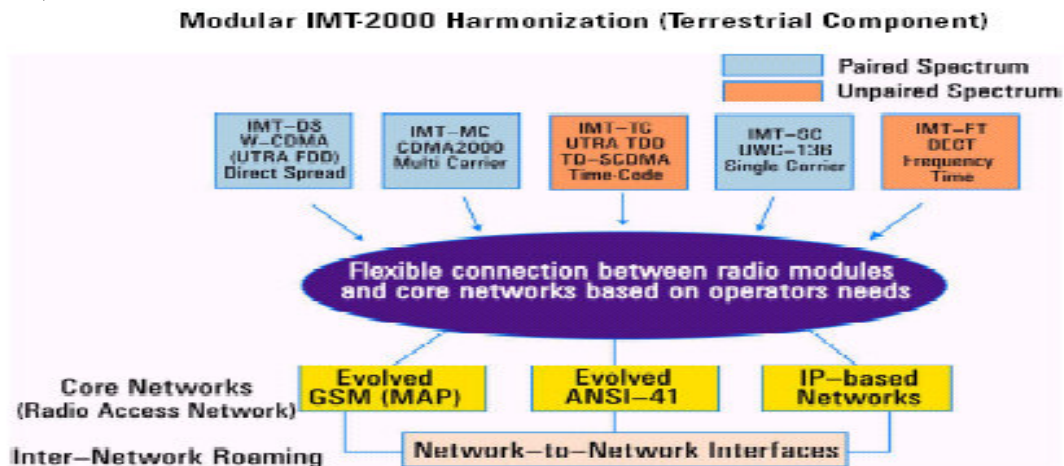


Figure 1: International Telecommunication Union's IMT-2000

UMTS W-CDMA Systems

Figure 2 shows a logical diagram of a UMTS W-CDMA system. In this, we can see the following main components:

- **User Equipment:** Sometimes called a Mobile Station. A more general name for handset. This could be one of many conceivable devices, e.g. a mobile cellular telephone, handheld Personal Digital Assistant (PDA), or a cellular modem connected to a PC.

Node B:

This is the name given by the 3GPP specifications, to the entity, which in real-life is usually called the Base Station Controller or Radio Base Station. This device provides the gateway between the RF interface to the handset, and RAN.

- **Radio Network Controller:** The RNC connects to and co-ordinates as many as 150 base stations. It is involved in making decisions and implementing Diversity Hand Over (DHO), which is a process where decisions are made on which base stations will be used to communicate to and from the user equipment.

Core Network

Interface: "Core Network" is the name given by 3GPP to the rest of the terrestrial core network infrastructure connected to the RAN through the IU interface. The gateway device is usually called a Mobile Switching Centre, or Mobile Multimedia Switch, and is the gateway into the various terrestrial core networks such as ATM, IP-Over-SDH, and the PSTN.

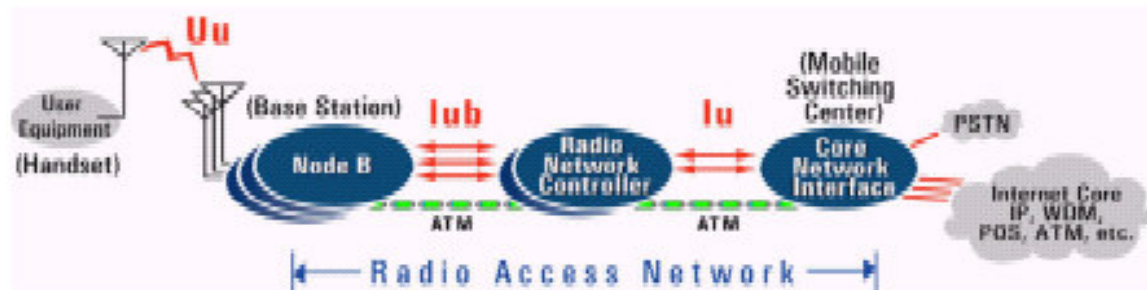


Figure 2: UMTS W-CDMA Logical Diagram

❖ 3GPP Protocols

The 3GPP specifications define a rich set of protocols for communication within the RAN, to and from the UE, and between other networks. These protocols sit above ATM Adaptation Layers 2 and 5 (AAL-2 and AAL-5). Together, they implement control-plane (for example, signaling required to establish a call) and user-plane functions (for example, voice or packet data). The IUB is the interface between the base station (Node B) and the Radio Network Controller (RNC). All user plane traffic on the IUB is transported in Frame Protocol (FP) frames. All FP frames are sent at regular intervals; with the interval, usually being 10ms. A single stream of FP frames on a single AAL-2 Channel Identifier (CID) constitutes a Radio Access Bearer (RAB). A RAB is the channel for communication of user plane traffic (e.g. voice or data).

between the RNC and UE. Services of differing bit rates are implemented by RABs with FP frames of differing lengths. Other protocol stacks running over AAL-5 and AAL-2 are used to implement the control plane functions. Q.AAL-2 is used to set up AAL-2 channels for RABs. RRC is used for communication between the UE and the RNC. NBAP is used for communication between the RNC and Node B. The Iu is the interface between the RNC and the Core Network Interface. Circuit switched user plane traffic (e.g. voice) is carried over Iu UP (Iu User Plane) frames, which in turn are carried over AAL-2. As for the Iub, Q.AAL-2 is used to set up these AAL-2 channels. Unlike the Iub, packet data on the Iu is encapsulated within UDP/IP packets, using GTP-u. Finally, RANAP is used for signaling between the RNC and other networks connected through the MSC.

Lubprotocol stack

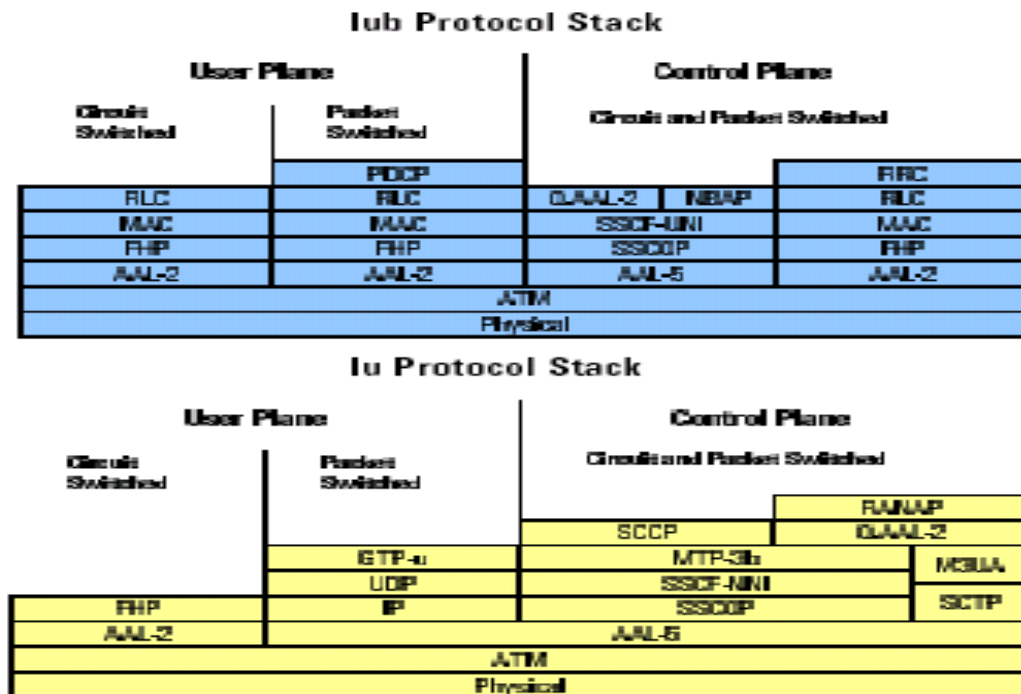


Figure 3: 3GPP Protocols on the Iu and Iub

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❖ Challenges Developing and Verifying UMTS W-CDMA Systems

Due to the complexity of UMTS W-CDMA systems, large hardware, software, integration, and QA teams are required to develop them. These developments are inevitably across more than one site, and often more than one country and continent. Development of 3G systems can be broken into the following major stages:

- Individual development of hardware, FPGA, and software modules
- Integration of hardware and software modules to form a component
- Debugging and verification of individual components
- Integration and verification of 3G systems made from these components

- Performance testing of individual components and the system as a whole.

Guaranteeing conformance and interoperability. Of course, in real-life, many of these activities occur simultaneously, and in an iterative fashion. There is usually little distinction between many activities, e.g. system-level and component-level verification and debugging. Figure 4 shows the progression of debugging and verification of components that results from the product development identified in the diagram. We have characterized the progression into five major categories:

- Transport Layer Verification
- Protocol Verification
- Basic Connection Test
- Advanced Connection Test
- Load Generation

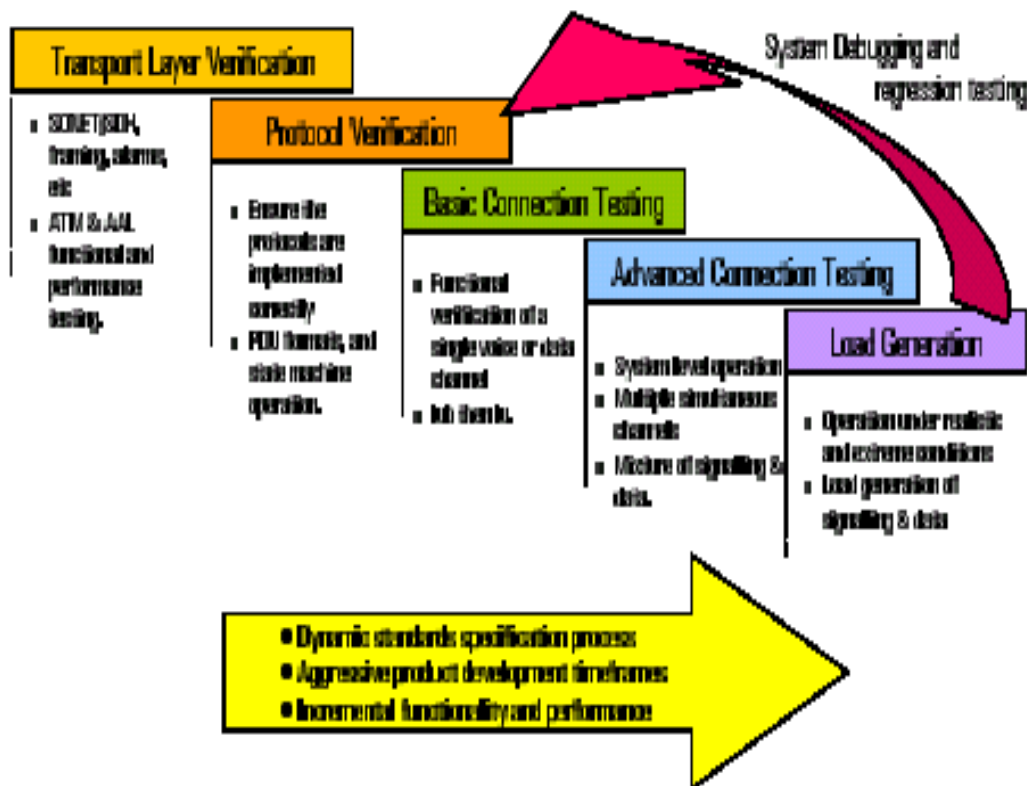


figure 4: Progression of Testing and Verification

Transport Layer Verification

Developing 3G components involves development of completely new hardware (including FPGAs), and/or significant re-engineering of existing ATM switching hardware to suit 3G purposes. Integral to this hardware development is the associated

software (or firmware, depending upon your naming preference). Together, these hardware and software modules form a base platform upon which the remainder of the 3G system can be built. This base platform can be considered to provide the transport layer for higher layer protocols, applications, services, etc.

Depending upon design and development decisions, the domain of the base platform may extend to delivery of lower layer protocol services to the radio network layer and application layer (e.g. FP, IP, and ATM signaling). However, for the purposes of testing, such services will be considered along with the higher layer software. In order to verify correct operation of the hardware and software platform, designers and QA people need to verify:

- Physical layer operation
- Cell layer operation, performance, etc.
- AAL-2 and AAL-5 Segmentation and re-assembly (SAR).

In early stages of testing, it will be necessary to ensure that the system is transmitting and receiving physical layer frames correctly. It will then be necessary to ensure that jitter is within acceptable tolerance, and that the necessary alarms and errors are transmitted, received, and handled correctly. Once the physical layer is considered stable, attention can be turned to the ATM layer. At early stages, this will involve ensuring that cells are correctly formed, recognized, and switched according to their address. Functional verification is only the beginning, as it is critical to ensure adequate performance at the ATM layer.

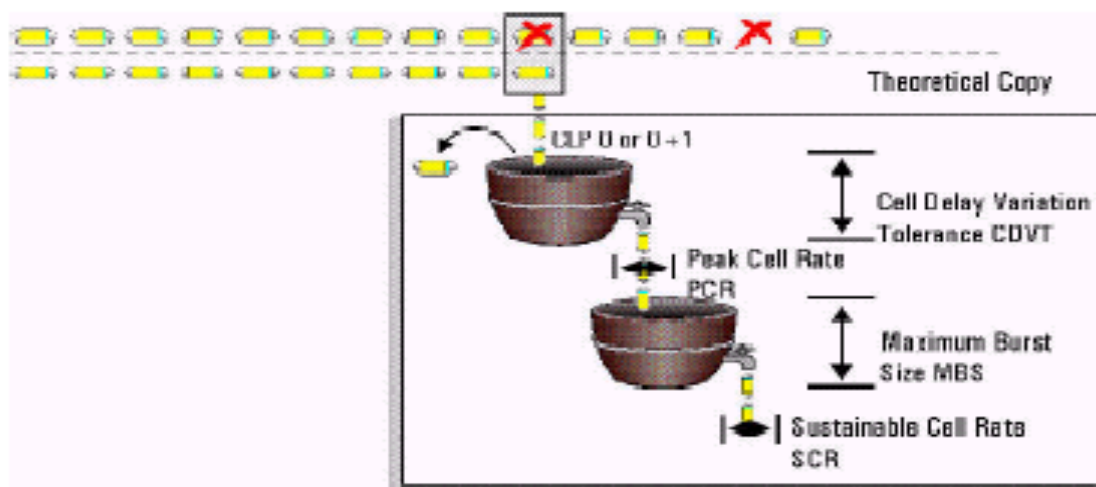


figure 5: Testing policing of the ATM switching fabric

7

Performance measures include cell loss, mis-insertion, and error rate. Integral to this is correct tagging and policing of cells under conditions of high back-plane load and port congestion. It is necessary to ensure that cells are dropped in a predictable and logical fashion under such circumstances. Such policing is usually performed by implementation of the Generic Cell Rate Algorithm (GCRA - otherwise known as the leaky bucket algorithm). It is critical to ensure that the transport layer behaves reliably and consistently under various conditions, particularly port and back-plane congestion. Failure to ensure correct operation at this level is likely to result in strange and hard to trace bugs at higher layers and later stages of testing. Similar challenges

occur at the ATM Adaptation Layers. AAL-2 and AAL-5 are used within the UMTS W-CDMA system. It is necessary to ensure that Segmentation and Re-assembly (SAR) is rock-solid. AAL-2 and AAL-5 packet loss, error-rate, delay and delay variation need to be within acceptable limits. Early Packet Discard (EPD) and Partial Packet Discard (PPD) can be implemented at the AAL-5 layer to increase performance at the higher layers, and must be verified thoroughly.

Protocol Verification

Developing a 3G component such as an RNC to a working stage involves many intermediate steps, transport layer operation being only the beginning. A large number of

inter-related protocols (and hence software modules) go to make up the entire component. It would be almost impossible to integrate all of these components before being satisfied that each appears to be working correctly in isolation. On the transmit side, it makes sense to ensure that all fields, PDUs, information elements, etc are correctly formed.

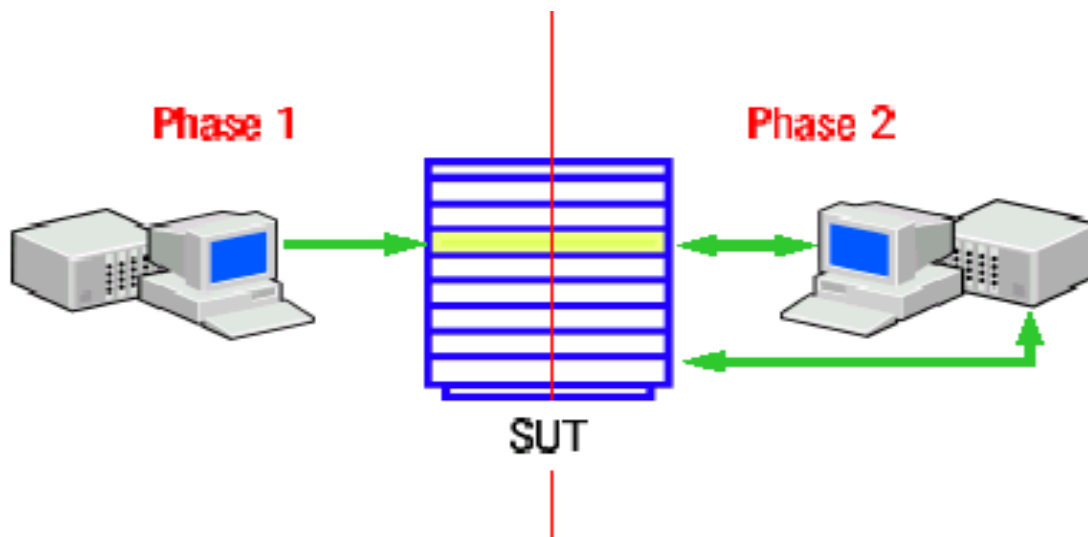


Figure 6: Progression from stimulus only to stimulus/response testing

On the receive side, you need to be confident that the protocols are being interpreted correctly, and that out-of-range values and incorrectly formed PDU's are handled in an acceptable, repeatable, and predictable fashion. As the protocol software may not be integrated with the hardware, early phases of verification would most likely involve software test scripts. As the software is integrated onto the hardware, testing would progress to stimulus testing only (perhaps using trace messages or a debugger), through to full stimulus response testing. figure 6 attempts to illustrate this.

Once this testing has been completed, testing can progress to verification that the state machines are correctly implemented. Again, predictable and repeatable behaviour under error conditions is crucial. Test cases should include handling of messages that are sent out of sequence, and/or with an out-of range value. In keeping with the incremental approach to development and verification, the system under test (SUT) would not yet have implemented timers in the state machines at the protocol layer being tested. This simplifies the test scenarios, by not having to deal with the added complexity of interacting with the SUT in real-time. A human can send a message and examine the response at his or her leisure, before progressing on to the next state or test case (see figure 7). Note that in order test at a particular protocol layer, it may be necessary for the tester to

implement emulation of protocols that are below that layer in the stack. For example, in order to test at the Q.AAL-2 layer using encode/decode techniques, it would be necessary for the tester to implement SSCOP emulation (which involves re-transmission of data in order to provide reliable transport). Emulation is not relevant to all protocols. It is only relevant to protocols that involve state machines and/or timers. Emulation will be discussed more in the coming section.

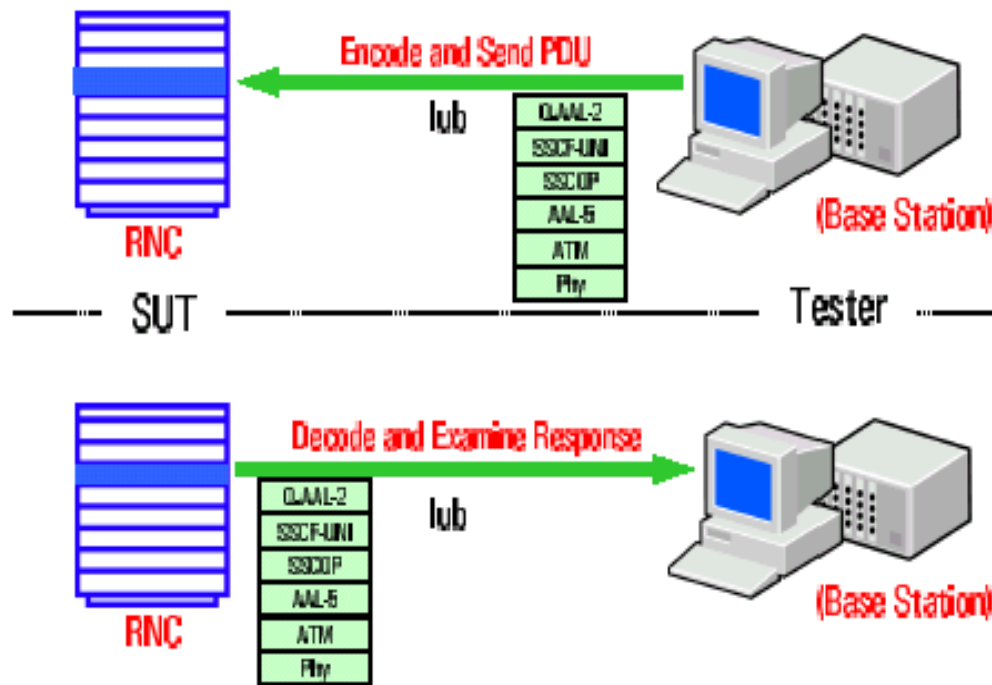


Figure 7: Before state machines are implemented on the SUT

Basic Connection Testing

Once all protocols appear to be implemented correctly, timers can be added, and testing can progress towards verification of subsets of functional operation. Once state machines have been implemented on the SUT, the test device needs to provide more than just encode and decode of protocols. It must also implement equivalent state machines, and participate in real-time protocol exchanges, as if it was a network component its-self. Figure 8 illustrates this point by showing the tester implementing Frame Protocol emulation as if it were a base station. This limited base station emulation would allow a Radio Access Bearer (RAB) to be sustained between the emulated base station, and the RNC under test.

This provides:

- Basic functional testing at the layer of the emulation (in this case FP)
- The basic transport within which higher layer messages may be sent, in order to perform protocol verification of the next highest layer (in this case MAC) .While it is often

necessary, emulation is not always relevant to basic connection testing. Basic connection testing involves testing minimal subsets of functionality at any one time.

For Frame protocol, this includes:

- Node and channel synchronization
- Call establishment and release
- Timing adjustment

These pieces of functionality require emulation at the FP layer, because FP involves both state machines and timers. NBAP has neither, and so emulation is not relevant to testing that layer. The tester would however have to emulate SSCOP (which is below NBAP in the protocol stack).

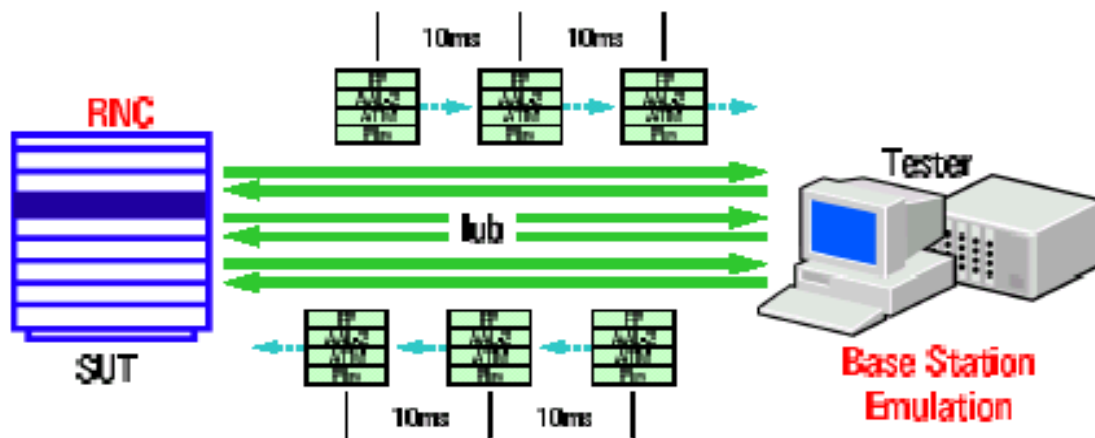


Figure 8: Emulation at the Frame Protocol layer

As a further example of basic connection testing, Figure 9 illustrates an example of testing that the RNC correctly implements call establishment. In this scenario, the tester emulates a single Node B, and the Core Network. The tester would participate in node synchronization, and all necessary signaling, in order to establish an end-to-end Radio Access Bearer (RAB). The tester would allow the bi-directional protocol exchange on IU and IUB to be monitored. The tester may also measure the time taken for the connection establishment to take place.

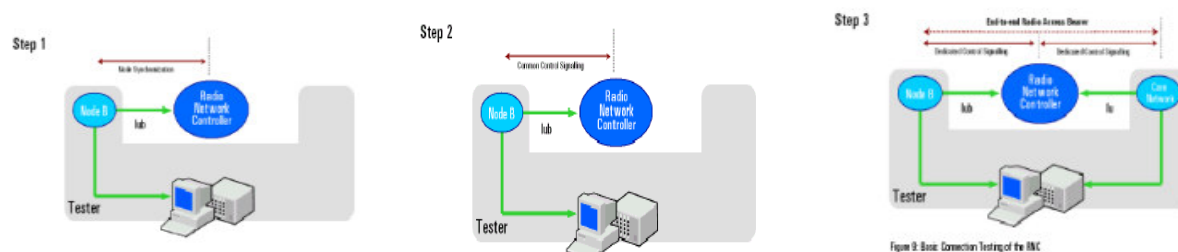


Figure 9: Basic Connection Testing of the RNC

Several variations on this scenario need to be considered, including:

- Core network and UE initiation of the call
- Establishment of various call types (e.g. voice, data, UDI)

- Correct participation in node and channel synchronization, and timing adjustment. Whilst the distinction between basic and advanced connection testing can be largely a matter of degree, the fundamental difference between the two lies in the number of functions being carried out simultaneously. Basic connection testing involves testing a minimum subset of functionality at any one time.

Advanced Connection Test

Advanced Connection testing involves testing and verification of a network component, where different and/or multiple similar functions are occurring at once. This increased number of simultaneous functions may be in order to test a more complex aggregate function such as hand-over, or may be in order to test how the SUT behaves as more than one function is performed simultaneously. The goal of advanced connection testing is to verify correct operation, as the various functions the component must perform, are progressively developed and integrated. The theoretical end-point is to verify that the SUT operates correctly for the complete set of functions that it must perform (both simultaneous and sequential). Examples of advanced connection testing include:

- Handling of multiple simultaneous UEs
- Handling of multiple RABs of various types (Voice, UDI, Data)
- Execution of Diversity Handover (DHO)

Load generation

The performance of each component and the 3G system as a whole is critical to characterize and understand, before rolling out a 3G service. Service Providers will be keen to understand the performance of the base stations, RNCs, and core network interfaces, as it has a direct affect on the cost of installing and operating a 3G system. Performance will be key to their selection of manufacturer(s), and deciding optimum network topology. Each component in the UMTS W-CDMA system can be a potential bottleneck to overall system performance; however, the RNC is arguably the most critical. Within the RNC, the bottleneck will generally be in processing power to handle the large number of simultaneous instances of protocol stacks and state machines, making up the control and user plane data. This will manifest it's self in the maximum number of:

- Base stations that can be supported per RNC.
- UEs that can be supported per RNC.
- Busy Hour Call Attempts (BHCA) under various conditions.
- Registered users, both home and roaming
- Active users under various conditions
- Simultaneous open calls

The key to testing performance is emulation of real-life conditions, as well as extreme conditions. It is necessary to simulate various mixtures of voice, UDI, and data, combined with various scenarios of typical end-user activity, combined with mobility (and hence DHO activity).

In order to facilitate this, it is desirable to specify scenarios in terms of the problem domain, rather than the protocols, signaling rates, etc. The ideal level of scenario building would be to specify scenarios in terms of groups of handsets with particular behavior profiles, e.g.:

- Type of device, e.g. mobile phone, videophone, web browser, etc
- Level and profile of use, e.g. two voice calls per hour plus 500Kb/h of interactive data content, peaking at 11pm.
- Speed and direction of travel

Conclusion:

3G cellular wireless technology provides much greater levels of functionality and flexibility than previous generations. 3G offers improved RF spectral efficiency and higher bit rates. While the focus for the first 3G systems appears to be voice and limited data services, 3G is also expected to become a significant Internet access technology. As always, equipment manufacturers that are early to market will gain a big jump on the competition. However, performance of 3G systems will be just as important as a competitive differentiator. The only way to achieve both objectives will be through a carefully planned and streamlined test and verification strategy.

Geothermal Energy- An Important Renewable Energy Source

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Introduction

Geothermal energy is the renewable and sustainable power source that comes from the heat stored in the earth, or the collection-absorbed heat derived from underground. The largest group of geothermal power plants in the world is located at The Geysers, a geothermal field in California, United States. The Philippines and Iceland are the only countries to generate a significant percentage of their electricity from geothermal sources. Geothermal power supplies less than 1% of the world's energy.

Geothermal fluids are corrosive and may contain trace amount of dangerous elements such as Mercury, Arsenic and Antimony. Geothermal energy production is virtually emission free and independent of weather conditions contrary to solar energy, wind energy and hydropower. Geothermal energy has minimal land use requirements; existing geothermal plants use 1-8 acres of land per megawatt only.

Where is Geothermal Energy Found?

Most geothermal reservoirs are deep underground with no visible clues showing above ground. The most active geothermal resources are usually found along major plate boundaries where earthquakes and volcanoes are concentrated. Most of the geothermal activity in the world occurs in an area called the Ring of Fire. This area rims the Pacific Ocean. Geothermal energy can sometimes find its way to the surface in the form of volcanoes and fumaroles (holes where volcanic gases are released), hot springs and, geysers.



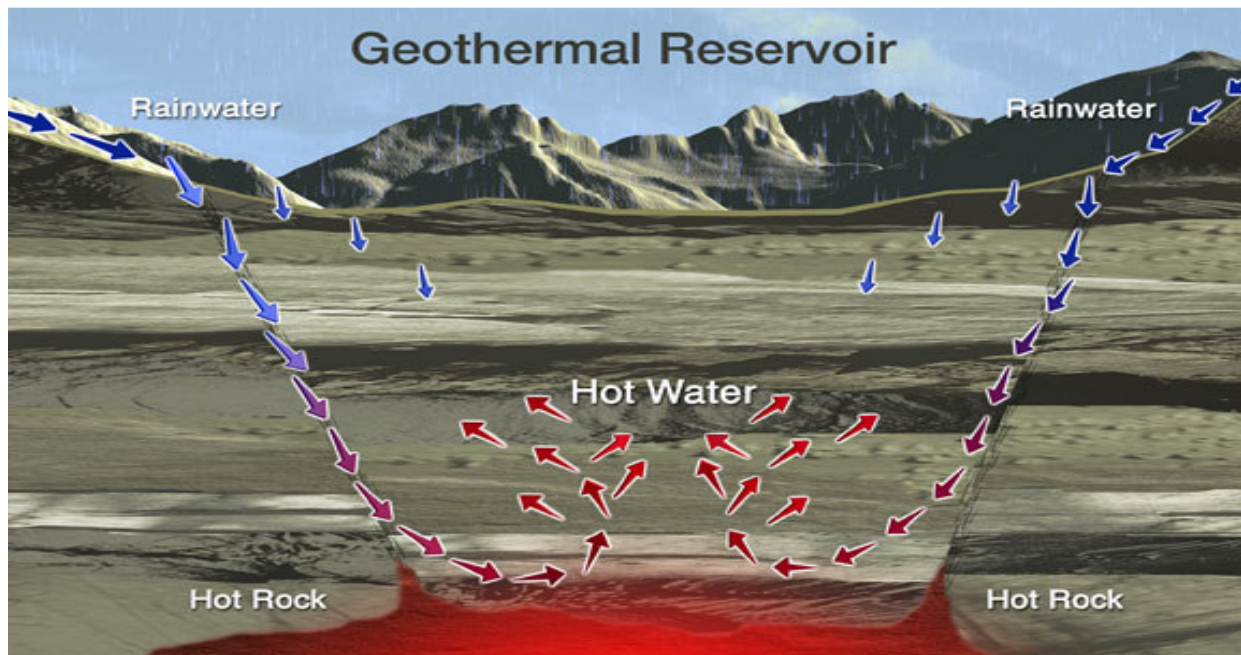
Countries employing Geothermal energy:

- Australia
- Canada
- Denmark
- Germany
- Iceland
- Kenya
- Mexico
- New Zealand
- Portugal
- Russia
- Saint Kitts and Nevis
- Turkey
- United Kingdom
- United States of America

Mechanism of Geothermal Energy

Earth's Crust:

The core itself has two layers: a solid iron core and an outer core made of very hot melted rock, called magma. The mantle, which surrounds the core, is about 1,800 miles thick. It is made up of magma and rock. The crust is the outermost layer of the earth, the land that forms the continents and ocean floors. It can be three to five miles thick under the oceans and 15 to 35 miles thick on the continents. The earth's crust is broken into pieces called plates. Magma comes close to the earth's surface near the edges of these plates. This is where volcanoes occur. The lava that erupts from volcanoes is partly magma. Deep underground, the rocks and water absorb the heat from this magma. The temperature of the rocks and water get hotter and hotter as you go deeper underground.



Types of Geothermal Power Plant:

1. Flash Steam power plant

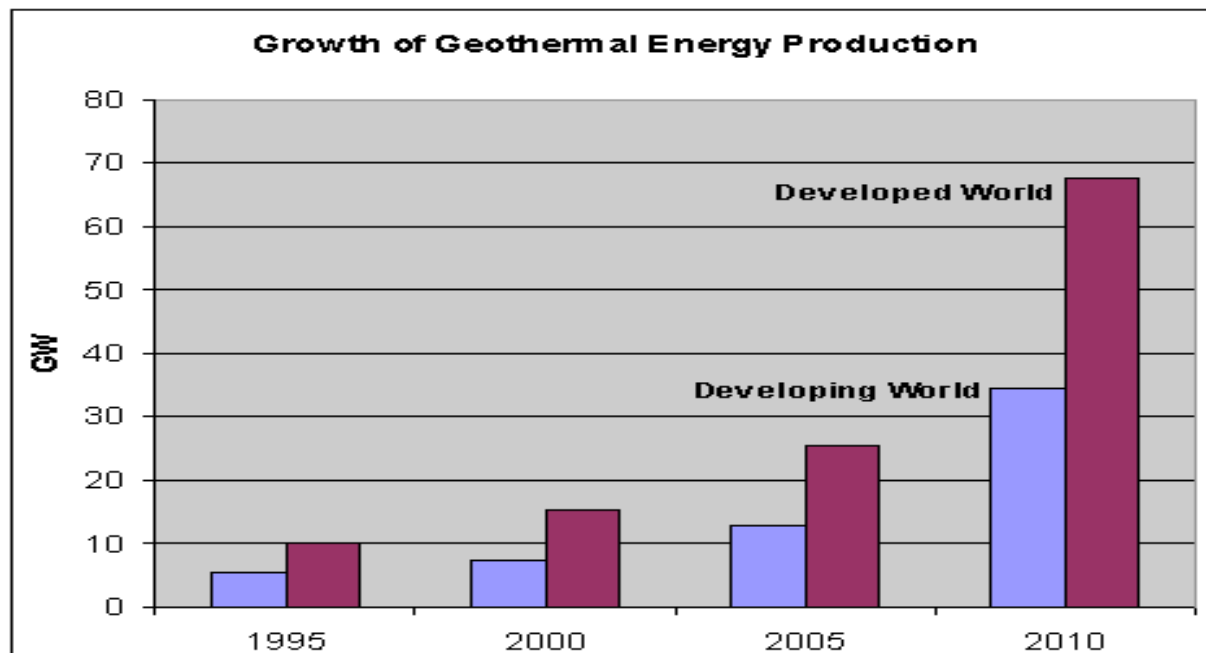
It is the most common type of geothermal power plant. The steam, once it has been separated from the water, is piped to the powerhouse where it is used to drive the steam turbine. The steam is condensed after leaving the turbine, creating a partial vacuum and thereby maximizing the power generated by the turbine-generator. The condensed steam then forms part of the cooling water circuit, and a substantial portion is subsequently evaporated and is dispersed into the atmosphere through the cooling tower. Excess cooling water called blow down is often disposed of in shallow injection wells. In this type of plant, the condensed steam does not come into contact with the cooling water, and is disposed of in injection wells.

2. Binary Cycle power plant

In reservoirs where temperatures are typically less than 220°C . but greater than 100°C binary cycle plants are often utilised. The reservoir fluid (either steam or water or both) is passed through a heat exchanger, which heats a secondary working fluid (organic) which has a boiling point lower than 100°C . This is typically an organic fluid such as Isopentane, which is vaporised and is used to drive the turbine. The organic fluid is then condensed in a similar manner to the steam in the flash power plant, except that a shell and tube type condenser rather than direct contact is used. The fluid in a binary plant is recycled back to the heat exchanger and forms a closed loop. The cooled reservoir fluid is again re-injected back into the reservoir

Growth of Geothermal Energy Production

The following figure gives the growth of geothermal energy production for developing as well as developed world in various years. It is evident from the figure that the power production from geothermal energy is increasing continuously.



Advantages:

As it requires no fuel, it is virtually emission free. It is insusceptible to fluctuations in fuel cost. It is considered to be sustainable because the heat extraction is small compared to the size of the heat reservoir. Geothermal heat is inexhaustible and is replenished from greater depths. Geothermal has minimal land use requirements; existing geothermal plants use 1-8 acres per megawatt (MW) versus 5-10 acres per MW for nuclear operations and 19 acres per MW for coal power plants. It also offers a degree of scalability: a large geothermal plant can power entire city while smaller power plants can supply more remote sites such as rural villages. Geothermal energy is independent of weather conditions, contrary to solar, wind, or hydro applications.

Geothermal Provinces in India:

- India has 400 medium to high enthalpy geothermal springs, clustered in seven provinces.
- The most promising provinces are:
 1. The Himalaya Province
 2. Cambay Province
 3. West coast province
 4. SONATA province
 5. Bakreswar province
 6. Godavari province
 7. The Barren island

Geothermal Energy in India:

Studies carried out by the Geological Survey of India have observed the existence of about 340 hot springs in the country. Investigations have been/are being carried out to assess potential of geothermal fields in different parts of the country. Puga valleys in Jammu & Kashmir and Tattapani in Chhattisgarh have been identified as potential sites for power generation. GeoSyndcate Power Private Ltd., at the Indian Institute of Technology Bombay, is reported to be planning to generate 50 MW from the Puga geothermal field. The government of Gujarat has framed a new policy and passed a government resolution aimed at formulating an incentive policy for solar, photovoltaic, geothermal, waste utilization, etc.

Hence Geo Thermal Energy is proving to be one of the very important energy sources not only in India but also worldwide.

Generation of Cryptographic Key and Fuzzy Vault using Iris Textures

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Abstract-- Crypto-biometric is an emerging architecture where cryptography and biometrics are merged to achieve high security. This paper explores the realization of cryptographic construction called fuzzy vault through iris biometric key. The proposed algorithm aims at generating a secret encryption key from iris textures and data units for locking and unlocking the vault. The algorithm has two phases: The first to extract binary key from iris textures, and the second to generate fuzzy vault by using Lagrange interpolating polynomial projections.

Introduction

Current cryptographic algorithms require their keys to be very long and random for higher security, that is, 128 bits for Advanced Encryption Standards [1]. These keys are stored in smart cards and can be used during encryption/decryption procedures by using proper authentication. There are two major problems with these keys: One is their randomness. The randomness provided by current mathematical algorithms is not sufficient to support the users for commercial applications. The second is authentication. Most of the authentication mechanisms use passwords to release the correct decrypting key, but these mechanisms are unable to provide non-repudiation. Such limitations can be overcome by using biometric authentication.

Positive biometric matching extracts secret key from the biometric templates. The performance of these algorithms depends on the correspondence between query minutiae sets and template minutiae sets. This correspondence is more in iris textures when compared with that of other biometric templates such as fingerprints and others. To improve the degree of correspondence, morphological operations [2] can be used to extract the skeletons from iris pseudo structures, with unique paths among the end points and nodes.

Biometric based random key is generated and combined with biometric authentication mechanism called fuzzy vault as proposed by Juels and Sudan [3]. The advantages of cryptography and iris based authentication can be utilized in such biometric systems.

Background

The scheme proposed by Juels and Sudan [3] can tolerate differences between locking and unlocking the vault. This fuzziness comes from the variability of biometric data. Even though the same biometric entity is analyzed during different acquisitions, the extracted biometric data will vary due to acquisition characteristics, noise etc. If the keys are not exactly the same, the decryption operation will produce useless random data. Fuzzy vault scheme requires alignment of biometric data at the time of enrolment with that of verification. This is a very difficult problem in case of other biometric templates such as fingerprint when compared to that of iris structures.

Proposed Method

The proposed method involves mainly two phases – one is feature extraction and the other is polynomial projection to generate vault. A random key combined with lock/unlock data both of 128 bit are extracted from iris textures and are projected on to a polynomial with cyclic redundancy code for error checking. To these projections, chaff points are added and scrambled to obtain vault.

Image Acquisition

We use the iris image data base from CASIA Iris image Database [CAS03a] and MMU Iris Database [MMU04a]. CASIA Iris Image Data base contributes a total number of 756 iris image which were taken in two different time frames. Each of the iris images is 8-bit gray scale with resolution 320X280. MMU data base contributes a total number of 450 iris images which were captured by LG Iris Access®2200.

Iris Localization

The eye image is acquired, converted to gray scale and its contrast is enhanced using histogram equalization [4]. Algorithm based on thresholding and morphological operators, is used to segment the eye image and to obtain region of interest. Initially the pupil boundary and limbic boundary were found to fix the iris area. Many algorithms are available today to fix these boundaries. But one of the easiest and simple algorithms is by using morphological operations. By using bit plane method, we can find the pupil boundary.

Further the iris image is normalized to a standard size of (87x360) using interpolation technique.

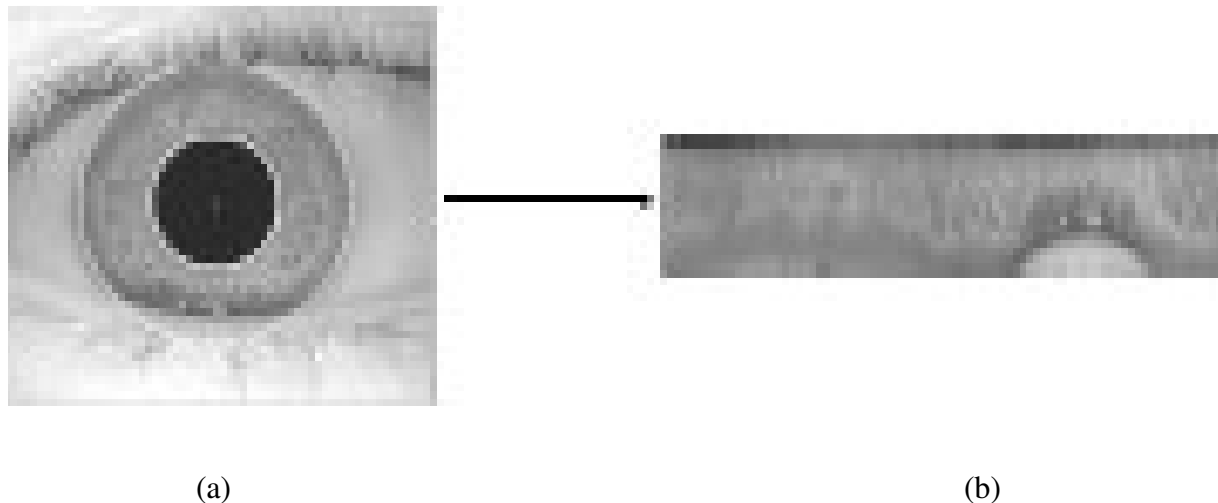


Fig. 1 Iris

a) After localization

b) After normalization

Feature Extraction

The feature extraction involves two stages - one to extract 128 bit secret code from iris texture and the other is to extract lock/unlock data from the same texture.

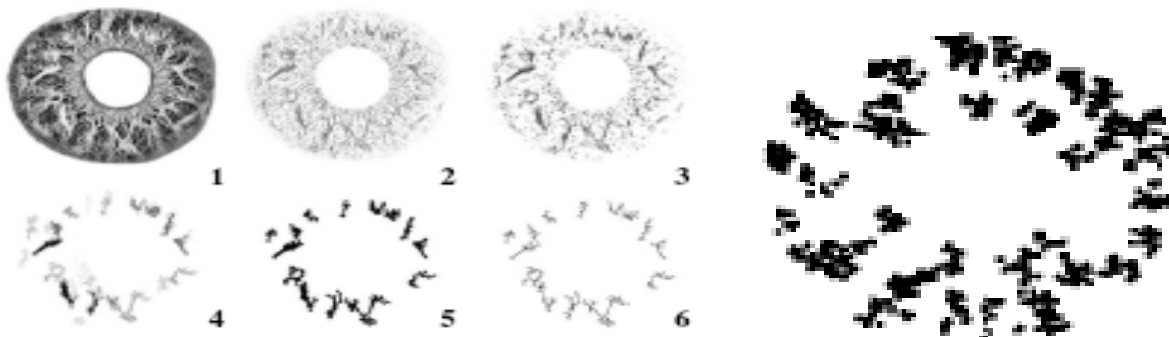
Extraction of Secret Code

The gray level value of $I(x,y,h)$ for all pixels in the iris template is normalized as, $I(x,y,h)=I(x,y,h) * L/H$, Where the L is window size and H is the maximum gray level,[8].

The pixels within each row along the angular direction are positioned into an appropriate square with $L \times L$ window size. L may be of any size in binary sequence, 16, 32,...128 bits. If the size of each row is 16, then each row can be used to generate 16 bit words of 128 bit secret code.

Extraction of lock/unlock data

On the highlighted iris structures as a whole, the following sequence of operations are used to extract the pseudo structures. Close – by - reconstruction top-hat opening area opening to remove structures in according to its size resulting image with structures disposed in layers and thresholding is applied to obtain binary image



Iris textures after Opening – Closing operations

Iris pseudo structures

The image is submitted to normalization that takes, as reference, an image containing pseudo structures . For appropriate representation of structures, thinning is used so that every structure presents itself as an agglomerate of pixels.

To have a single path between nodes and end points, redundant pixels are removed using 3×3 masks run over them [5]. When the foreground and background pixels in mask exactly match with the pixels in the image, the pixel to be modified is the image pixel underneath the origin of mask

Fixing the Center & X/Y Coordinates

Black hole search method [8] is used to detect the center of pupil. The center of mass refers to the balance point (x, y) of the object where there is equal mass in all directions. Both the inner and outer boundaries can be taken as circles and center of pupil can be found by calculating its center of mass.

The steps of black hole search method are as follows:

1. Find the darkest point of image in global image analysis.
2. Determine a range of darkness designated as the threshold value (t) for identification of black holes.
3. Determine the number of black holes and their coordinates according to the predefined threshold. Calculate the center of mass of these black holes.
4. E_x and E_y denotes the x, y coordinates of center which satisfy $I(x,y) < t$.

$$E_x = \{ \sum_{x=0 \text{ to } w-1} \sum_{y=0 \text{ to } H-1} X \} / WH$$

$$E_y = \{ \sum_{x=0 \text{ to } w-1} \sum_{y=0 \text{ to } H-1} Y \} / WH$$

Where W and H are the sum of detected coordinates x,y and t is the threshold value.

The radius can be calculated from the given area (total number of black holes in the pupil, where $\text{radius} = \sqrt{\text{area}/\pi}$). From the center of the pupil, the x,y coordinates of every node is found and used to form lock/unlock data as shown in Fig.2

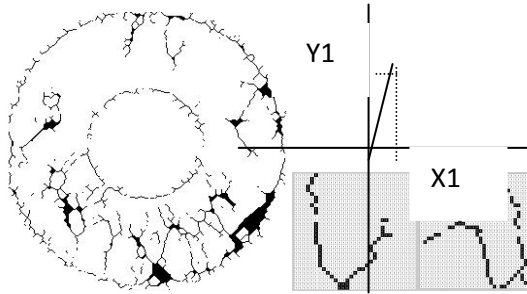


Fig. 2: Iris showing x/y coordinates

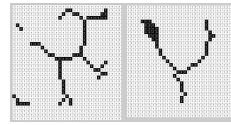


Fig 3: Nodes and End Points

Encoding:

The x and y coordinates of nodes (8 bits each) are used as [x/y] to obtain 16 bit lock/unlock data unit u. Secret code is used to find the coefficients of the polynomial p. Secret code is of 128 bit size and 16 bit CRC for error check. A total of 144 bits are used to generate a polynomial of $9(144/16)$ coefficients with degree $D=8$. Hence

$$p(u) = c_8 u^8 + c_7 u^7 + \dots + c_0.$$

The 144 bit code is divided into non overlapping 16 bit segments and each segment is declared as a specific coefficient. Normally MSB bits are used to represent higher degree coefficients and LSB bits for lower degree coefficients. The same mapping is also used during decoding.

Genuine set G is found by projecting the polynomial p using N iris template features $u_1, u_2, \dots$. Thus $G = \{ [u_1, p(u_1)], [u_2, p(u_2)], \dots \}$. Chaff set C is found by randomly assuming M points $c_1, c_2, \dots$ which do not overlap with $u_1, u_2, \dots$. Another set of random points $d_1, d_2, \dots$, are generated, with a constraint that pairs (c_j, d_j) , $j=1, 2, \dots, M$ do not fall onto the polynomial $p(u)$. Chaff set C is then

$$C = \{ (c_1, d_1), (c_2, d_2), \dots \}.$$

Union of these two sets, $G \cup C$, and degree of polynomial D form vault V which is finally transmitted.

Decoding:

Let $u^*_1, u^*_2, \dots$ be the points from query features used for polynomial reconstruction. If u^*_i , $i=1, 2, \dots, N$ is equal to values of vault V , then v_i , $i=1, 2, \dots, (M+N)$, the corresponding vault point is added to the list of points used. For decoding D degree polynomial, $(D+1)$ unique projections are needed. Thus $C(k, D+1)$ combinations are needed to construct a polynomial, where $k \leq N$. After constructing the polynomial, the coefficients are mapped back to the decoded secret code. For checking errors the polynomial is divided with CRC primitive polynomial. A zero remainder means no errors. The first 128 bits in secret code leads to actual information. If the query list overlaps with template list, then the information transmitted is correct.

Experimental Results:

Data Base: CASIA iris data base, i) Image type: Gray ii) Image Size of Database: 756 images iii) Class Information: The images are from 108 eyes of 80 subjects iv) Sensor: A digital optical sensor. Each image is of 320 x 280 pixel size and of 96 dpi resolution in both horizontal and vertical directions with a depth of 8 bits. The indices of nodes are converted to 8-bit range. Pre alignment of template and query data sets are not needed since both are acquired from a fixed position in iris and traveling in same direction, clockwise.

The 144 bits are converted to polynomial $p(u)$ as

$$p(u) = 1804u^8 + 16384u^7 + 52868u^6 + 59549u^5 + 14256u^4 + 3167u^3 + 40820u^2 + 3160u + 10280$$

The indices of x and y coordinates of nodes are used for projections.

The co-ordinates of nodes are

$$(13,0), (23,15), \quad (12,18), (29,5), \quad (14,17), (20,18), \quad (16,13)$$

Using these indices, genuine points are generated to which chaff points are added later to form vault. The ratio of chaff points and original points is taken as 10:1 so that the combinations are

large in giving high security. During decoding 20 query points are selected on the average. Out of 100 iris templates, 82 are successful in unlocking the vault. Hence False Rejection Rate (FRR) of the system is 0.18 that is genuine acceptance ratio is 82% which is considerably higher than by other biometric templates.

Biometric	Features used	FRR
Finger print	Minutiae	79%
Iris texture	Nodes	82%

The vault has 220 points, hence there are a total of $C(220,9) = 2.8 \times 10^{15}$ combinations with 9 elements. Only $C(20,9) = 167960$ of these are used to open the vault. Therefore, it takes $C(220,9)/C(20,9) = 1.67 \times 10^{10}$ evaluations for an attacker to open the vault.

Conclusion

Fuzzy vault, constructed for iris templates, is superior to that of other biometric templates. When compared with other biometrics, iris provides stable structures irrespective of acquisition characteristics. But histogram processing is needed for contrast enhancement of iris after acquiring. Also pre alignment of templates is not necessary since nodes are always constant in iris texture. The time complexity and space complexity of algorithm are high due to long integers involved in genuine set calculation since the size of each template is 32×32 . Also multiple combinations are to be verified. Quantizing the iris features to 8×8 level can minimize these complexities.

Camless Engines

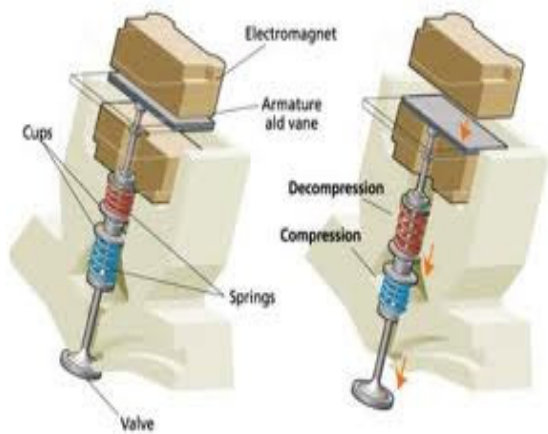
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Definition: To eliminate the cam, camshaft and other connected mechanisms, the Cam less engine makes use of three vital components - the sensors, the electronic control unit and the actuator.

Mainly five sensors are used in connection with the valve operation. One for sensing the speed of the engine, one for sensing the load on the engine, exhaust gas sensor, valve position sensor and current sensor. The sensors will send signals to the electronic control unit. The electronic control unit consists of a microprocessor, which is provided with a software algorithm. The microprocessor issues signals to the solid-state circuitry based on this algorithm, which in turn controls the actuator, to function according to the requirements.

Cam less valve train: In the past, electro hydraulic cam less system was created primarily as research tools permitting quick simulation of a wide variety of cam profiles. For example, systems with precise modulation of a hydraulic actuator position in order to obtain a desired engine valve lift versus time characteristic, thus simulating the output of different camshafts. In such systems, the issue of energy consumption is often unimportant. The system described here has been conceived for use in production engines. It was, therefore, very important to minimize the hydraulic energy consumption.



Hydraulic pendulum

The Electro hydraulic Cam less Valve train, (ECV) provides continuously variable control of engine valve timing, lift, and velocity. It uses neither cams nor springs. It exploits the elastic properties of a compressed hydraulic fluid, which, acting as a liquid spring, accelerates and decelerates each

engine valve during its opening and closing motions. This is the principle of the hydraulic pendulum. Like a mechanical pendulum," the hydraulic pendulum involves conversion of potential energy into kinetic energy and, then, back into potential energy with minimal energy loss". During acceleration, potential energy of the fluid is converted into kinetic energy of the valve.

During deceleration, the energy of the valve motion is returned to the fluid. This takes place both during valve opening and closing. Recuperation of kinetic energy is the key to the low energy consumption of this system. Figure 7 illustrates the hydraulic pendulum concept. The system incorporates high and low-pressure reservoirs. A small double-acting piston is fixed to the top of the engine valve that rides in a sleeve. The volume above the piston can be connected to either a high- or a low-pressure source. The volume below the piston is constantly connected to the high-pressure source. The pressure area above the piston is significantly larger than the pressure area below the piston. The engine valve opening is controlled by a high-pressure solenoid valve that is open during the engine valve acceleration and closed during deceleration. Opening and closing of a low-pressure solenoid valve controls the valve closing. The system also includes high and low-pressure check valves.

During the valve opening, the high-pressure solenoid valve is open, and the net pressure force pushing on the double-acting piston accelerates the engine valve downward. When the solenoid valve closes, pressure above the piston drops, and the piston decelerates pushing the fluid from the lower volume back into the high-pressure reservoir. Low-pressure fluid flowing through the low-pressure check valve fills the volume above the piston during deceleration. When the downward motion of the valve stops, the check valve closes, and the engine valve remains locked in open position. The process of the valve closing is similar, in principle, to that of the valve opening.

The low-pressure solenoid valve opens, the pressure above the piston drops to the level in the low-pressure reservoir, and the net pressure force acting on the piston accelerates the engine valve upward. Then the solenoid valve closes, pressure above the piston rises, and the piston decelerates pushing the fluid from the volume above it through the high-pressure check valve back into the high-pressure reservoir. The hydraulic pendulum is a spring less system. Figure 8

shows idealized graphs of acceleration, velocity and valve lift versus time for the hydraulic pendulum system. Thanks to the absence of springs, the valve moves with constant acceleration and deceleration. This permits to perform the required valve motion with much smaller net driving force, than in systems, which use springs. The advantage is further amplified by the fact that in the spring less system the engine valve is the only moving mechanical mass. To minimize the constant driving force in the hydraulic pendulum the opening and closing accelerations and decelerations must be equal.

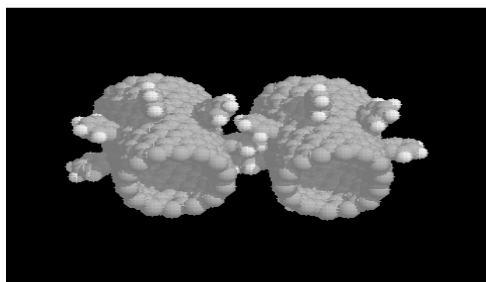
Nano-Technology

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Introduction:

The term “nanotechnology” generally refers to engineering and manufacturing at the molecular or nanometer length scale. (A nanometer is one-billionth of a meter, about the width of 6 bonded carbon atoms.) . Nanotechnology will have given us specially engineered drugs which are nanoscale cancer-seeking missiles, a molecular technology that specifically targets just the mutant cancer cells in the human body, and leaves everything else blissfully alone. To do this, these drug molecules will have to be big enough – thousands of atoms – so that we can code the information into them of where they should go and what they should kill. They will be examples of an exquisite, human-made nanotechnology of the future. It is most useful to regard the emerging field of nanomedicine as a set of three mutually overlapping and progressively more powerful technologies. First, in the relatively near term, nanomedicine can address many important medical problems by using nanoscale-structured materials that can be manufactured today. This includes the interaction of nanostructures materials with biological systems. Second, over the next 5-10 years, biotechnology will make possible even more remarkable advances in molecular medicine and biorobotics (microbiological robots), some of which are already on the drawing boards. Third, in the longer term, perhaps 10-20 years from today, the earliest molecular machine systems and nanorobots may join the medical armamentarium, finally giving physicians the most potent tools imaginable to conquer human disease, ill health, and suffering. Our paper concentrates mainly on our dream system that user nano sensor in mobile phones to detect human blood sugar level and also nano robots in respiratory process. Most broadly, nanomedicine is the process of diagnosing, treating, and preventing disease and traumatic injury, of relieving pain, and of preserving and improving human health, using molecular tools and molecular knowledge of the human body. “Over the past century we have learned about the workings of biological nanomachines to an incredible level of detail, and the benefits of this knowledge are beginning to be felt in medicine. In coming decades we will learn to modify and adapt this machinery to extend the quality and length of life.”



Making Nano Robots:

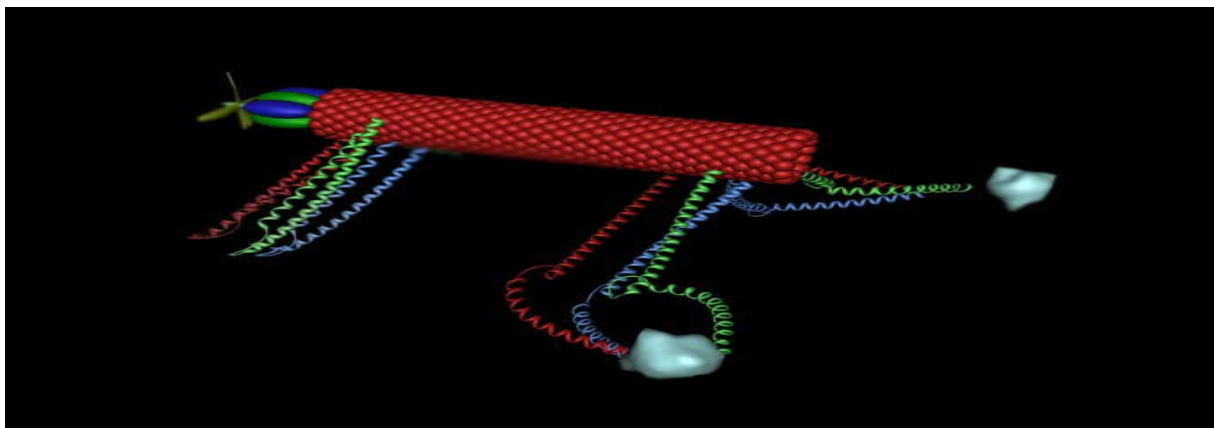
The typical medical nanodevice will probably be a micron-scale robot assembled from nanoscale parts. These parts could range in size from 1-100 nm (1 nm = 10^{-9} meter), and might be fitted together to make a working machine measuring perhaps

0.5-3 microns (1 micron = 10^{-6} meter) in diameter. Three microns is about the maximum size for blood borne medical nanorobots, due to the capillary passage requirement. Carbon will likely be the principal element comprising the bulk of a medical nanorobot, probably in the form of diamond or diamonded/fullerene nanocomposites largely because of the tremendous strength and chemical inertness of diamond. Many other light elements such as hydrogen, sulfur, oxygen, nitrogen, fluorine, silicon, etc. will be used for special purposes in nanoscale gears and other components.

Appearance of Nano Robots:

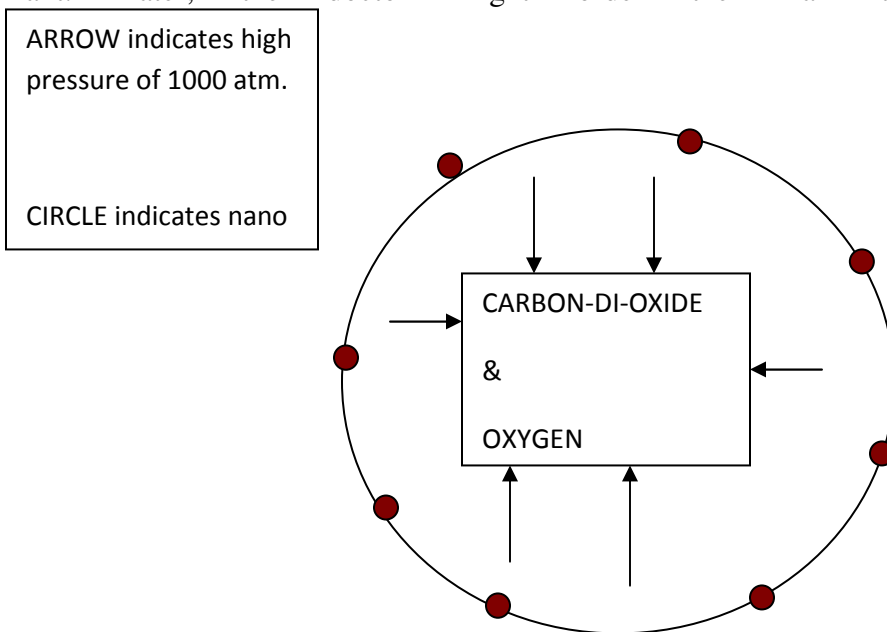
It is impossible to say exactly what a generic nanorobot would look like. Nanorobots intended to travel through the bloodstream to their target will probably be 500-3000 nanometers (1 nanometer = 10^{-9} meter) in characteristic dimension. Non-blood borne tissue-traversing nanorobots might be as large as 50-100 microns, and alimentary or bronchial-traveling nanorobots may be even larger still. Each species of medical nanorobot will be designed to accomplish a specific task, and many shapes and sizes are possible.

In most cases a human patient who is undergoing a nanomedical treatment is going to look just like anyone else who is sick. The typical nanomedical treatment (e.g. to combat a bacterial or viral infection) will consist of an injection of perhaps a few cubic centimeters of micron-sized nanorobots suspended in fluid (probably a water/saline suspension). The typical therapeutic dose may include up to 1-10 trillion (1 trillion = 10^{12}) individual nanorobots, although in some cases treatment may only require a few million or a few billion individual devices to be injected. Each nanorobot will be on the order of perhaps 0.5 micron up to perhaps 3 microns in diameter. (The exact size depends on the design, and on exactly what the nanorobots are intended to do.) The adult human body has a volume of perhaps $100,000 \text{ cm}^3$ and a blood volume of $\sim 5400 \text{ cm}^3$, so adding a mere $\sim 3 \text{ cm}^3$ dose of nanorobots is not particularly invasive. The nanorobots are going to be doing exactly what the doctor tells them to do, and nothing more (barring malfunctions). So the only physical change you will see in the patient is that he or she will very rapidly become well again. Most symptoms such as fever and itching have specific biochemical causes which can also be managed, reduced, and eliminated using the appropriate injected nanorobots. Major rashes or lesions such as those that occur when you have the measles will take a bit longer to reverse, because in this case the broken skin must also be repaired.



Artificial Red Cell:

We named this Nanorobot as ventilons. The ventilons measures about 1 micron in diameter and just floats along in the bloodstream. It is a spherical nanorobot made of 18 billion atoms. These atoms are mostly carbon atoms arranged as diamond in a porous lattice structure inside the spherical shell. The ventilons is essentially a tiny pressure tank that can be pumped full of up to 9 billion oxygen (O_2) and carbon dioxide (CO_2) molecules. Later on, these gases can be released from the tiny tank in a controlled manner. The gases are stored onboard at pressures up to about 1000 atmospheres. (Ventilons can be rendered completely nonflammable by constructing the device internally of sapphire, a flame proof material with chemical and mechanical properties otherwise similar to diamond.). The surface of each ventilons is 37% covered with 29,160 molecular sorting rotors that can load and unload gases into the tanks. There are also gas concentration sensors on the outside of each device. When the nanorobot passes through the lung capillaries, O_2 partial pressure is high and CO_2 partial pressure is low, so the onboard computer tells the sorting rotors to load the tanks with oxygen and to dump the CO_2 . When the device later finds itself in the oxygen-starved peripheral tissues, the sensor readings are reversed. That is, CO_2 partial pressure is relatively high and O_2 partial pressure relatively low, so the onboard computer commands the sorting rotors to release O_2 and to absorb CO_2 . Ventilons mimic the action of the natural hemoglobin-filled red blood cells. But a ventilons can deliver 236 times more oxygen per unit volume than a natural red cell. This nanorobot is far more efficient than biology, mainly because its diamonded construction permits a much higher operating pressure. (The operating pressure of the natural red blood cell is the equivalent of only about 0.51 atm, of which only about 0.13 atm is deliverable to tissues.) So the injection of a 5 cm^3 dose of 50% ventilons aqueous suspension into the bloodstream can exactly replace the entire O_2 and CO_2 carrying capacity of the patient's entire $5,400\text{ cm}^3$ of blood! Ventilons will have pressure sensors to receive acoustic signals from the doctor, who will use an ultrasound-like transmitter device to give the ventilons commands to modify their behavior while they are still inside the patient's body. For example, the doctor might order all the ventilons to just stop pumping, and become dormant. Later, the doctor might order them all to turn on again.



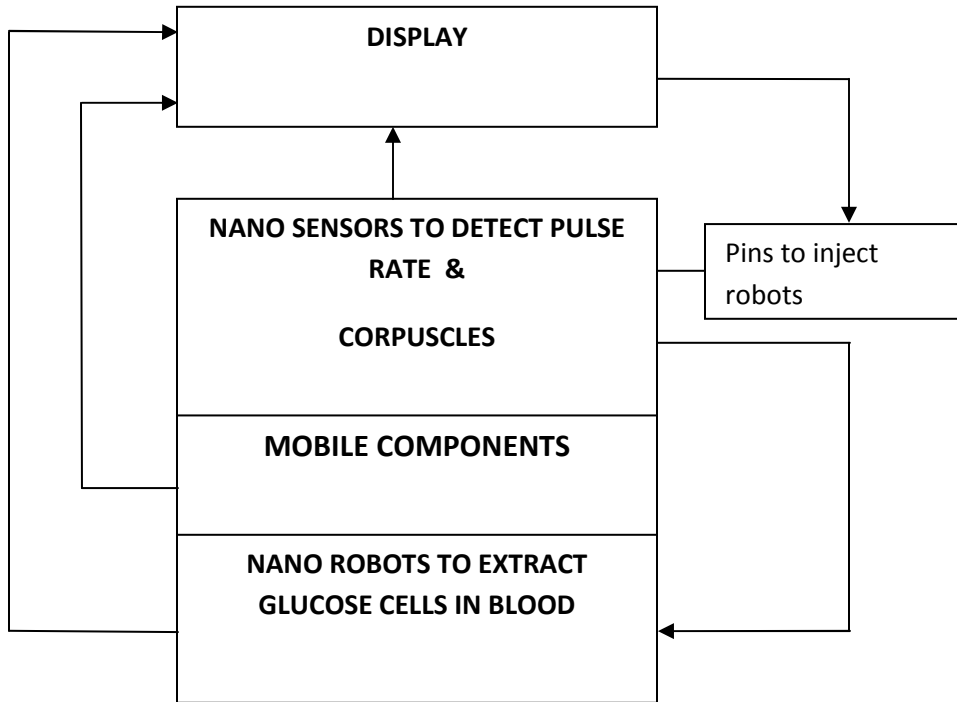
Application:

By adding 1 liter of ventilons into our bloodstream, we could then hold our breath for nearly 4 hours if sitting quietly at the bottom of a swimming pool. Or if we were sprinting at top speed, we could run for at least 15 minutes before we had to take a breath! It is clear that very "simple" medical nanodevices can have extremely useful abilities, even when applied in relatively small doses. Other more complex devices will have a broader range of capabilities. Some devices may have mobility the ability to swim through the blood, or crawl through body tissue or along the walls of arteries. Others will have different shapes, colors, and surface textures, depending on the functions they must perform. They will have different types of robotic manipulators, different sensor arrays and so forth. Each medical nanorobot will be designed to do a particular job extremely well, and will have a unique shape and behavior.

Our Nanosystem to Detect Human Physiology:

Currently operate with micron sized active regions and offer the ability to do thousands of measurements individual gene activities. Such arrays will allow hundreds of thousands of human genes to be monitored throughout a mission and will allow the determination of the effects of microgravity on human physiology in ways that are not imagined at present, as well as providing early warning of cancer or other disease states. By determining which genes are activated or inhibited, rack-mounted intelligent medical systems will be able to apply preventative care at the earliest possible point. Comprehensive cellular protein analysis and enzyme assays are equally feasible and instructive. Nanotech-based gas chromatograph/mass spectrometer similar technologies, such as a nanotech-based MS/MS, will allow the characterization and quantification of multitudes of substances in a single small biological sample. In many cases, sensors will be integrated with on-chip signal processing and data acquisition along with micro fluidics and other sample transport and preparation technologies. Systems for sensing biological and inorganic substances of interest in both aqueous and gaseous phases are needed. Technologies such as micro-machined ion-mobility spectrometers, ion trap mass spectrometers, calorimetric spectrometers, micro lasers and optics, on-chip separators, optical spectrometers (e.g., UV, visible, and infrared), ultra sensitive acoustic wave detectors, polymerase chain reaction (PCR) gene sequencing instrumentation (including restriction enzyme digestion and PCR amplification) and many others could potentially reside on the same chip or in close proximity allowing minute quantities of sample to provide a wealth of information. The advantages of a laboratory on a chip include device miniaturization for the space and volume restrictions of space travel, lower power consumption, nearly instantaneous response times for near-real time results, conservation of reagents, and ease of operation by non-laboratory personnel, such as astronauts. As with many advances in nanotechnology, the chief difficulty may be in integrating these many different units into functioning systems and interfacing them to the macro real world.

Nanosensors in Mobilephones:



System demonstration:

- ⇒ Our mobile system has small pins attached to the mobile phones.
- ⇒ These pins help in taking samples of glucose.
- ⇒ From these samples, the corpuscles are readied using the small specific nanorobots inside the mobile.
- ⇒ Nano-chromatrons separate the glucose molecules which cause diabetes.
- The molecules inhibited are read and compared with the other section and the approximation is made about the sugar level.
- These sugar levels are compared with compressed DB, s and precautions are displayed.
- By having sound sensors it may possible to calculate heartbeats & pulse rates there by calculating the BP level.



Nano robots used in our mobile phones

Conclusion:

Nano medicine will eliminate virtually all common diseases of the 20th century, virtually all medical pain and suffering, and allow the extension of human capabilities most especially our mental abilities. Consider that a nanostructured data storage device measuring $\sim 8,000 \text{ micron}^3$, a cubic volume about the size of a single human liver cell and smaller than a typical neuron, could store an amount of information equivalent to the entire Library of Congress. If implanted somewhere in the human brain, together with the appropriate interface mechanisms, such a device could allow extremely rapid access to this information.

A single Nano computer CPU, also having the volume of just one tiny human cell, could compute at the rate of 10 teraflops (10^{13} floating-point operations per second), approximately equalling (by many estimates) the computational output of the entire human brain. Such a nanocomputer might produce only about 0.001 watt of waste heat, as compared to the ~ 25 watts of waste heat for the biological brain in which the nanocomputer might be embedded.

But perhaps the most important long-term benefit to human society as a whole could be the dawning of a new era of peace. We could hope that people who are independently well-fed, well-clothed, well-housed, smart, well-educated, healthy and happy will have little motivation to make war. Human beings who have a reasonable prospect of living many "normal" lifetimes will learn patience from experience, and will be extremely unlikely to risk those "many lifetimes" for any but the most compelling of reasons.

DNA – A Storage Device

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Introduction:

All of the world's information, about 1.8 zettabytes, could be stored in about four grams of DNA. Computerworld. Researchers have created a way to store data in the form of DNA, which can last for tens of thousands of years. The encoding method makes it possible to store at least 100 million hours of high-definition video in about a cup of DNA. The researchers, from UK-based EMBL-European Bioinformatics Institute (EMBL-EBI), claimed to have stored encoded versions of an .mp3 of Martin Luther King's "I Have a Dream" speech, along with a .jpg photo of EMBL-EBI and several text files.

Assumptions:

"We already know that DNA is a robust way to store information because we can extract it from woolly mammoth bones, which date back tens of thousands of years, and make sense of it," Nick Goldman, co-author of the study at EMBL-EBI, said in a statement. "It's also incredibly small, dense and does not need any power for storage, so shipping and keeping it is easy. "Reading DNA is fairly straightforward, but writing it has been a major hurdle.

Challenges:

There are two challenges: First, using current methods, it is only possible to manufacture DNA in short strings. Secondly, both writing and reading DNA are prone to errors, particularly when the same DNA letter is repeated.

Researches:

Goldman and co-author Ewan Birney, associate director of EMBL-EBI, set out to create a code that overcomes both problems. The new method requires synthesizing DNA from the encoded information. EMBL-EBI worked with California-based Agilent Technologies, a maker of electronic and bio-analytical measurement instruments such as oscilloscopes and signal generators, to transmit the data and then encode it in DNA. Agilent downloaded the files from the Web and then synthesized hundreds of thousands of pieces of DNA to represent the data. "The result looks like a tiny piece of dust," said Emily Leproux of Agilent.

Agilent then mailed the sample to EMBL-EBI, where the researchers were able to sequence the DNA and decode the files without errors. This is not the first time DNA has been shown to be an effective method of storing data. Last fall, researchers at Harvard University demonstrated the ability to store 70 billion copies of a book in HTML form in DNA binary code. The researchers created the binary code through DNA markers to preserve the text of the book, *Regenesis: How Synthetic Biology Will Reinvent Nature and Ourselves in DNA*. The difference between the two

studies is that the EMBL-EBI was the first to present an error-correcting code that converts zeros and ones to As, Gs, Ts and Cs," according to an institute spokeswoman. Genetic data is encoded as a sequence of nucleotides recorded using the letters G, A, T, and C, which represent guanine, adenine, thymine, and cytosine. "Because of the way the code is written, it overcomes the most common errors that occur when reading and writing DNA. The study is the first to demonstrate a method that works, and that can be scaled up," she said. "The papers [from Harvard and EMBL-EBI] were submitted around the same time to two different journals, and the different groups weren't aware that they were working on the same thing."

Implementations:

The Harvard researchers stored 5.5 petabits, or 1 million gigabits, per cubic millimeter in the DNA storage medium. Because of the slow process for setting down the data, the researchers consider the DNA storage medium suitable only for data archive purposes for now. "The total world's information, which is 1.8 zettabytes, [could be stored] in about four grams of DNA," Sriram Kosuri, a senior scientist at Harvard's Wyss Institute and senior author of the paper explaining the science, said at the time. Researchers are pursuing methods of storing data in smaller and smaller packets because of the tremendous growth of data. During the next eight years, the amount of digital data produced will exceed 40 zettabytes, which is the equivalent of 5,200GB of data for every man, woman and child on Earth, according to the latest Digital Universe study by research firm IDC.

Conclusion:

The majority of data between now and 2020 will not be produced by humans but by machines as they talk to each other over data networks. That would include, for example, machine sensors and smart devices communicating with other devices. "We've created a code that is error tolerant using a molecular form we know will last in the right condition for 10,000 years, or possibly longer. "As long as someone knows what the code is, we will be able to read it back if you have a machine that can read DNA. The researchers said the next step in development is to perfect the coding scheme and explore practical aspects, paving the way for a commercially viable DNA storage model.

Windows Phone: the Rising Mobile Platform

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Windows Phone is a series of proprietary mobile operating systems developed by Microsoft, and is the successor to its Windows Mobile platform, although incompatible with it. Unlike its predecessor, it is primarily aimed at the consumer market rather than the enterprise market. It was first launched in October 2010, with a release in Asia following in early 2011.

The latest release of Windows Phone is Windows Phone 8, which has been available to consumers since October 29, 2012. Microsoft also has a new version, Windows Phone Apollo Plus, in the works. With Windows Phone, Microsoft created a new user interface, featuring its design language called the Modern design language. Additionally, the software is integrated with third party services and Microsoft services, and sets minimum requirements for the hardware on which it runs.

Features:

User interface:

Windows Phone features a user interface based on Microsoft's Windows Phone design system, codenamed Metro.

Text input:

Users input text by using an on-screen virtual keyboard, which has a dedicated key for inserting emoticons, and features spell checking and word prediction. App developers (both in-house and ISV) may specify different versions of the virtual keyboard in order to limit users to certain character sets, such as numeric characters alone.

Messaging:

Windows Phone utilizes "Threads", which allow conversations to be held among users through multiple platforms dynamically switching between services depending on availability.

Web browser:

It uses the internet explorer mobile web browser. The browser supports up to six tabs, which can all load in parallel.

Contacts:

Contacts are organized via the "People hub". Contacts can be manually entered into contacts or imported from Facebook, Windows Live Contacts, Twitter, LinkedIn and Google, and Outlook

Email:

Windows Phone supports Hotmail, Exchange, Yahoo! Mail, and Gmail natively and supports many other services via the POP and IMAP protocols. For the native account types, contacts and calendars may be synced as well

Multimedia:

Xbox Music + Video is a built-in application hub providing entertainment and synchronization capabilities between PC, Windows Phone, and other Microsoft products.

Games:

The "Games hub" provides access to games on a phone along with Xbox Live functionality, including the ability for a user to interact with their avatar, view and edit their profile, see their achievements and view leader boards, and send messages to friends on Xbox Live.

Windows Phone vs. Android:

Windows Phone 7 is a rising star, and many people favorite mobile platform is now the Windows Phone. With this let us see some advantages and some aspects that make WP7 stand out, and outshine Android.

- Streamlined User Interface
- Easy to Use Interface
- Microsoft LIVE Integration Is Superb
- Stableness with WP7
- Experience Zune with WP7
- Keyboard in Windows Phone 7 is more Snappier
- No Pop-Up Ads!

- Grow Smarter

- Ramya.Bhairya, III B.Tech , Mechanical Engineering
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-
- SMART MATERIALS:

- Over the past century, we have learned how to create specialized materials that meet our specific needs for strength, durability, weight, flexibility, and cost. However, with the advent of smart materials, components may be able to modify themselves, independently, and in each of these dimensions. Smart materials can come in a variety of sizes, shapes, compounds, and functions. But what they all share- indeed what makes them "smart"-is their ability to adapt to changing conditions. Smart materials are the ultimate shape shifters. They can also alter their physical form, monitor their environment, and even diagnose their own internal conditions. They can also do all of this while intelligently interacting with the objects and people around them. More boldly, it is highly likely that once smart materials become truly ubiquitous-once they are seamlessly integrated into a webbed, wireless, and pervasive network -smart materials will challenge our basic assumptions about, and definitions of "living matter."
- **IMPORTANCE:**
- In certain respects, smart materials are an answer to many contemporary problems. In a world of diminishing resources, they promise increased sustainability of goods through improved efficiency and preventive maintenance. In a world of health and safety threats, they offer early detection, automated diagnosis, and even self-repair. In a world of political terrorism, they may offer sophisticated biowarfare countermeasures, or provide targeted scanning and intelligence- gathering in particularly sensitive environments. In general, smart materials come in three distinct flavors: passively smart materials that respond directly and uniformly to stimuli without any signal processing; actively smart materials that can, with the help of a remote controller, sense a signal, analyze it, and then "decide" to respond in a particular way; and finally, the more powerful and autonomous intelligent materials that carry internal, fully integrated controllers, sensors, and actuators.
- **INTERESTING USES AND APPLICATIONS!**
- The components of the smart materials revolution have been finding their way out of the labs and into industrial applications for the past decade. Yet, they fall into several classes and categories: piezoelectrics, electro restrictors, magneto restrictors, shape-memory alloys, and electro rheological fluids. What these materials all have in common is the ability to act as both sensors and actuators. In some cases, when a force is applied to these smart materials, they "measure" the force, and "reverse" the process by responding with, or creating, an appropriate counter force. In other cases, the materials are populated by sensors that detect environmental conditions within the material itself. When conditions cross-designated thresholds, the materials then send a signal that is processed elsewhere in the system. For instance, "smart concrete"-under development at the State University of New York at Buffalo-would be programmed to sense and detect internal hairline fissures. If these conditions were detected, the smart material would alert other systems to avoid a structural failure. Smart materials are currently used for a growing range of commercial applications, including noise and vibration suppression (noise-canceling headphones) strain sensing (seismic monitoring of bridges and buildings) and

sensors and actuators (such as accelerometers for airbags). A number of companies, including The Electric Shoe Company and Compaq, are also exploring the use of smart materials. The Electric Shoe Company is currently producing piezoelectric power systems that generate electric power from the body's motion while walking. Compaq is investigating the production of special keyboards that generate power by the action of typing.

RAT

Anirudh Challa II B.Tech Computer Science Engineering,

What is RAT (Remote Access Trojan)?

RAT stands for Remote Access Trojan or Remote Administration Tool. It is one of the most dangerous viruses out there over the internet. Hacker can use RAT to get complete control to your computer. He can do anything with your computer. Using RAT, hacker can install key loggers and other malicious viruses remotely to your computer infect files on your system and more. It is a piece of software or program which hacker uses to get complete control of your computer. It can be send to you in form of images, videos or any other files. Even antivirus software cannot detect some RATs. So always be sure about what you are downloading from the internet and never save or download files that anonymous user send you over the mail or in chat room.

What you can do with RAT?

Once a RAT is installed on any computer, hacker can do almost anything with that computer. Some malicious tasks that you can do with RAT are listed below:

- * Infecting Files
- * Installing Key loggers
- * Controlling Computer
- * Remotely start webcam, sounds, movies etc
- * Using your PC to attack Website (DDOS)
- * View Screen

Harmless RAT or Good RAT?

As you have seen how harmful RAT are for your computer, but there are some good RAT which some of you might be using daily. You might have heard of TeamViewer, it is software, which you use to control some one's computer with his permission for file transfer, sharing your screen and more.

Some Commonly Used RAT

- * ProRAT
- * CyberGate RAT
- * DarkComet RAT

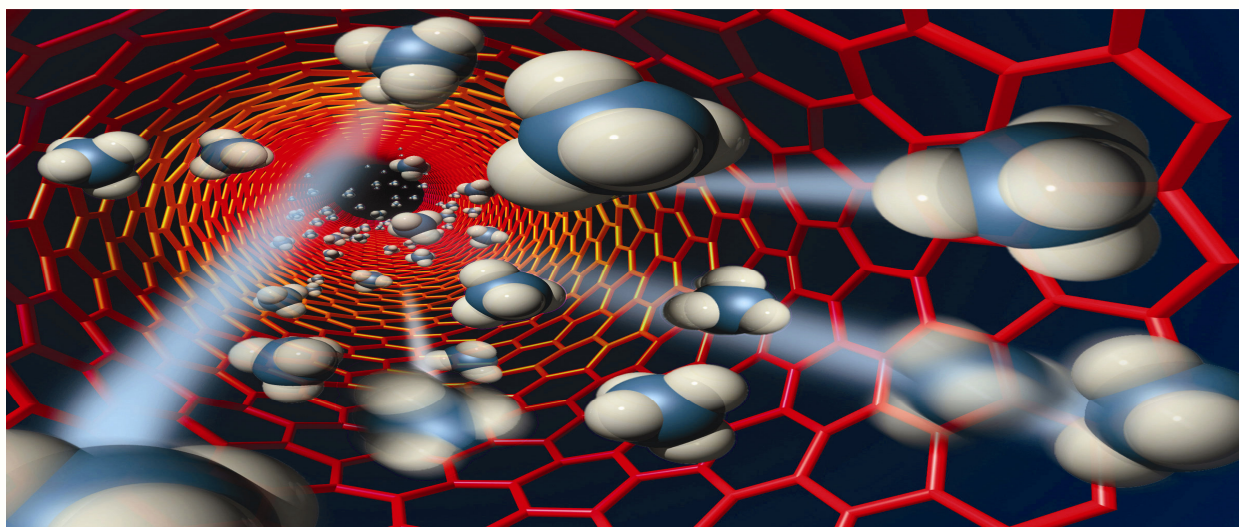
Nanotechnology for Pollution Control

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Introduction:

During the last twenty years, scientists have been looking towards nanotechnology for the answer to problems in medicine, computer science, ecology and even sports. In particular, new and better techniques for pollution control are emerging as nano particles push the limits and capabilities of technology.



Artist's rendering of methane molecules flowing through a carbon Nano tube.

Nano particles:

- These are the particles of size 1-100 nanometers in length (one nanometer being the equivalent of one billionth of a meter) hold enormous potential for the future of science.
- Their small size opens up possibilities for targeting very specific points, such as diseased cells in a body without affecting healthy cells.
- Nano particles become better at conducting heat or reflecting light.
- Nano particles can change colour.
- Some get stronger, and some change or develop magnetic properties.
- Certain plastics at the nanometer range have the strength of steel.
- Tennis racquet manufacturers already utilize Nano-silicon dioxide crystals to improve equipment performance.

These special properties and the large surface area of Nano-particles prove valuable for engineering effective energy management and pollution control techniques

Some Applications:

- If super-strength plastics could replace metal in cars, trucks, planes, and other heavy machinery, there would be enormous energy savings and consequent reduction in pollution.
- Batteries are also being improved using Nano scale materials that allow them to deliver more power faster.
- Nano-materials that absorb enough light for conversion into electrical energy have also been used to recharge batteries.
- Other environmentally-friendly technologies include energy efficient non-thermal white LED's, and Solar Stucco, a self-cleaning coating that decomposes organic pollutants using photo catalysts.

Nanotechnology and Pollution Control:

Pollution results from resource production and consumption, which in their current state are very wasteful. Most waste cannot be reintegrated into the environment effectively or cheaply. Thus, processes like petroleum and coal extraction, transportation, and consumption continue to result in photochemical smog, acid-mine drainage, oil slicks, acid rain, and fly ash. Biological systems, on the other hand, efficiently oxidize fuel through molecular-scale mechanisms without extracting the chemical energy through thermalization. Thus, nanofabrication holds much potential for effective pollution control, but it currently faces many problems that prevent it from mass commercialization — particularly its high cost.

The basic concept of pollution control on a molecular level is separating specific elements and molecules from a mixture of atoms and molecules. The current method for separating atoms is thermal partitioning, which uses heat to force phase changes. However, the preparation of reagents and the procedure itself are costly and inefficient. Current methods of energy extraction utilize combustion to create heat energy, most of which is wasted and results in unwanted byproducts that require purification and proper disposal. Theoretically, these high costs could be solved with the Nano structuring of highly specific catalysts that will be much more efficient. Unfortunately, we have yet to find an optimal way of obtaining the particles in workable form.

Current means are essentially “shake and bake” methods called wet-chemical synthesis, which allows for very limited control on the final product and may still result in unwanted byproducts.

Air Pollution

Air pollution can be remediated using nanotechnology in several ways.

- Use of Nano-catalysts with increased surface area for gaseous reactions. Catalysts work by speeding up chemical reactions that transform harmful vapors from cars and industrial plants into harmless gases. Catalysts currently in use include a Nano fiber catalyst made of manganese oxide that removes volatile organic compounds from industrial smokestacks.
- Nano structured membranes that have pores small enough to separate methane or carbon dioxide from exhaust. John Zhu of the University of Queensland is researching carbon Nano tubes (CNT) for trapping greenhouse gas emissions caused by coal mining and power generation. CNT can trap gases up to a hundred times faster than other methods, allowing integration into large-scale industrial plants and power stations.
- The substances filtered out still presented a problem for disposal, as removing waste from the air only to return it to the ground leaves no net benefits. In 2006, Japanese researchers found a way to collect the soot filtered out of diesel fuel emissions and recycle it into manufacturing material for CNT. The diesel soot is used to synthesize the single-walled CNT filter through laser vaporization.

Water Pollution:

As with air pollution, harmful pollutants in water can be converted into harmless chemicals through chemical reactions.

- Tri-chloro-ethene, a dangerous pollutant commonly found in industrial wastewater, can be catalyzed and treated by Nano particles
- The deionization method of using Nano sized fibers as electrodes are not only cheaper but also more energy efficient.
- Traditional water filtering systems use semi-permeable membranes for electro-dialysis or reverse osmosis. Decreasing the pore size of the membrane to the nanometer range would increase the selectivity of the molecules allowed to pass through. Membranes that can even filter out viruses are now available.

- Also widely used in separation, purification, and decontamination processes are ion exchange resins, which are organic polymer substrate with Nano-sized pores on the surface where ions are trapped and exchanged for other ions.
- Ion exchange resins are mostly used for water softening and water purification. In water, poisonous elements like heavy metals are replaced by sodium or potassium. However, ion exchange resins are easily damaged or contaminated by iron, organic matter, bacteria, and chlorine.

Cleaning up Oil Spills:

According to the U.S. Environmental Protection Agency (EPA), about 14,000 oil spills are reported each year. Dispersing agents, gelling agents and biological agents are most commonly used for cleaning up oil spills.

However, none of these methods can recover the oil lost. Recent developments of Nano-wires made of potassium manganese oxide can clean up oil and other organic pollutants while making oil recovery possible. These Nano wires form a mesh that absorbs up to twenty times its weight in hydrophobic liquids while rejecting water with its water repelling coating. Since the potassium manganese oxide is very stable even at high temperatures, the oil can be boiled off the nano wires and both the oil and the Nano wires can then be reused.

In 2005, Hurricane Katrina damaged or destroyed more than thirty oil platforms and nine refineries. The Interface Science Corporation successfully launched a new oil remediation and recovery application, which used the water repelling Nano wires to clean up the oil spilled by the damaged oil platforms and refineries.

Conclusion:

Nanotechnology's potential and promise have steadily been growing throughout the years. The world is quickly accepting and adapting to this new addition to the scientific toolbox. Although there are many obstacles to overcome in implementing this technology for common usage, science is constantly refining, developing, and making breakthroughs.

Artificial Intelligence

V.Chinnarao, K.Mohan Rao, II B.Tech Information Technology

Abstract:

Blindness is more feared by the public than any other ailment. Artificial **vision for the blind was once the stuff of science fiction**. Now, a limited form of artificial vision is a reality. Now we are at the end of blindness with this type of technology.

In an effort to illuminate the perpetually dark world of the blind, researchers are turning to technology. They are investigating several electronic-based strategies designed to bypass various defects or missing links along the brain's image processing pathway and provide some form of artificial sight.

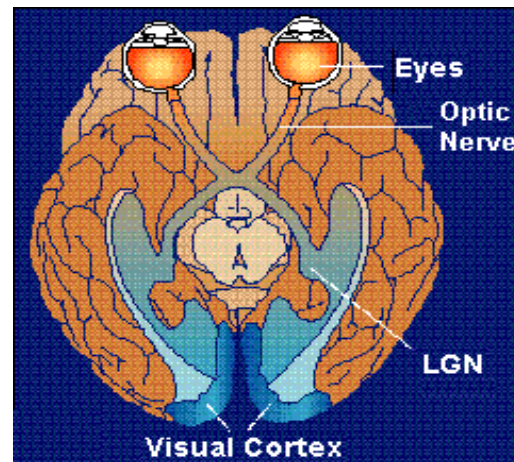
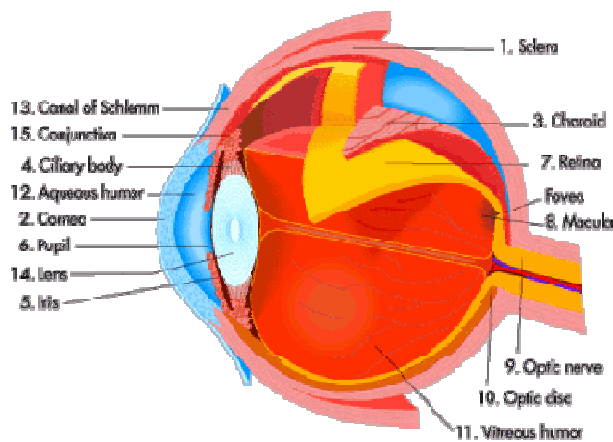
This paper is about curing blindness. Linking **electronics** and **biotechnology**, the scientists have made the commitment to the development of technology that will provide or restore vision for the visually impaired around the world.

This paper describes the development of **artificial vision system**, which cures blindness to some extent. This paper explains the process involved in it and explains the concepts of artificial silicon retina, cortical implants etc. The roadblocks that are created are also elucidated clearly. Finally the advancements made in this system and scope of this in the future is also presented clearly.

Introduction:

Artificial-vision researchers take inspiration from another device, the cochlear implant, which has successfully restored hearing to thousands of deaf people. However, the human vision system is far more complicated than that of hearing. The eye is one of the most amazing organs in the body. Before we understand how artificial vision is created, it is important to know about the important role that the retina plays in how we see. Here is a simple explanation of what happens when we look at an object:

- Scattered light from the object enters through the cornea.
- The light is projected onto the retina.
- The retina sends messages to the brain through the optic nerve.
- The brain interprets what the object is.



Figures (1, 2): the anatomy of the eye and its path view

The retina is complex in itself. This thin membrane at the back of the eye is a vital part of our ability to see. Its main function is to receive and transmit images to the brain. These are the three main types of cells in the eye that help perform this function: Rods, Cones and Ganglion Cells. The information received by the rods and cones are transmitted to the nearly 1 million ganglion cells in the retina. These ganglion cells interpret the messages from the rods and cones and send the information on to the brain by way of the optic nerve. There are a number of retinal diseases that attack these cells, which can lead to blindness. The most notable of these diseases are **retinitis pigmentosa** and **age-related macular degeneration**. Both of these diseases attack the retina, rendering the rods and cones inoperative, causing either loss of peripheral vision or total blindness. However, it has been found that neither of these retinal diseases affects the ganglion cells or the optic nerve. This means that if scientists can develop artificial cones and rods, information could still be sent to the brain for interpretation. This concept laid the foundation for the invention of the **ARTIFICIAL VISION SYSTEM** technology.

How to Create Artificial Vision?

The current path that scientists are taking to create artificial vision received a jolt in 1988, when Dr. Mark Humayun demonstrated that a blind person could be made to see light by stimulating the nerve ganglia behind the retina with an electrical current. This test proved that the nerves behind the retina still functioned even when the retina had degenerated. Based on this information, scientists set out to create a device that could translate images and electrical pulses that could restore vision. Today, such a device is very close to be available to the millions of people who have lost their vision to retinal disease. In fact, there are at least two silicon microchip devices that are being developed. The concept for both devices is similar, with each being:

- Small enough to be implanted in the eye
- Supplied with a continuous source of power
- Biocompatible with the surrounding eye tissue



Figures (3, 4) The dot above the date on this penny is the full size of the Artificial Silicon Retina.

Perhaps the more promising of these two silicon devices is the **ARTIFICIAL SILICON RETINA** (ASR). The ASR is an extremely tiny device. It has a diameter of just 2 mm (.078 inch) and is thinner than a human hair. In order for an artificial retina to work, it has to be small enough so that doctors can transplant it in the eye without damaging the other structures within the eye. Groups of researchers have found that blind people can see spots of light when electrical currents stimulate cells, following the experimental insertion of an electrode device near or into their retina. Some patients even saw crude shapes in the form of these light spots. This indicates that despite damage to cells in the retina, electronic techniques can transmit signals to the next step in the pathway and provide some form of visual sensation. Researchers are currently developing more sophisticated computer chips with the hope that they will be able to transmit more meaningful images to the brain.

How does ARTIFICIAL SILICON RETINA work?

The ASR contains about 3,500 microscopic solar cells that are able to convert light into electrical pulses, mimicking the function of cones and rods. To implant this device into the eye, surgeons make three tiny incisions no larger than the diameter of a needle in the white part of the eye. Through these incisions, the surgeons introduce a miniature cutting and vacuuming device that removes the gel in the middle of the eye and replaces it with saline. Next, a pinpoint opening is made in the retina through which they inject fluid to lift up a portion of the retina from the back of the eye, which creates a small pocket in the sub retinal space for the device to fit in. The retina is then resealed over the ASR.

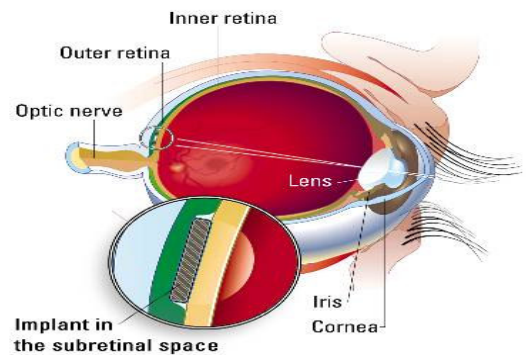
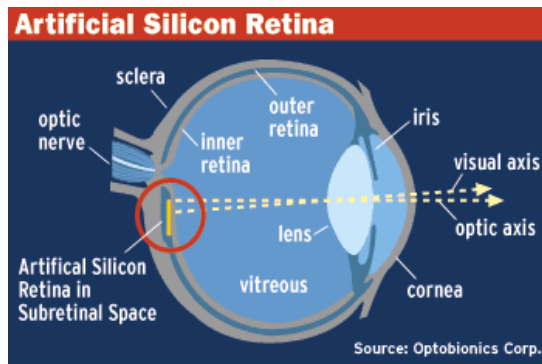


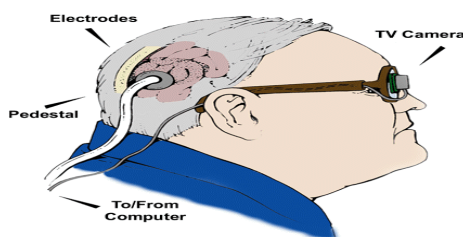
Figure 5: Here you can see where the ASR is placed between the outer and inner retinal layers.

For any microchip to work it needs power and the amazing thing about the ASR is that it receives all of its needed power from the light entering the eye. This means that with the ASR implant in place behind the retina, it receives all of the light entering the eye. This solar energy eliminates the need for any wires, batteries or other secondary devices to supply power.

Another microchip device that would restore partial vision is currently in development called the **artificial retina component chip** (ARCC); this device is quite similar to the ASR. Both are made of silicon and both are powered by solar energy. The ARCC is also a very small device measuring 2 mm square and a thickness of .02 millimeters (.00078 inch). There are significant differences between the devices, however. According to researchers, the ARCC will give blind patients the ability to see 10 by 10 pixel images, which is about the size of a single letter on this page. However, researchers have said that they could eventually develop a version of the chip that would allow 250 by 250 pixel arrays, which would allow those who were once blind to read a newspaper.

Working of Artificial Vision System:

The main parts of this system are miniature video camera, a signal processor, and the brain implants. The tiny pinhole camera, mounted on a pair of eyeglasses, captures the scene in front of the wearer and sends it to a small computer on the patient's belt. The processor translates the image into a series of signals that the brain can understand, and then sends the information to the brain implant that is placed in patient's visual cortex. In addition, if everything goes according to plan, the brain will "see" the image.



Figures (6, 7) illustrating the AV SYSTEM

Light enters the camera, which then sends the image to a wireless wallet-sized computer for processing. The computer transmits this information to an infrared LED screen on the goggles. The goggles reflect an infrared image into the eye and on to the retinal chip, stimulating photodiodes on the chip. The photodiodes mimic the retinal cells by converting light into electrical signals, which are then transmitted by cells in the inner retina via nerve pulses to the brain. The goggles are transparent so if the user still has some vision, they can match that with the new information - the device would cover about 10° of the wearer's field of vision.

The patient should wear sunglasses with a tiny pinhole camera mounted on one lens and an ultrasonic range finder on the other. Both devices communicate with a small computer carried on his hip, which highlights the edges between light and dark areas in the camera image. It then tells an adjacent computer to send appropriate signals to an array of small electrodes on the surface of patient's brain, through wires entering his skull. The electrodes stimulate certain brain cells, making the person perceive the specks of light. The shifting patterns as scans across a scene tells him where light areas meet dark ones, letting him find the black cap on the white wall, for example. The device provides a sort of tunnel vision, reading an area about the size of a card 2 inches wide and 8 inches tall, held at arm's length.

***Advancements in Creating Artificial Vision:**

Ceramic optical detectors based on the photo-ferroelectrics effect are being developed for direct implantation into the eyes of patients with **retinal dystrophies**. In retinal dystrophies where the optic nerve and retinal ganglia are intact (such as Retinitis Pigmentosa), direct retinal implant of an optical detector to stimulate retinal ganglia could allow patients to regain some sight. In such cases additional wiring to the brain cortex is not required, and for biologically inert detectors, surgical implantation can be quite direct. The detector currently being developed for this application is a thin film ferroelectric detector, which under optical illumination can generate a local photocurrent and photo voltage. The local electric current generated by this miniature detector excites the retinal neural circuit resulting in a signal at the optic nerve that may be translated by the cortex of the brain as "seeing light". Detectors based on PbLaZrTiO_3 (PLZT) and BiVMnO_3 (BVMO) films exhibit a strong photo response in visible range overlapping eye response from 380 nm to 650 nm. The thin film detector, heterostructures have been implanted into the eyes of rabbits for biocompatibility test, and have shown no biological incompatibilities. The bionic devices tested so far include both those attached to the back of the eye itself and those implanted directly in the brain. Patients with both types of implants describe seeing multiple points of light and, in some cases, crude outlines of objects. Placing electrodes in the eye has proved easier. During the past decade, work on these retinal implants has attracted growing government funding and commercial interest. Such implants zap electrical signals to nerves on the back of the eye, which then carry them to the brain. However, since these devices take advantage of surviving parts of the eye they will help only the subset of blind people whose blindness is due to retinal disease, by some estimates about 30% of the blind. Moreover, scientists do not believe any implant could help those blind since birth, because their brains never have learned to recognize vision.

What blind patients would not be able to use this device?

We believe the device will be applicable to virtually all patients who are blind or who have very low vision. The only ones contraindicated would be a few blinded by serious brain damage, or who have chronic infections, etc. that preclude surgical implants. Patients who have a small amount of vision are not contraindicated. Visual cortex stimulation seems to work the same in both sighted and blind patients.

Bottlenecks Raised by this Technology:

1. The first and foremost thing is the cost .The miniaturization of equipment and more powerful computers have made this artificial vision possible, but it is not cheap: The operation, equipment and necessary training cost \$70,000 per patient. Also may be much higher depending upon the context and severity.
2. It may not work for people blinded as children or as infants, because the visual cortex does not develop normally. However, it will work for the vast majority of the blind -- 98 to 99 percent.
3. Researchers caution, however, that artificial vision devices are still highly experimental and practical systems are many years away. Even after they are refined, the first wave will most likely provide only crude images, such as the outline of a kitchen doorway. It does not function as well as the real eye, and does not have crystal-clear vision (as it is only a camera).The device is a very limited navigational aid, and it is very different from the visual experience normal people enjoy.

The earliest stage of visual processing is the transduction of light into electrical signals by the **photoreceptors**. If this is the only process that is interrupted in a blind individual, he or she may benefit from a **Sub-Retinal Prosthesis**, a device that is designed to replace only the photoreceptors in the retina. However, if the **Optic Nerve** itself is damaged, the only possibility for restoring sight is to directly stimulate the visual cortex. **Cortical prosthesis** is designed specifically for this task. Although the categories presented account for most of the research in Artificial Vision, there are a few more exotic techniques being developed. One of these is the **BioHybrid Implant** a device that incorporates living cells with man-made elements. Regardless of the specific design, all of these devices are working towards the same goal-- a permanent replacement for part of the human visual system.

Conclusion:

The electronic eye is the latest in high-tech gadgets aimed at helping millions of blind and visually impaired people. Although the images produced by the artificial eye were far from perfect, they could be clear enough to allow someone who is otherwise blind to recognize faces. The first useful artificial eye is now helping a blind man walk safely around and read large letters. Several efforts are now underway to create vision in otherwise blind eyes. While technically exciting, much more work in this area needs to be completed before anything is available to the majority of patients. Research is ongoing in two areas: cortical implants and

retinal implants. There is still an enormous amount of work to be done in developing artificial retinas. In recent years, progress is being made towards sensory distribution devices for the blind. In the end, there could be the possibility of brain implants. A brain implant or cortical implant provides visual input from a camera directly to the brain via electrodes in contact with the visual cortex at the backside of the head.

5 Pen PC Technologies

Titti Sireesha, II MCA,

Introduction:

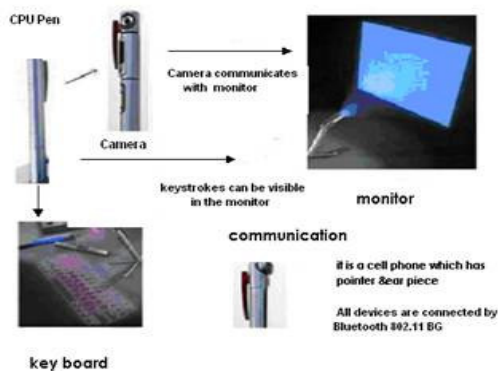
P-ISM ("Pen-style Personal Networking Gadget Package"), which is nothing but the new discovery, which is under developing, stage by NEC Corporation. P-ISM is a gadget package including five functions: a pen-style cellular phone with a handwriting data input function, virtual keyboard, a very small projector, camera scanner, and personal ID key with cashless pass function. P-ISMs are connected with one another through short-range wireless technology. The whole set is also connected to the Internet through the cellular phone.



ISM

P-ISM is a gadget package including five functions: a pen-style cellular phone with a handwriting data input function, virtual keyboard, a very small projector, camera scanner, and personal ID key with cashless pass function. P-ISMs are connected with one another through short-range wireless technology. The whole set is also connected to the

Internet through the cellular phone function. This personal gadget in a minimalistic pen style enables the ultimate ubiquitous computing. The P-ISM system was based on "low-cost electronic perception technology" produced by the San Jose, California, firm of Canasta, Inc., developers of technologies such as the "virtual keyboard".



In fact, no-one expects activity on 802.11n installations until the middle of 2008. "Rolling out 802.11n would mean a big upgrade for customers who already have full Wi-Fi coverage, and would be a complex add-on to existing wired networks, for those who haven't. Bluetooth is widely used because we can able to transfer data or make connections without wires. This is very effective because we can able to connect whenever we need without having

wires. They are used at the frequency band of 2.4 GHz ISM (although they use different access mechanisms). Blue tooth mechanism is used for exchanging signal status information between two devices.

This techniques have been developed that do not require communication between the two devices (such as Blue tooth's Adaptive Frequency Hopping), the most efficient and comprehensive solution for the most serious problems can be accomplished by silicon vendors. They can implement information exchange capabilities within the designs of the Blue tooth. The circuit diagram for the 802.11B/G is given below. It is nothing but also type of Blue tooth. Using this connectivity we can also connect it with the internet and can access it anywhere in the world.

LED Projector:

The role of monitor is taken by LED Projector which projects on the screen. The size of the projector is of A4 size. It has the approximate resolution capacity of 1024 X 768. Thus it is gives more clarity and good picture.

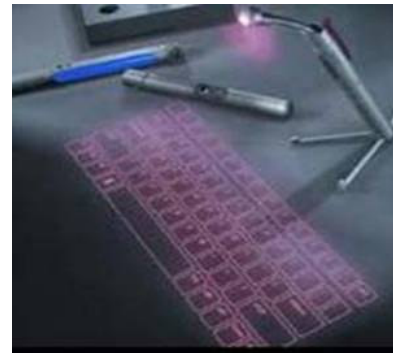
Virtual Keyboard:



The Virtual Laser Keyboard (VKB) is the ULTIMATE new gadget for PC users. The VKB emits laser on to the desk where it looks like the keyboard having QWERTY arrangement of keys i.e., it uses a laser beam to generate a full-size perfectly operating laser keyboard that smoothly connects to of PC and Most of the handheld devices (PDA's, tablet PC's). The I-Tech laser keyboard acts exactly like any other "ordinary" keyboard:

Features of virtual keyboards are:

VKB settings can be changed by Sound:
Controllable Virtual Keyboard sound effects (key clicks)
Connection: Connection to the appropriate Laptop/PC port
Intensity: Intensity of the projected Virtual Keyboard
Timeouts: coordinated timeouts to conserve the Virtual Keyboard's battery life
Sensitivity: adjustable sensitivity of the Virtual Keyboard
Auto-repeat: Allows the VKB to automatically repeat a key based on prescribed parameters.



Digital Camera:

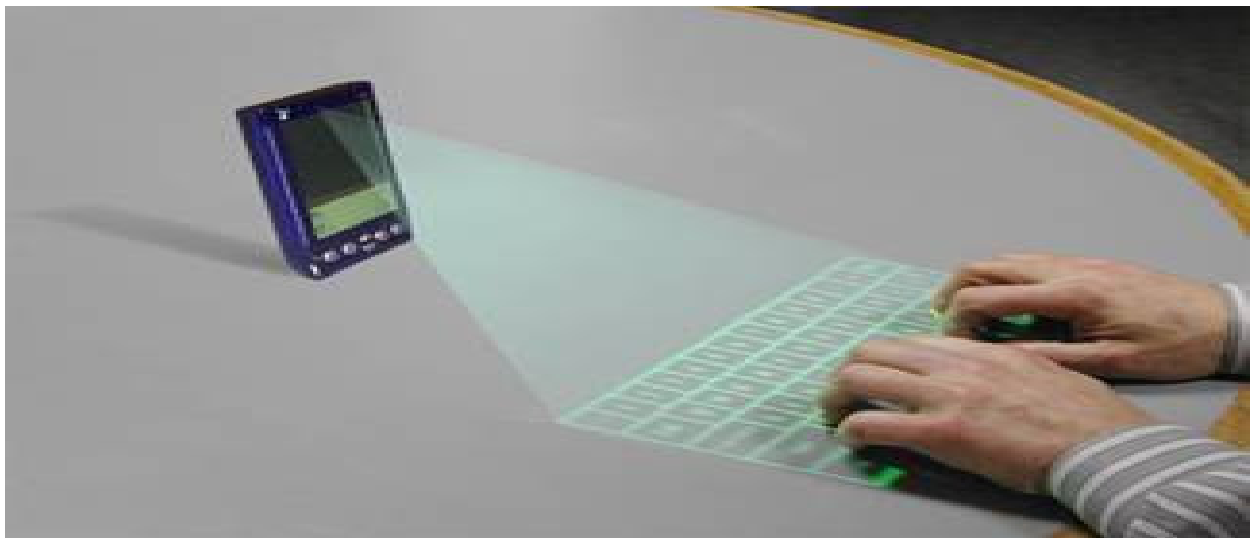
We had digital camera in the shape of pen .It is useful in video recording, video conferencing, simply it is called as web cam. It is also connected with other devices through Blue tooth. The major advantage it is small which is easily portable. It is a 360-Degree Visual Communication Device. We have seen video phones hundreds of times in movies. However, why can't we act naturally in front of videophone cameras? Conventional visual communications at a distance

have been limited due to the display devices and terminals. This terminal enables showing of the surrounding atmosphere and group-to-group communication with a round display and a central super-wide-angle camera.

Battery:

The most important part in the portable type of computer is its battery. Usually batteries must be small in size and work for longer time. It comes with a battery life of 6+. For normal use it can be used for 2 weeks.

This 'pen sort of instrument' produces both the monitor as well as the keyboard on any flat surfaces from where you can carry out functions you would normally do on your desktop computer.

**Conclusion:**

The communication devices are becoming smaller and compact like pen pc.