



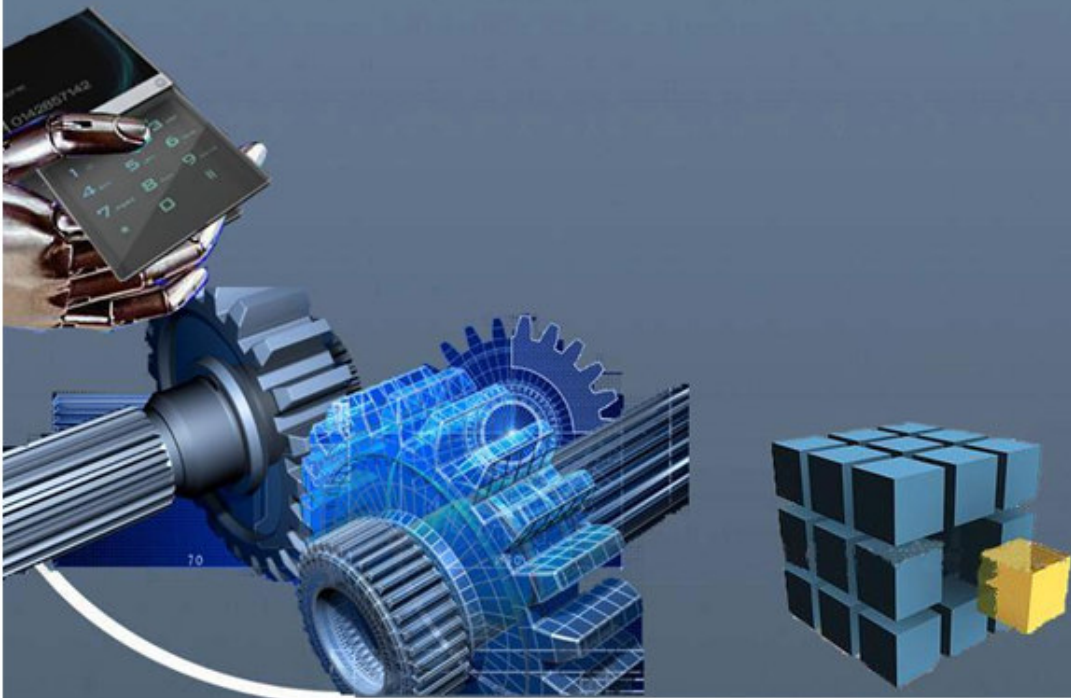
GMARIT



GMARIT TECHMAG

Vol: 5

April-2011



A few selected Photos will be pasted (Cover page back side view)

TechMag 2011

TechMag- GMRIT

Vol . 5

April 2011

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Foreword (First Draft)

**Dr. C.L.V.R.S.V.PRASAD,
Principal, GMRIT, Rajam**

Principal's photo



Reverse side of Foreword (No matter will be printed)

MODEL FOR PRODUCTION OF FRESH WATER FROM RAW WATER USING HUMIDIFICATION & DEHUMIDIFICATION TECHNIQUES

N.G.P. Jawahar, S. Tulasi Rani, G. Srinivasa Rao, R. Naresh and Upendra Naidu

IV/IV - B-Tech, Department of Chemical Engineering

Water is known as the elixir of life and vital commodity for the sustenance of human activities. Water has a deep influence on the development and progress of mankind. So a special technique that is based on the production of fresh water using humidification and dehumidification is used for making the water potable. The present model is used to take input both raw impure water and saline water. Desalination refers to a process where salt water is converted to fresh or drinkable water. Different methods used for this purpose are Multi stage flash distillation, multiple effect distillation, vapour compression distillation, electro dialysis, reverse osmosis, freezing, solar humidification and membrane distillation. In nature, desalination occurs by water cycle. In this present project it is tried to mimic this natural cycle by using humidification and dehumidification cycle in the model.

PROCESS SETUP:

- | | | |
|-------------------|---------------|---------------------------------------|
| 1) Air blower | 2) Air heater | 3) Humidification column (humidifier) |
| 4) Water sprinkle | 5) Water pump | 6) Dehumidifier |

AIR HEATER: Material of construction is copper, Length of heater = 60 cm

HUMIDIFIER: A humidifier is provided where an unsaturated hot air is sent and the air is humidified by making contact with sprinkling raw water. The air water contact is made counter currently. The air is maintained at specific temperature using air heater and unsaturated air is sent through humidifier and made saturated.

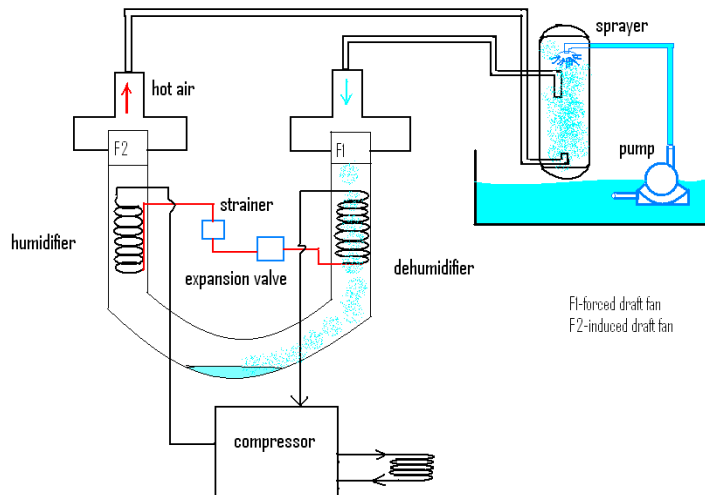
Material of constriction is PVC pipe, Height of humidifier column = 76.5 cm

Outer diameter of humidifier = 16cm, Inner diameter of humidifier = 15.5cm

DEHUMIDIFIER:

Material of construction = Copper coil, Length of Copper coil = 400cm (4meters)

Capillary tube length = 304.8 cm, Capillary diameter = 0.5 cm



PROCESS: As shown in process flow diagram the preheated air was sent to the humidification column to be humidified with the raw tap water. The required latent heat of vaporization is provided by transfer of sensible heat of the gas phase to liquid along with water vapour migration from the liquid phase. The process involves in the saturation of the unsaturated air by passing through a humidifier where the hot air in contact with raw water counter- currently and air gets humidified next sent through the dehumidifier and humid air condenses.

HUMIDIFICATION AND DEHUMIDIFICATION DESALATION HIGHLIGHTS

1. Humidification-Dehumidification desalination process viewed as a promising technique for small capacity production plant.
2. The process has several attractive features such as
 - Operation at low temperature and atmospheric pressure.
 - Ability to combine with sustainable energy sources such as Solar energy, Geothermal energy, Requirements of low level of technical features.

The humidification-dehumidification process is an interesting technique, which has been adapted for water desalination. Where air and water contact is in counter-current fashion.

CONCLUSION:

The present method of fresh water production produced 80 ml of water in 15 minutes when maintained at above conditions. The water thus produced is to be analysed with sophisticated equipments for the presence of any special type of impurities. The present system of humidification and dehumidification technique for fresh water production especially for desalination makes use of the present model and can be replaced with the other contemporary methods, also scale up the present model to improve the efficiency in near future.

CYBORGS EVOLUTION

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How does it feel to shake hands with an ex-cyborg, a man who has gone through the experience of being part-human part-robot in the past?

Well, the experience is tempered down somewhat when you hear Kevin Warwick joking about his own experiments with artificial intelligence at the University of Reading, UK. Kevin Warwick imagines a day when humans will speak to each other not in words but in thought. A time when people will be able to upgrade their own intelligence and even take vacations in faraway lands just by downloading them directly to their brains.

To Warwick, this is no science-fiction fantasy. This is the reality of the not-too-distant future - a time when humans have brain implants connecting them to the vastly superior intellectual powers of computers.

He believes this cyborg evolution is inevitable and vital to our very survival as a species.

"I've been a cyborg for three months," he says, rolling his eyes and adding a la Arnold Schwarzenegger in 'Terminator', "And I'll be back."

The story so far goes that Kevin Warwick, who shocked the scientific world so much when he inserted a silicon chip in his forearm and connected himself to a computer in 1998, that when he actually connected his nervous system to a robot via the Internet to turn himself into a cyborg four years later, the world simply sat back to watch his experiments. Was the experiment successful? "Well, it definitely let me realise a few of my dreams of



communicating directly without speaking," he replies.

"My nervous system was connected, from where I was in New York, to a robot in UK through the Internet, and I could actually move the robot's hand by moving my hand. The experience worked vice versa too. In the sense, that when the robot gripped any object, I could sense the pressure thousands of miles away."

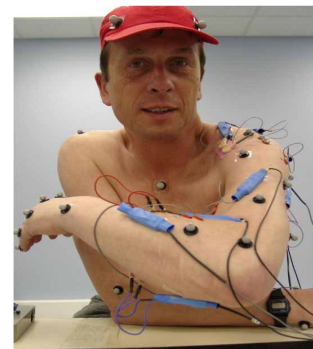
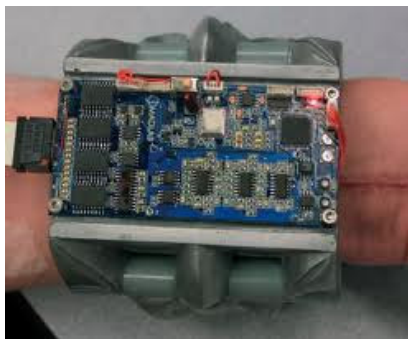
Mr Warwick roped in his wife, Irena, to test his theory that communication between two people need not be through the old-fashioned way of speech.

"She had electrodes put into her hand, so that every time I moved, the signal from my nervous system reached hers directly," he explains. "It was exciting to feel my nerves go 'ting ting' each time she moved, miles and miles away from me." Mr Warwick's current project involves developing a robot which has five senses—besides having vision and hearing, it has a radar noise, an infra-red sensitive lip and an ultrasonic sensitive forehead.

As far as human experimentation goes, a patient of multiple sclerosis has volunteered to have his brain connected to a computer, which will help him to do simple motor functions around the house and drive a car.

He says, he will be experimenting personally with a brain transplant after 10 years. "Technically I know it's possible to communicate what we're thinking directly into the brain of another person. This implant may help me prove it." Says he... As for the dangers of self-experimentation, Mr Warwick argues that he knows the risks, but he isn't the first since scientists have done this through history.

"Scientists have swallowed cholera-causing bacteria, inserted catheters in their hearts, etc," he says. "I know I could have lost the use of my hand if anything had gone wrong with my nervous system implant. But I chose to take the risk. And no, right now there's no worldwide ethical body to stop me from doing so."



What is the purpose behind his dogged work on cybernetics, which began 15 years ago when he made his first simple robot? "Well, let's accept it, in another 30 years, we are going to have machines and computers that will be more intelligent than human beings," he replies.

"In an ideal world, it would be nice to say that we should be careful about how much intelligence we put in robots. But in the real world, there will always be people who will put

in superior intelligence in robots, especially military robots. In such a scenario, it makes sense to upgrade the human brain too, in order to keep up. I believe that in the future humans will become cyborgs and no longer be stand-alone entities.”

A pioneer in this area of research is John Chapin, director of the Center for Neurorobotics and Neuroengineering at the State University of New York. His focus is on having the brain instruct robotic limbs so that people who are paralysed can one day regain function of their arms or legs. He is hoping to devise a system that will allow limbs not only to respond to thought commands, but to send sensory information back to the brain - restoring the feeling of touch.

He agrees that it will be possible - at least in theory - for the human brain and computers to link on a wide scale, that the technology will grow beyond helping people with disabilities.

"That being the case, whether or not it can ever really be done ethically or technologically is a totally different story," he says, wondering aloud how the brain would have to be wired up to talk to the computer. "How many electrodes do you need? You might need tens of thousands. You'd almost have to wait for some sort of non-invasive technique to become available to do that."

REVOLUTIONS OF WEB

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Web technologies are playing the leading role in world wide web includes many latest evolutions in it web Services Web2.0, Web3.0, HTML, XHTML, XML, CSS2.0, RSSetc. Web technologies relate to the interface between web servers and their clients. Web technology aims to enhance creativity, secure information, sharing, collaboration and functionality of the web.

WEB 1.0: The first implementation of the web represents the Web 1.0, could be considered the "read-only web." The early web allowed us to search for information and read it. There was very little in the way of user interaction or content contribution.

This is exactly what most website owners wanted: Their goal for a website was to establish an online presence and make their information available to anyone at any time.

WEB 2.0: Web2.0 is the revolutionary technology that is allowing users to interact with the data available .Web2.0 is the business revolution which led to the development and evolution of many web culture communities and hosted many services.

Web 2.0 websites allow users to do more than just retrieve information. They provide the user with more user-interface, software and storage facilities, all through their browser. This has been called "Network as platform" computing. Users can provide the data that is on a Web 2.0 site and exercise some control over that data. These sites may have an "Architecture of participation" that encourages users to add value to the application as they use it.

WEB 3.0 -- will make tasks like your search for movies and food faster and easier. Instead of multiple searches, you might type a complex sentence or two in your Web 3.0 browser, and the Web will do the rest. In our example, you could type "I want to see a funny movie and then eat at a good Mexican restaurant. What are my options?" The Web 3.0 browser will analyze your response, search the Internet for all possible answers, and then organize the results for you.

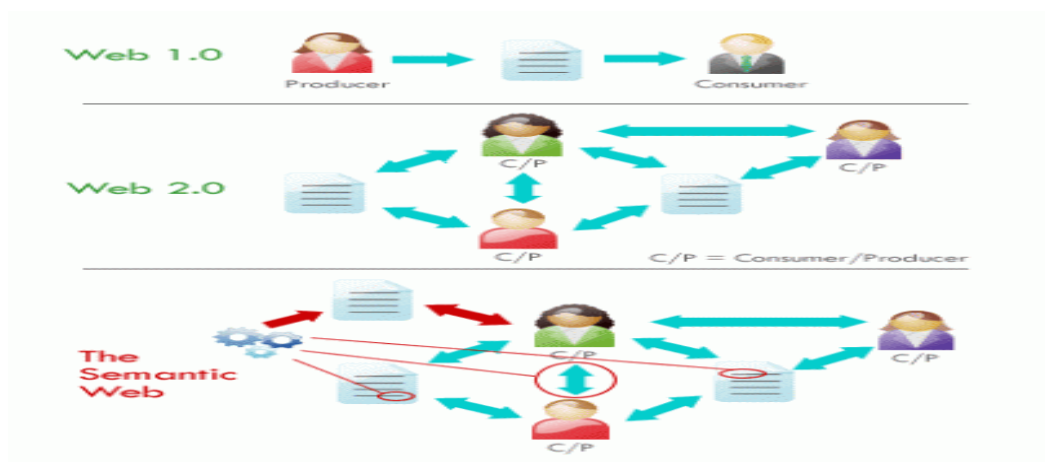
That's not all. Many of these experts believe that the Web 3.0 browser will act like a personal assistant. As you search the Web, the browser learns what you are interested in. The more you use the Web, the more your browser learns about you and the less specific you'll need to be with your questions. Eventually you might be able to ask your browser open questions like

"where should I go for lunch?" Your browser would consult its records of what you like and dislike, take into account your current location and then suggest a list of restaurants.

WEB 3.0 AS SEMANTIC WEB: There is a lot of work going to make Web3.0 as semantic web, where all information is categorized and stored that a computer and human can understand it.

Semantic Web is a group of methods and technologies to allow machines to understand the meaning – or "semantics" – of information on the World Wide Web.

The evolution of Semantic Web will specifically make possible scenarios that were not otherwise, such as allowing customers to share and utilize computerized applications simultaneously in order to cross reference the time frame of activities with documentation and/or data.

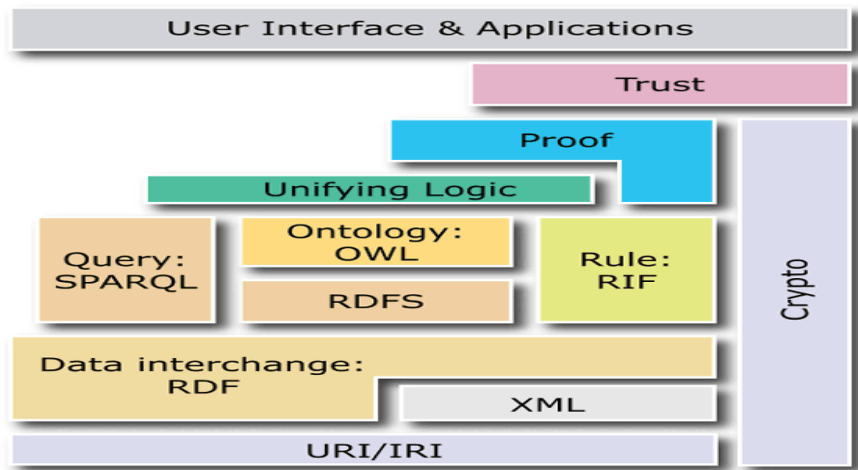


An example of a tag that would be used in a non-semantic web page: `<item>cat</item>`

Encoding similar information in a semantic web page might look like this: `<item rdf:about="http://dbpedia.org/resource/Cat">Cat</item>`

Humans are capable of using the Web to carry out tasks such as finding the Irish word for "folder," reserving a library book, and searching for a low price for a DVD through semantic web.

It involves publishing in languages specifically designed for data: Resource Description Framework(RDF), Web Ontology Language(OWL), and Extensible Markup Language (XML). HTML describes documents and the links between them. RDF, OWL, and XML, by contrast, can describe arbitrary things such as people, meetings, or airplane parts.



- XML provides a surface syntax for structured documents, but imposes no semantic constraints on the meaning of these documents.
- XML Schema is a language for restricting the structure of XML documents and also extends XML with data types.
- RDF is a data model for objects ("resources") and relations between them provides a simple semantics for this data model, and these data models can be represented in an XML syntax.
- RDF Schema is a vocabulary for describing properties and classes of RDF resources, with a semantics for generalization-hierarchies of such properties and classes.

OWL sublanguages

- The W3C-endorsed OWL specification includes the definition of three variants of OWL, with different levels of expressiveness. These are OWL Lite, OWL DL and OWL Full (ordered by increasing expressiveness). Each of these sublanguages is a syntactic extension of its simpler predecessor.
- Every legal OWL Lite ontology is a legal OWL DL ontology.
- Every legal OWL DL ontology is a legal OWL Full ontology.
- Every valid OWL Lite conclusion is a valid OWL DL conclusion.
- Every valid OWL DL conclusion is a valid OWL Full conclusion.

OWL abstract syntax:

- This high level syntax is used to specify the OWL ontology structure and semantics.
- The OWL abstract syntax presents an ontology as a sequence of annotations, axioms and facts. Annotations carry machine and human oriented meta-data. Information about the classes, properties and individuals that compose the

ontology is contained in axioms and facts only. Each class, property and individual is either anonymous or identified by an URI reference.

OWL2 functional syntax

- This syntax closely follows the structure of OWL2 ontology. It is used by OWL2 to specify semantics, mappings to exchange syntaxes and profiles.

There is no single correct ontology for any domain. Ontology design is a creative process and no two ontologies designed by different people would be the same. The potential applications of the ontology and the designer's understanding and view of the domain will undoubtedly affect ontology design choices. "The proof is in the pudding"—we can assess the quality of our ontology only by using it in applications for which we designed it.

“GROWING GENERATION SCALING NEW HORIZONS”

----- **“DNA COMPUTING”**

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A DNA computer is a molecular computer that works biochemically. It "computes" using enzymes that react with DNA strands, causing chain reactions. The chain reactions act as a kind of simultaneous computing or *parallel processing*, whereby many possible solutions to a given problem can be presented simultaneously with the correct solution being one of the results.

Most people think of a computer today as a machine that can generate word processing, produce spread sheets, display graphics, cruise the Internet and play MP3 files. However, at its core, it is a collection of electronic impulses working across silicon-based circuitry.

Electronic computers store information in binary form, then reassemble and interpret that information in a meaningful way. A DNA computer has the same basic ability to store information and compute solutions, though its methodology is different in that it works off molecular automations, or preset reactions. Its greatest potential benefits might lie in different areas than those of electronic computers.

A DNA computer is a tiny liquid computer — DNA in solution -- that could conceivably do such things as monitor the blood in vitro. If a chemical imbalance were detected, the DNA computer might synthesize the needed replacement and release it into the blood to restore equilibrium. It might also eliminate unwanted chemicals by disassembling them at the molecular level, or monitor DNA for anomalies. This type of science is referred to as nanoscience, or nanotechnology, and the DNA computer is essentially a nanocomputer.

“KNOW ABOUT DNA.....” Before discussing DNA Computing, it is important to first understand the basic structure of a molecule of DNA.

- DNA stands for deoxy-ribo-nucleic acid and it acts as a genetic code in almost all living organisms present on this planet.
- Structure of DNA is double stranded helix ; strands are anti-parallel to each other and are made up of millions of bases(nucleotides).
- Each strand contains many different combinations of 4 bases of nucleotides such as Adenine(A) , Thymine(T) , Cytosine(C) and Guanine(G).

“WHY IS DNA UNIQUE COMPUTATIONAL ELEMENT? “

- Extremely dense information storage.

A normal CD can hold 800 MB of data. 1 gram of DNA can hold about $1 \times (10)^{14}$ MB of data. The number of CD's required to hold this amount of information, lined up edge to edge, would circle the earth 375 times and would take 1,63,000 centuries to listen to !!!

- Enormous parallelism

A test tube of DNA can contain trillions of strands.

Each operation on a test tube of DNA is carried out on all strands in the test tube in parallel.

Check this out.....

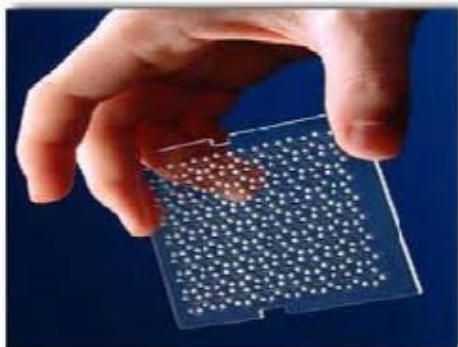
We typically use : 300,000,000,000,000 molecules at a time.

- Extraordinary efficiency

Adleman “the father of DNA computing” figured his computer was running $2 \times (10)^{19}$ operations per joules.

: 20,000,000,000,000,000 operations per joule.

SILICON MICRO PROCESSORS vs DNA MICRO PROCESSORS



Silicon microprocessors have been the heart of the computing world for more than 40 years. In that time, manufacturers have crammed more and more electronic devices onto their microprocessors. In accordance with Moore's Law, the number of electronic devices put on a microprocessor

has doubled every 18 months. Moore's Law is named after Intel founder Gordon Moore, who predicted in 1965 that microprocessors would double in complexity every two years. Many have predicted that Moore's Law will soon reach its end, because of the physical speed and miniaturization limitations of silicon microprocessors.

DNA computers have the potential to take computing to new levels, picking up where Moore's Law leaves off. There are several advantages to using DNA instead of silicon:

- As long as there are cellular organisms, there will always be a supply of DNA.
- The large supply of DNA makes it a cheap resource.
- Unlike the toxic materials used to make traditional microprocessors, DNA biochips can be made cleanly.
- DNA computers are many times smaller than today's computers.

DNA's key advantage is that it will make computers smaller than any computer that has come before them, while at the same time holding more data. One pound of DNA has the capacity to store more information than all the electronic computers ever built;- and the computing power of a teardrop-sized DNA computer, using the DNA logic gates, will be more powerful than the world's most powerful supercomputer. More than 10 trillion DNA molecules can fit into an area no larger than 1 cubic centimetre(0.06 cubic inches).

With this small amount of DNA, a computer would be able to hold 10 terabytes of data, and perform 10 trillion calculations at a time. By adding more DNA, more calculations could be performed.

Unlike conventional computers, DNA computers perform calculations parallel to other calculations. Conventional computers operate linearly, taking on tasks one at a time. It is parallel computing that allows DNA to solve complex mathematical problems in hours, whereas it might take electrical computers hundreds of years to complete them.



THE FUTURE AWAITS.....

The first DNA computers are unlikely to feature word processing, e-mailing and solitaire programs. Instead, their powerful computing power will be used by national governments for cracking secret codes, or by airlines wanting to map more efficient routes. Studying DNA computers may also lead us to a better understanding of a more complex computer -- the human brain.

BIOMETRICS

Vanama. Raja Jagannadh

3rd ECE ,08-4c1,GMRT

The Biometric Society is "devoted to the mathematical and statistical aspects of biology".

Our system uses infrared light to look into an individual's hand, like an x-ray it uses this image to compare to a computer database allowing access to a room, data, or a network. When someone grabs our device, infrared light takes a digital picture of the inside of an individual's hand. A computer then analyzes the data and since no two hands are alike, the computer can make a positive identification of that individual.

Retinal-Scan— People are very reluctant to put their eye on a scanner, even though it's safe. There are also problems with monthly menstrual cycles in women, and diseases such as diabetes.

Voice Recognition— Digital voice recording can be done very easily on an individual thus allowing you to duplicate a person's voice very easily.

Geometric Hand Measuring—Just as in voice recognition devices the external dimensions of the hand can be duplicated and clocked in as another person.

Fingerprint Mapping—We can make a false finger that will be read by most fingerprint systems with 5¢ of Latex and one half hour for the Latex to dry.

Face Recognition---I'm sure it's getting better. One computer magazine author used a picture of him and cut a hole for his nose, and walked through the system.

Hand-Scan-- Hand scan, also known as hand geometry, is a biometric authentication technology, which dominates an important segment of the biometric industry- access control and time and attendance. Hand-scan reads the top and sides of the hands and fingers, using such metrics as the height of the fingers, distance between joints, and shape of the knuckles. Although not the most accurate physiological biometric, hand scan has proven to be an ideal solution for low- to mid-security applications where deterrence and convenience are as much a consideration as security and accuracy.

Signature Scan---Signature scan, also known as Dynamic Signature Verification, is a biometric technology, which has not seen broad usage, but may soon help address the very large demand for document authentication. Measuring the manner in which one signs his or her signature or password, signature scan looks for stroke order, speed, pressure, and other factors which relate to the actual behavior of signing a tablet. Although not yet a very

accurate behavioral biometric, signature scan has drawn significant interest from software companies looking to develop non-repudiated document trails.

HAND-SCAN:

Geometric Hand Measuring—The external Hand scans, also known as hand geometry, is a biometric authentication technology, which dominates an important segment of the biometric industry - access control, time and attendance. Hand-scan reads the top and sides of the hands and fingers, using such metrics as the height of the fingers, distance between joints, and shape of the knuckles. Although not the most accurate physiological biometric, hand scan has proven to be an ideal solution for low- to mid-security applications where deterrence and convenience are as much a consideration as security and accuracy.

The system uses infrared light to look into an individual's hand, like an x-ray it uses this image to compare to a computer database allowing access to a room, data, or a network. When someone grabs the device, infrared light takes a digital picture of the inside of an individual's hand. A computer then analyzes the data and since no two hands are alike, the computer can make a positive identification of that individual.



FINGER-SCAN:

Finger-scan technology is the most prominent biometric authentication technology, one used by millions of people worldwide. Used for decades in forensic applications, finger-scan technology is steadily gaining acceptance in fields as varied as physical access, network security, public services, e-commerce, and retail. Although more accurate technologies exist, finger-scan is still considered highly accurate; although the technology still bears a slight stigma from the use of fingerprinting, its acceptance rate among current users is exceptionally

high; and although less expensive technologies exist, prices have dropped to the point that the average home user can control his or her PC with a peripheral finger-scan device.

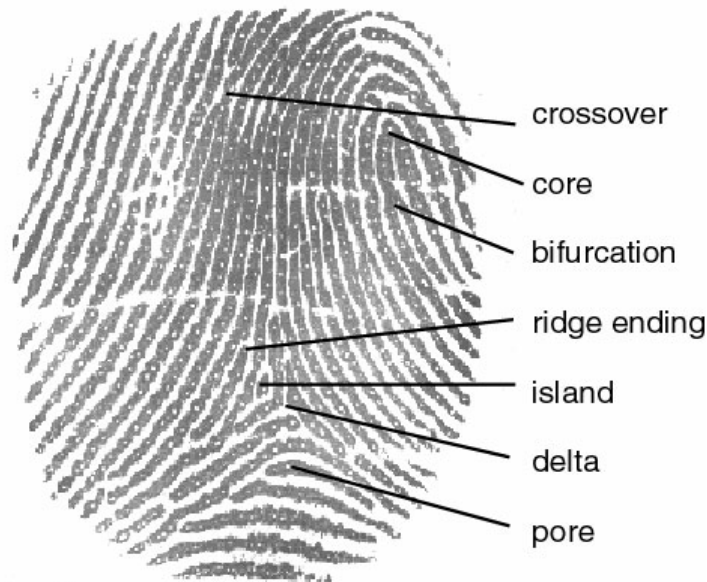


Figure 1

FACIAL-SCAN:

Just as with hand scan biometrics, there are various methods by which facial scan technology recognizes people. All share certain commonalities, such as emphasizing those sections of the face which are less susceptible to alteration, including the upper outlines of the eye sockets, the areas surrounding one's cheekbones, and the sides of the mouth. Most technologies are resistant to moderate changes in hairstyle, as they do not utilize areas of the face located near the hairline. All of the primary technologies are designed to be robust enough to conduct 1-to-many searches, that is, to locate a single face out of a database of thousands, even hundreds of thousands, of faces.

The system designs for facial scan verification vs. identification differ in a number of ways. The primary difference is that identification does not require a claimed identity. Instead of employing a PIN or user name, then delivering confirmation or denial of the claim, identification systems attempt to answer the question "Who am I?" If there are only a handful of enrollees in the database, this requirement is not terribly demanding; as databases grow very large, into the tens and hundreds of thousands, this task becomes much more difficult. The system may only be able to narrow the database to a number of likely candidates, and then require human intervention at the final verification stages.



A second variable in identification is the dynamic between the target subjects and capture device. In verification, one assumes a cooperative audience, one comprised of subjects who are motivated to use the system correctly. Facial scan systems, depending on the exact type of implementation, may also have to be optimized for non-cooperative and uncooperative subjects. Non-cooperative subjects are unaware that a biometric system is in place, or don't care, and make no effort to either be recognized or to avoid recognition. Uncooperative subjects actively avoid recognition, and may use disguises or take evasive measures. Facial scan technologies are much more capable of identifying cooperative subjects, and are almost entirely incapable of identifying uncooperative subjects.

Automatic Face Processing (AFP) is a more rudimentary technology, using distances and distance ratios between easily acquired features such as eyes, end of nose, and corners of mouth. Though overall not as robust as eigenfaces, feature analysis, or neural network, AFP may be more effective in dimly lit, frontal image capture situations.

IRIS-SCAN:

Iris identification technology is a tremendously accurate biometric. Only retinal scan can offer nearly the security that iris scan offers, and the interface for retina scan is thought by many to be more challenging and intrusive. More common biometrics provides reasonably accurate results in verification schematics, whereby the biometric verifies a claimed identity, but they cannot be used in large-scale identification implementations like iris recognition.

Biometrics, the use of a physiological or behavioral aspect of the human body for authentication or identification, is a rapidly growing industry. Biometric solutions are used successfully in fields as varied as e-commerce, network access, time and attendance, ATM's, corrections, banking, and medical record access. Biometrics' ease of use, accuracy, reliability, and flexibility are quickly establishing them as the premier authentication technology.

Iris recognition leverages the unique features of the human iris to provide an unmatched identification technology. So accurate are the algorithms used in iris recognition that the entire planet could be enrolled in an iris database with only a small chance of false acceptance or false rejection.

The technology also addresses the FTE (failure to enroll) problems, which lessen the effectiveness of other biometrics. The tremendous accuracy of iris recognition allows it, in many ways, to stand apart from other biometric technologies. All iris recognition technology is based on research and patents held by Dr. John Daugman.



Iris recognition can also account for those ongoing changes to the eye and iris, which are defining aspects of living tissue. The pupil's expansion and contraction, a constant process separate from its response to light, skews and stretches the iris. The algorithm accounts for such alteration after having located the boundaries of the iris. Dr. Daugman draws the analogy to a "homogenous rubber sheet" which, despite its distortion, retains certain consistent qualities. Regardless of the size of the iris at any given time, the algorithm draws on the same amount of data, and its resultant Iris Code is stored as a 512-byte template. A question asked of all biometrics is their ability to determine fraudulent samples. Iris recognition can account for this in several ways: the detection of papillary (pupil) changes; reflections from the cornea; detection of contact lenses atop the cornea; and use of infrared illumination to determine the state of the sample eye tissue.

RETINAL-SCAN:

Iris identification technology is a tremendously accurate biometric. Only retinal scan can offer nearly the security that iris scan offers, and the interface for retina scan is thought by many to be more challenging and intrusive. More common biometrics provides reasonably

accurate results in verification schematics, whereby the biometric verifies a claimed identity, but they cannot be used in large-scale identification implementations like iris recognition.

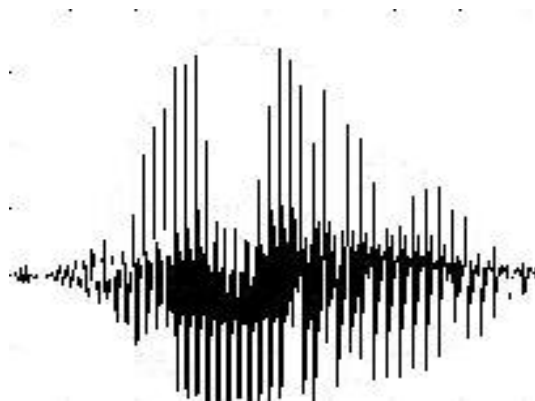
Retina scan devices read through the pupil - this requires the user to situate his or her eye within 1/2 inch of the capture device, and to hold still while the reader ascertains the patterns. The user looks at a rotating green light as the patterns of the retina are measured at over 400 points. By comparison, a fingerprint may only provide 30-40 distinctive points (minutia) to be used in the enrollment, template creation, and verification process. This leads to a very high level of accuracy in comparison to most other biometrics.

No reliable statistics are available regarding the Failure to Enroll rate, or the number of users who are simply unable to perform an acceptable enrollment. Based on experience, it is fair to conclude that a statistically significant number of people, perhaps 5-10%, may be unable to perform a satisfactory enrollment.



VOICE RECOGNITION:

Voice scan, also known as voice or speaker verification, is a biometric authentication technology well suited for a handful of applications and systems in which other biometric technologies would be difficult to use. Making use of distinctive qualities of a person's voice, some of which are behaviorally determined and others of which are physiologically determined, voice scan is deployed in areas such as call centers, home imprisonment, banking, account access, home PC and network access, and many others.



Voice-scan is most often deployed in environments where the voice is already captured, such as telephony and call centers. If users become accustomed to speaking to their

PC, especially in speech-to-text applications, voice-scan may also become a solution for PC and web access.

SIGNATURE- SCAN:

Signature scan, also known as Dynamic Signature Verification, is a biometric technology which has not seen broad usage, but may soon help address the very large demand for document authentication.

Measuring the manner in which one signs his or her signature or password, signature scan looks for stroke order, speed, pressure, and other factors which relate to the actual behavior of signing a tablet. Although not yet a very accurate behavioral biometric, signature scan has drawn significant interest from software companies looking to develop non-repudiated document trails. Signature-Scan.com will cover the following aspects of the signature verification industry

APPLICATIONS OF BIOMETRICS:

Applications that currently uses keys, ID cards, ATM cards, or passwords for verification purposes has the potential to be converted to a biometrics application. Also, in an age where highly sensitive personal information can be accessed through several different remote channels, the need for more accurate and fraud-proof verification methods becomes large. Below are some of the potential and commercial applications of biometrics:

- Some of the biggest potential applications include the use of biometrics for access to Automated Teller Machines (ATMs) or for use with credit or debit cards. Many types of financial transactions are also potential applications; e.g., banking by phone, banking by Internet, and buying and selling securities by telephone or by Internet.
- **Credit cards next** --the beauty of a biometric trait is that it is as unique as the individual from whom it was created. Unlike a password or PIN, a biometric trait cannot be lost, stolen, or recreated. This makes biometrics an obvious antidote to identity theft, a problem that is mushrooming alongside databases of personal information.
- Banks and others who have tested biometric-based security on their clientele, however, say consumers overwhelmingly have a pragmatic response to the technology. Anything that saves the information-overloaded citizen from having to remember another password or personal identification number comes as a welcome respite.

- There are also commercial applications for computer access control, access to web site servers, access through firewalls, and physical access control to protect sensitive information.
- Finger scan has the world's largest application of biometrics in the servicing of automated teller machines.
- There are many law enforcement applications, mostly for fingerprint recognition, at the Federal, State, and local levels. Other law enforcement applications include home incarceration and physical access control in jails and prisons.

The **future applications** of biometrics are very promising. Biometrics will play a crucial role in serving the identification needs of our future. Listed below are some potential future verification applications of biometrics:

- Voter Registration-verify identity at the polls to prevent fraudulent voting.
- In-store purchases- eliminate the need for credit cards to make in-store purchases.
- Online purchases- approve online purchases using biometric authentication.
- Academics/Certifications- verify person's identity prior to taking an exam.
- Home access- eliminate the need for keys in home access.
- Personal transportation- eliminate the need for keys for cars, boats, motorcycles, planes, etc.
- Restaurants- replace the credit card as form of payment when dining.
- Event Tickets- eliminate the need for paper tickets for concerts, sporting events, etc. Alternatively, allow buyer to claim purchased paper tickets from un-manned booth using biometrics.

HAZARDOUS WASTE MANAGEMENT

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3rd ECE, GMRIT

Hazardous waste can be a liquid, solid, or gas which is chronically hazardous to human health if, not managed, handled or disposed off properly. It may be a byproduct of one or more manufacturing processes or a commercial process. Improper storage, handling, transportation, treatment and disposal of hazardous waste results in adverse impacts on ecosystems and the human environment. Heavy metals and certain organic compounds are phototoxic and at relatively low levels can adversely affect soil productivity for extended periods. For example, uncontrolled release of chromium contaminated wastewater and sludge resulted in the contamination of aquifers in the North area of Tamil Nadu. These aquifers can no longer be used as sources of freshwater. Discharge of acidic and alkaline waste affects the natural buffering capacity of surface waters and soils and may result in reduction of a number of species. It is said that one gallon of used oil can contaminate one million gallons of water rendering it unpotable.

How it is generated ?

Sources of hazardous waste in the country include those from industrial processes, mining extraction, pesticide based agricultural practices, etc. Industrial operations generate considerable quantities of hazardous waste and in rapidly industrializing countries such as India the contribution to hazardous waste from industries is largest. Since industrial units are spread all over the country, the impacts are region wide. States such as Gujarat, Maharashtra, Tamil Nadu, and Andhra Pradesh, which have undergone relatively greater industrial expansion, face problems of toxic and hazardous waste disposal far more acutely than less developed states. Industries that are major producers of hazardous waste include:

- Petrochemicals
- Pharmaceuticals
- Pesticides
- Paints and dyes
- Petroleum
- Fertilizers
- Inorganic chemicals and
- General engineering.

HAZARDOUS WASTE CHARACTERISTICS:

Waste is called hazardous if it possesses one or more of the following properties:

Ignitable Waste:

If the waste is a liquid with a flash point less than 140⁰ F.

Examples are: Many paint solvents and mineral spirits, paint waste, solvents, alcohol, fine carbon particles, flammable gas cylinders.

Corrosive Waste:

If the measured pH equal to or less than 2, or greater than or equal to 12.5 in liquid solution.

Examples: Acids, corrosive cleaners, many photo chemicals, strippers, rust removers, batteries drain cleaners, bases, alkaline liquids.

Reactive Waste:

This includes a wide field of materials. Generally waste that will cause any of the following

Examples: React violently with water, Contains cyanides or sulfides, is unstable, is capable of explosion, Forms explosive mixtures with water or generates toxic gases when mixed with water. Example: sulfide-containing wastes.

Toxic Materials:

Includes thousands of materials including hundreds on government lists. Includes materials that do not pass so-called TCLP tests for toxicity, Poisons.

Examples are: Lead containing materials, rodent poisons, mercury and heavy metals.

Radioactive waste:

Radioactive wastes comprise of a variety of materials generated from the process of production, utilization and storage of radioactive substances that emits nuclear radiation. The disposal of these substances requires different types of management to protect people and the environment. Radioactive wastes are normally classified as low- level, medium level or high level wastes, according to the amount and types of radioactivity in them.

Effects of hazardous waste:

The hazardous waste includes substances present in industrial processes such as solvents, cyanide, heavy metals, organic acids, nitrogenous substances, salts, dyes, pigments, sulphides & ammonia and other household wastes. The health hazards of these waste includes exposure to high concentrations of toxic chemicals using poisoning and burns or exposure to low doses for low periods, which can induce chronic diseases, cancer, sterility and reproductive problems. The priority environmental health problems associated with improper hazardous waste handling and management on water, land and human health are:

- 1) The waste constituent affects the workers handling the hazardous waste.
- 2) Toxic substances can have detrimental effects on human health.

E.g. cyanide inhibits the phosphorylative oxidation reactions that permit cellular respiration; mercury and its compounds are associated with impact hearing, vision and muscular coordination; lead produces variety of serious effects, including neurological disorders.

3) Fish kills are often the results of acute toxicity due to dumping of sludges or accidental release of highly toxic matters in the water bodies.

4) Many organic materials may cause excessive oxygen demand due to their degradation and render the water incapable of supporting aqueous life.

5) Coloring matter may substantially decrease light penetration, preventing photosynthetic process.

6) Uncontrolled disposal to land of hazardous waste e.g. metal-bearing sludge, concentrated spent acids and alkalies, organic residues and wasted oils.

7) Uncontrolled burning of solid waste on land sites, leaving residuals of ash, Burned rubber, toxic wastes and other burned debris contaminates the land.

8) Soil pollution due to influents running uncontrolled over land, permanent or temporary storage of discarded chemicals, production residues, toxic wastes, putrescible matter.

9) Air pollution problems are intensified due to the existence of clusters of industrial plants that operates obsolete equipment and generate excessive pollutant emission with no provision for pollution control.

10) Waste oil is another potent pollutant. When it is dumped in the open environment, into sewers or in landfills, it is capable of migrating into the soil and underground aquifers. Since waste oil contains various hazardous contaminants, the burning of such oil increases air pollution as toxic gases are vented to the atmosphere, affecting not just human beings but plants and birds as well.

11) The difficulty is that recycling of hazardous wastes itself generates hazardous wastes that are often more toxic in concentration than the material recycled. Such wastes, left unattended or carelessly disposed of, have a seriously detrimental impact on public health and the natural environment, including wildlife.

The waste minimization efforts should be made prior to considering the hazardous waste for treatment and disposal. Waste minimization is an important hazardous waste management strategy. The concept of waste minimization includes the following:

1. **Source Reduction:** Any activity that reduces or eliminates the generations of hazardous waste within a process.

2. **Recycling** : Any activity that reduces volume and / or toxicity of hazardous waste.

3. **Reuse:** Attendant generation of a valuable material, which is subsequently reused.

History of Robotics

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Some historians believe the origin of ROBOTICS can be traced back to the ancient Greeks. It was around 270 BC when Ctesibus (a Greek engineer) made organs and water clocks with movable figures. Other historians believe robotics began with mechanical dolls. In the 1770s, Pierre Jaquet-Droz, a Swiss clock maker and inventor of the wristwatch, created three ingenious mechanical dolls. He made the dolls so that each one could perform a specific function: one would write, another would play music on an organ, and the third could draw a picture. As sophisticated as they were, the dolls, whose purpose was to amuse royalty, performed all their respective feats using gears, cogs, pegs, and springs. More recently, in 1898, Nikola Tesla built a radio-controlled submersible boat. This was no small feat in 1898. The submersible was demonstrated in Madison Square Garden. Although Nikola Tesla had plans to make the boat autonomous, lack of funding prevented further research.

The word "robot" was first used in a 1921 play titled R.U.R.: Rossum's Universal Robots, by Czechoslovakian writer Karel Capek. Robot is a Czech word meaning "worker." The play described mechanical servants, the "robots." When the robots were endowed with emotion, they turned on their masters and destroyed them.

Historically, we have sought to endow inanimate objects that resemble the human form with human abilities and attributes. From this is derived the word anthropoids, robots in human form. Since Karel Capek's play, robots have become a staple in many science fiction stories and movies. As robots evolved, so did the terminology needed to describe the different robotic forms. So, in addition to the old "tin-man" robot, we also have cyborgs, which are part human and part machine, and androids, which are specially built robots designed to be humanlike

Many people had their first look at a real robot during the 1939 World's Fair. Westinghouse Electric built a robot they called Elektro the Moto Man. Although Elektro had motors and gears to move its mouth, arms, and hands, it could not perform any useful work. It was joined on stage by a mechanical dog named Sparko.

Why build robots?

Robots are indispensable in many manufacturing industries. The reason is that the cost per hour to operate a robot is a fraction of the cost of the human labor needed to perform the

same function. More than this, once programmed, robots repeatedly perform functions with a high accuracy that surpasses that of the most experienced human operator. Human operators are, however, far more versatile. Humans can switch job tasks easily. Robots are built and programmed to be job specific. You wouldn't be able to program a welding robot to start counting parts in a bin. Today's most advanced industrial robots will soon become "dinosaurs." Robots are in the infancy stage of their evolution. As robots evolve, they will become more versatile, emulating the human capacity and ability to switch job tasks easily. While the personal computer has made an indelible mark on society, the personal robot hasn't made an appearance. Obviously there's more to a personal robot than a personal computer. Robots require a combination of elements to be effective: sophistication of intelligence, movement, mobility, navigation, and purpose.

Purpose of Robots

In the beginning, personal robots will focus on a singular function (job task) or purpose. For instance, today there are small mobile robots that can autonomously maintain a lawn by cutting the grass. These robots are solar powered and don't require any training. Underground wires are placed around the lawn perimeter. The robots sense the wires, remain within the defined perimeter, and don't wander off. Building a useful personal robot is very difficult.

Robot building is not restricted to Ph.D.s, professors, universities, and industrial companies. By playing and experimenting with robots you can learn many aspects of robotics: artificial intelligence, neural networks, usefulness and purpose, sensors, navigation, articulated limbs, etc. The potential is to learn first hand about robotics and possibly make a contribution to the existing body of knowledge on robotics. And to this end amateur robotists do contribute, in some cases creating a clever design that surpasses mainstream robotic development. As the saying goes, look before you leap. The first question to ask yourself when beginning a robot design is, "What is the purpose of this robot? What will it do and how will it accomplish its task?" We will provide the necessary information about circuits, sensors, drive systems, neural nets, and microcontrollers in forthcoming articles to build a robot. But before we begin, let's first look at a few current applications and how robots may be used in the future.

The National Aeronautics and Space Administration (NASA) and the U.S. military build the most sophisticated robots. NASA's main interest in robotics involves (couldn't you guess) space exploration and telepresence. The military on the other hand utilizes the technology in warfare. Exploration NASA routinely sends unmanned robotic explorers where it is impossible to send human explorers. Why send robots instead of humans? In a word,

economics. It's much cheaper to send an expendable robot than a human. Humans require an enormous support system to travel into space: breathable atmosphere, food, heat, and living quarters. And, quite frankly, most humans would want to live through the experience and return to Earth in their lifetime. Explorer spacecraft travel through the solar system where their electronic eyes transmit back to Earth fascinating pictures of the planets and their moons. The Viking probes sent to Mars looked for life and sent back pictures of the Martian landscape. NASA is developing planetary rovers, space probes, spider-legged walking explorers, and underwater rovers. NASA has the most advanced telerobotic program in the world, operating under the Office of Space Access and Technology (OSAT)⁴. Robotic space probes launched from Earth have provided spectacular views of our neighboring planets in the solar system. And in this era of tightening budgets, robotic explorers provide the best value for the taxpayer dollar. Robotic explorer systems can be built and implemented for a fraction of the cost of manned flights. Let's examine one case. The Mars Pathfinder represents a new generation of small, low-cost spacecraft and explorers.

Mars Pathfinder (Sojourner)

The Mars Pathfinder consists of a lander and rover. It was launched from Earth in December of 1996 on board a McDonnell Douglas Delta II rocket and began its journey to Mars. It arrived on Mars on July 4, 1997. The Pathfinder did not go into orbit around Mars; instead it flew directly into Mars's atmosphere at 17,000 miles per hour (mph) [27,000 kilometers per hour (km/h) or 7.6 kilometers per second (km/s)]. To prevent Pathfinder from burning up in the atmosphere, a combination of a heat

shield, parachute, rockets, and airbags was used. Although the landing was cushioned with airbags, Pathfinder decelerated at 40 gravities (Gs). Pathfinder landed in an area known as Ares Vallis. This site is at the mouth of an ancient outflow channel where potentially a large variety of rocks are within reach of the rover. The rocks would have settled there, being washed down from the highlands, at a time when there were floods on Mars. The Pathfinder craft opened up after landing on Mars (see Fig. below) and released the robotic rover.

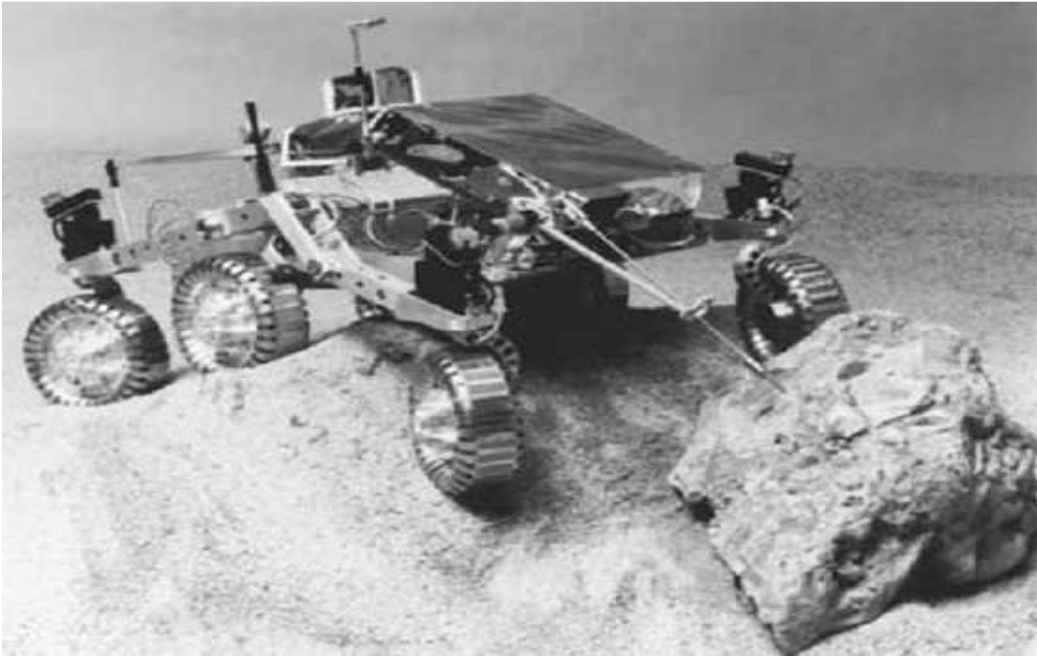


Mars Pathfinder. Photo courtesy of NASA

The rover on Pathfinder is called Sojourner . Sojourner is a new class of small robotic explorers, sometimes called microrovers. It is small, with a weight of 22 pounds (lb) [10.5 kilograms (kg)], height of 280 millimeters (mm) (10.9"), length of 630 mm (24.5"), and width of 480 mm (18.7"). The rover has a unique sixwheel (Rocker-Bogie) drive system developed by Jet Propulsion Laboratories⁵ (JPL) in the late 1980s. The main power for Sojourner is provided by a solar panel made up of over

200 solar cells. Power output from the solar array is about 16 watts (W). Sojourner began exploring the surface of Mars in July 1997. Previously this robot was known as Rocky IV. The development of this microrover robot went through several stages and prototypes including Rocky I through Rocky IV.

Both the Pathfinder lander and rover have stereo imaging systems. The rover carries an alpha proton X-ray spectrometer⁶ that is used to determine the composition of rocks. The lander made atmospherical and meteorological observations and was the radio relay station to Earth for information and pictures transmitted by the rover.



Sojourner Rover. Photo courtesy of NASA

Mission Objectives

The Sojourner rover itself was an experiment. Performance data from Sojourner determined that microrover explorers are cost efficient and useful. In addition to the science that has already been discussed, the following tasks were also performed:

- Long-range and short-range imaging of the surface of Mars
- Analysis of soil mechanics
- Tracking Mars dead-reckoning sensor performance
- Measuring sinkage in Martian soil
- Logging vehicle performance data
- Determining the rover's thermal characteristics
- Tracking rover imaging sensor performance
- Determining UHF link effectiveness
- Analysis of material abrasion
- Analysis of material adherence
- Evaluating the alpha proton X-ray spectrometer
- Evaluating the APXS deployment mechanism
- Imaging of the lander

Performing damage assessment Sojourner was controlled (driven) via telepresence by an Earthbased operator. The operator navigated (drove) the rover using images obtained from the rover and lander. Because the time delay between the Earth operator's actions and the

rover's response was between 6 and 41 minutes depending on the relative positions of Earth and Mars, Sojourner had onboard intelligence to help prevent accidents, like driving off a cliff. NASA is continuing development of microrobotic rovers. Small robotic land rovers with intelligence added for onboard navigation, obstacle avoidance, and decision making are planned for future Mars exploration. These robotic systems provide the best value per taxpayer dollar. The latest microrover currently being planned for the next Mars expedition will again check for life. On August 7, 1996, NASA released a statement that it believed it had found fossilized microscopic life on Mars. This information has renewed interest in searching for life on Mars.

3G ANTENNA

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There are some devices that are typically designed to support the existing internet connection signal enhancements. 3G antenna is form one such devices that help improves the internet signals and also allows the device to connect with the local wireless network are as and computer. The 3G technology is one the third generation technologies introduce to provide the access at relatively higher speed to data transfer and mobile phone systems

Installing 3G Antenna:

Installation of 3G antenna is very simple usually complete installation guide is provide when user purchase this device. 3G antenna are installed to improve the data signal and also for reducing the created noise and for achieving the maximum transfer rate with the existing wireless network.

Mostly they are installed in the handsets and mobile device to permit the instant and relatively quicker access to the internet .There are numerous tasks that require high internet speed such as ,email sending ,local video conferencing via cell phone ad video streaming. 3G antenna provide required support in speeding up these activities .they are also used by the computer users in there computer system and laptops to maximize the internet connection strength without costing much on the speed enhancement.

Historical Background:

“G” patterns in the antenna ere not common 20 years back. IMT -200 internal mobile Communication firstly introduced the G patterns in the antenna in mid 1990s. At the beginning this technology was executed for the 2G which was totally supportive the mobile networks and cell phone assistance. After some time they introduced 2.5g version of the same technology will little more advancement .this advancement was based on the concept of maximizing the data transfer rate. Finally 3G technology the antenna were use which ahs both the features of high data rate and signal enhancements capapcity. 3g technology is much faster than the precious 2G and 2.5G with the highest data transfer rate 200 kilobytes per second when compared to the other “G” technologies.

Types of the 3G antenna:

3G antennas have three major types that are categorized on the basis of the use and specifical features that differentiate them. The major types of the antenna are.

1. Clip antenna
2. High gain antenna
3. Outdoor antenna

Clip antenna:

These types of antenna are typically designed with the clipping feature that makes them easy to clip with the laptop screens and they are most suitable types of the 3g antenna for the users who love to use their computer while traveling.

High Gain antenna:

High gain antenna is the most used type of the 3G antenna .They is uses on the area where low signal is the issue. They are installed to boost up the existing signals for better performance of the wireless internet.

Outdoor antenna:

Outdoor antenna is suitable for the users who live in low signal areas get port quality signal due to the distortion and obstacles. They are typically designed for the remote area access. They boost up signals and allow users to get connected to internet.

Some of the branded 3G antennas are omni direction which is capable of picking up the signals in any direction, they also don't need any local tower to execute the signals and send them to the assisting device. Omni antenna are sometimes referred to as the Mobile antennas directly because they are most suitable for the cell phone internet connections to improve the weak and poor signals, it also speed up the cell internet performance and provide good data rate too. Directional version of eth 3G antenna are also available they are comparatively lower in price but good service can be achieved by them.

Plasmonics Promises Faster Communication

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Get ready to witness even faster computing and telecom. Plasmonics—a new technology—promises to bring this revolution by putting together the best of electronics and photonics

Currently, communication systems are based on either electronics or photonics. However, with the quest for transporting huge amounts of data at a high speed along with miniaturisation, both these technologies are facing limitations. Due to their mismatched capacities and sizes, it is very difficult to cobble them to get a high bit rate with miniaturisation.

So researchers are pioneering a new technology called ‘plasmonics.’ Due to its frequency being approximately equal to that of light and ability to interface with similar-size electronic components, plasmonics can act as a bridge between photonics and electronics for communication.

What is plasmonics?

The term ‘plasmonics’ is derived from plasmons—quanta associated with surface charge oscillations. Their frequency is almost equal to that of light; optical frequencies are about 105 times greater than the frequency of today’s electronic microprocessors. So light can be used to excite them on the surface of a material in a localised regime.

The energy required to receive and send a surface plasmon pulse can be less than for electric charging of a metallic wire. This could allow plasmons to travel along nanoscale wires (called interconnects) carrying information from one part of a microprocessor to another with a high bit rate.

Plasmonic interconnects would be a great boon for chip designers, who have been able to develop ever smaller and faster transistors but have had a harder time building minute electronic circuits that can move data quickly across the chip.

Surface plasmons can be excited on a flat nano-film, nano strip or other shaped nano particles such as nano sphere, nano rod, nano cube and nano star. When nano particles are used to excite surface plasmons by light, these are known as localised surface plasmons. Silver and gold are of particular interest due to their high field enhancement and resonance wavelength lying in the visible spectral regime. The speed of these surface plasmons is almost equal to that of light with wavelength of the order of tens of nanometres.

Limitations of present modes

Presently, electronics plays an important role in communication. In laboratories, though, photonics has started replacing electronics where a high data transfer rate is required.

Electronics deals with the flow of charge (electrons). When the frequency of an electronic pulse increases, the electronic device becomes hot and wires become very loose. Hence by the principle of “the higher the frequency, the higher the data transfer rate,” a huge amount of data cannot be transferred.

On the other hand, when the size of an electronic wire reduces, its resistance (inversely proportional to the cross-sectional area of the wire) increases but the capacitance remains almost the same. This leads to time delay effects.

Communication with plasmonics

Plasmonic structures can exert huge control over electromagnetic waves at the nanoscale. As a result, energy carried by plasmons allows for light localisation in ultra-small volumes--far beyond the diffraction limit of light.

To generate surface plasmons, it is necessary to excite the metal-dielectric interface in which the dielectric constant of the metal is a function of frequency and negative. At the nanoscale, the electromagnetic (EM) field of the EM wave displays the electron cloud due to its well coupling, which is not possible in the case of bulk matter. Hence plasmonics is frequently associated with nanotechnology.

Investigators have found that by creatively designing the metal dielectric interface, they can generate surface plasmons with the same frequency as the electromagnetic wave but with much smaller wavelength. This phenomenon could allow plasmons to travel along nanoscale wires called ‘interconnects’ in order to carry information from one part of the microprocessor to another.

Methods

Plasmonic waveguides are attracting much attention owing to their ability to operate in various parts of the spectrum—ranging from visible to far-infrared region. A plasmon could travel as far as several micrometres in the slot waveguide (dielectric core with metallic cladding)—far enough to convey a signal from one part of a chip to another. The plasmon slot waveguide squeezes the optical signal, shrinking its wavelength.

Metallic nano wires can provide lateral confinement of the mode below the diffraction limit. Nano wires have larger attenuation than planer films but light transport over a distance of several microns has been demonstrated.

A chain of differently-shaped nano particles (such as spheres and rods) can be used to transport EM waves from one nano particle to another via the near-field electro dynamic interaction between them. If the second particle is situated in the near field of the other and so on along the chain, EM energy can be propagated within the lateral size confinement less than the diffraction limit. In a chain of closely spaced nanostructures, the propagation distance depends upon the shape and nature of materials, separation between them as well as the dielectric constant of the host medium.

Latest developments

The possibility to confine light to the nanoscale and the ability to tune the dispersion relation of light have evoked large interest and led to rapid growth of plasmonic research. The parallel development of nanoscale fabrication techniques like electron beam lithography and focused-ion- beam milling has opened up new ways to structure metals' surfaces and control surface plasmon polariton propagation and dispersion at the nanoscale.

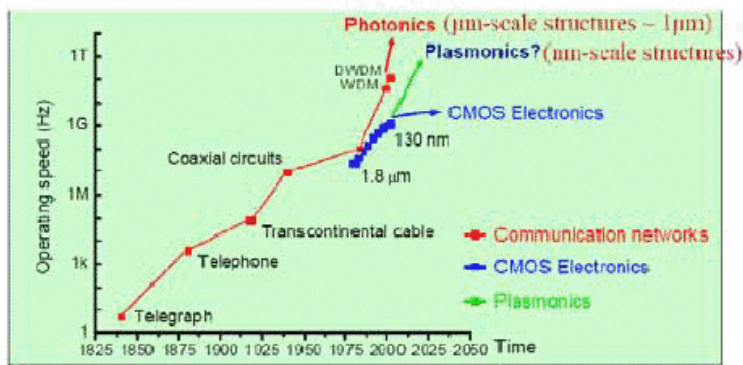


Fig. 1: Operating speed of data transporting and processing systems

In 2000, Mark L. Brongersma et al (and others) proposed that EM energy could be transported below the diffraction limit with high efficiency and group velocity greater than $0.1c$ along a wire of its characteristic length

0.1λ . In year 2002, Maier et al experimentally observed the most efficient frequency for transport to be 3.19×10^{15} rad/sec with a corresponding group velocity of 4.0×10^6 m/s for longitudinal mode of plasmon waveguide having an inter-particle distance of 75 nm. The achieved bandwidth was calculated to be 1.4×10^{14} rad/sec.

Dionne et al in year 2006 constructed slot waveguides. Slot waveguides can support both transverse electric and transverse magnetic photonic polarisation. The loss in slot waveguide can be minimised by using a low-refractive-index material; for example, a 100nm thick Ag/SiO₂/Ag slab waveguide sustains signal propagation up to 35 μ m at wavelength of 840 nm.

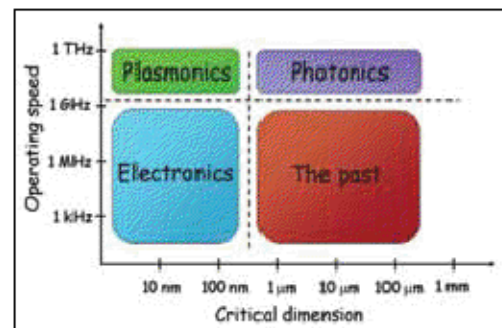


Fig. 2: Operating regimes—applicable size and speed scale—for plasmonic and other devices

In 2007, Feng et al observed that field localisation could be improved by introducing the partial dielectric filling of the metal slot waveguide, which also reduces propagation losses. The channel in metal surface waveguides supports surface plasmons at telecommunication wavelength with very low loss (having propagation length of 100 μm) and well-confined guiding. In this experiment, surface plasmons are guided along a 0.6 μm wide and 1 μm deep triangular groove in gold material.

Thin metallic strips can support long-range surface plasmons—a particular type of surface plasmon mode characterised by electromagnetic fields mostly contained in the region outside of the metal, i.e., in dielectric medium. Jung et al in 2007 experimentally confirmed that long-range surface plasmons could transfer data signal as well as the carrier light. In a demonstration, a 10Gbps signal was transmitted over a thin metallic strip (14nm thick, 2.5 μm wide and 4cm long gold strip).

Furthermore, to reduce the propagation loss, Jin Tae Kim et al fabricated a low-loss, long-range surface Plasmon polariton waveguide in an ultraviolet-curable acrylate polymer having low refractive index and absorption loss. A 14nm thick and 3 μm wide metallic strip cladded in acrylate polymer material shows a loss of 1.72 dB/cm.

Rashid Zia et al obtained the numerical solution by using the full-vectorial magnetic field finite-difference method for 55nm thick and 3.5nm wide strip on glass at a wavelength of 800 nm and noted that surface plasmons are supported on both sides of the strip and can propagate independently.

Alexandra et al in year 2008 suggested that triangular metal wedge could guide surface plasmons at telecommunication wavelength. It was experimentally observed that 1.43-1.52 μm wavelength can propagate over a distance of about 120 μm with confined-mode width of 1.3 μm along a 6 μm high and 70.5° angled triangular gold wedge.

Future directions

In the field of plasmonics, studying the way light interacts with metallic nanostructures will make it easier to design new optical material devices.

One primary goal of this field is to develop new optical components and systems that are of the same size as today's smallest integrated circuits and that could ultimately be integrated with electronics on the same chip. The next step will be to integrate the components with an electronic chip to demonstrate plasmonic data generation, transport and detection.

Plasmon waves on metals behave much like light waves in glass. That means engineers can use techniques like multiplexing or sending multiple waves.

AREA - 51

DISCLOSURE-UFO / ET THE HIDDEN TRUTH

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What & where is area 51?



Area 51 is a parcel of land in the Nellis Range Complex located about 30 miles south of the town of Rachel, Nevada. In Area 51, near the dry bed of Groom Lake, is a test facility for military aircraft. It is a base was so secret that even though it had been there over forty years it wasn't until 1994 that the government confirmed that it existed.

At the border of Area 51 are no trespassing signs that warn that the "use of deadly force is authorized." On the public land outside the boundaries electronic sensors in the ground detect foot and vehicle traffic. Unmarked Blackhawk helicopters that cruise the perimeter, searching for intruders, are ready to summon unidentified, armed patrols to greet unwelcome visitors.

When curious spectators found a ridge that let them observe the base from a distance of 12 miles the government quickly moved to withdraw the hill from public use. Now the closest public observation point to Groom Lake is now Tikaboo Peak (7908') some 25 miles away to the east. Even the sky there is made secure by the "Dreamland" restricted airspace zone that extends outside the borders of Area 51 and up to space.

In 1986 a gentleman named Bob Lazar went to the press. He claimed that he was a former government physicist and had been assigned to work in a secret underground base, designated "S4", that was about 15 miles south of Groom Lake at a place called Papoose Lake. (This is just north of Yucca and Frenchman Lakes where above and below ground nuclear testing took place since the 1940s).

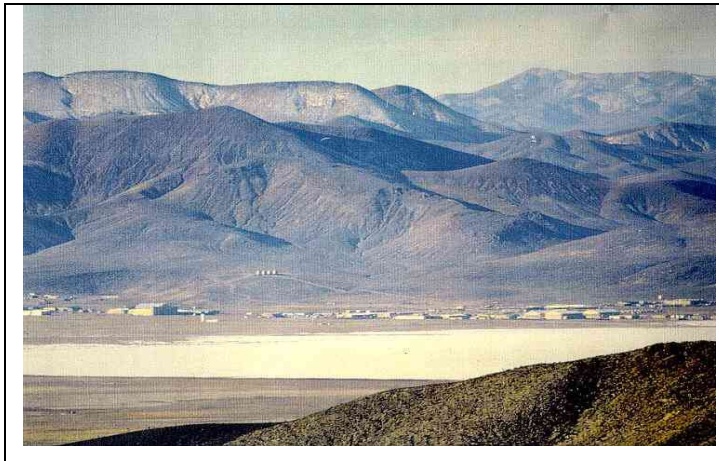
According to Lazar the base consisted of a series of hangers containing nine alien flying saucers that the government was trying to understand and reproduce. Most dismissed Lazar when the educational background he described for himself did not check out. Still, the incident helped cement the idea of UFO's and Area 51 in the public's mind. (For the hobby

mind you can purchase a model of the flying saucers, built to Lazer's specifications, that is marketed by the Testor Corporation.)

Quite a few UFOs have been reported being seen near Area 51. Though many locals suspect the sightings are the result of seeing disc shaped conventional aircraft, a cottage industry has grown up outside the boundaries based on the mystique of UFO's and aliens. You can get a burger at the "Little A'Le'Inn" (pronounced "Little Alien"), a cafe located in the town of Rachel. Even the legislature of Nevada, in a fit of whimsy, has gotten into the act, renaming route 375, which runs along the eastern edge of the Nellis Complex, "The Extra-terrestrial Highway."

Area 51, a History and Update

For a place that doesn't officially exist, Area 51 has been referred to by a lot of names over the years. Some of those names included; GroomLake, Dreamland, Paradise Ranch, Watertown Strip, the Box, the Pig Farm and several others. Many people do not know how or when Area 51 came into existence in the desert some 85 miles northwest of Las Vegas, Nevada.



Most people believe it was a military base, when in fact it was originally opened by the CIA (Central Intelligence Agency).

Area 51 is still alive and well. The signs around the perimeter still indicate "the use of deadly force is authorized", and the patrols by

the "cammo dudes" in their Jeeps, and 4 wheel drive Ford and Chevy pickups, still monitor any unauthorized individuals approaching too close to the boundary of the base.

After World War II the United States was very concerned about whether the Soviet Union had developed an atomic bomb. One way to find out would be to over fly the Soviet Union in a high altitude aircraft equipped with cameras. Lockheed's Kelly Johnson designed such an aircraft and went directly to the CIA with it. Normally such aircraft would have been test flown at Edwards Air Force Base, but with the security required for such a top-secret project as this, it was decided to look for a new secure site somewhere in the Southwest. A dozen sites were looked at before deciding on Groom Lake, Nevada, adjacent to the Nevada Test site. The area which was previously controlled by the Atomic Energy Commission for

testing atomic weapons was expanded to include Groom Lake and by July 1955 the CIA had its secret base. A fake construction firm “CLJ” was formed to oversee the construction on the base mostly done by sub-contractors to build hangars, a mile long runway, ramps, control tower, mess hall and other required structures.

The airplane designed by Kelly was known as the “Aquatone” by the CIA, and as “Angel” by Lockheed. The first prototype was called “Article 341”, and flown to Groom Lake. Eventually that aircraft became known as the U-2.

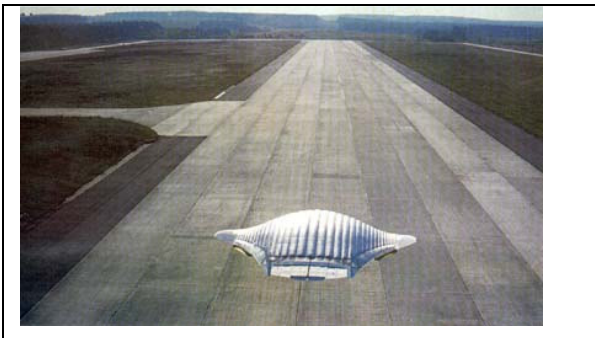
The thing to remember about the inception of Area 51 is that it was not an Air Force base, but rather that Lockheed and the CIA were in charge, not the military. Pilots were recruited from the F-84 pilots with top-secret clearances from SAC bases.

The first mission over the Soviet Union took place on July 4, 1956, and the missions were quite effective due to their speed and high altitude capabilities, until May 1, 1960 when Francis Gary Powers was shot down by a Soviet missile, captured and forced to confess to spying. That same day the first American spy satellite film was retrieved which showed more information about the Soviet Union than all the previous U-2 flights combined. The satellites however did not put an end to spy planes developed and test flown at Area 51.

It is true that UFOs are the subject of a government conspiracy and cover-up. During the early 1960s the CIA launched a secret project called "Ox Cart," not to hide alien life forms but to hide a multimillion-dollar spy plane. Ironically, for a project named after one of the slowest vehicles on Earth, Ox Cart involved one of the fastest creations in flight history, pioneered by aviation legend Kelly Johnson.

With Project Oxcart, which eventually became the SR-71, a longer runway was needed and in fact a small town was built for the support personnel assigned there. Area 51 probably is hidden in underground facilities or in hangars to keep the prying eyes of foreign satellites from knowing what is going on there.

MYSTERY OF THE LONG RUNWAY:



During the close of WWII, General Patton's army came upon a very unusual find at a captured German facility in France (near the V1 and V2 launch sites). This finding was described in Patton's biography, which included

specific data and photos, and also in an official document known as the "Patton memo". In fact, General Patton specifically warned the U.S. military of unbelievable facilities being found.

General Patton described coming upon a huge runway that was 200 feet wide, 11,300 feet long, and was made of concrete which was 14 feet thick. It was his written opinion that the construction materials and labor force "surpassed that of the great pyramids" (his words). An upward turned "ski slope" was built into the runway to allow larger aircraft with heavy cargo loads to take off more easily. This "ski slope" feature was later incorporated into the designs of British and Russian aircraft carriers.

What was Lockheed Test 2334?

While the technology may seem out of this world, it is certain that Test 2334 is no UFO. Clearly, Test 2334 was flown by a USAF pilot and not ET. Several researchers have indicated that the crashed saucer from Roswell, originally taken to Wright-Patterson AFB in Ohio in 1947, may be at Area 51 today. Other reports indicate that Area 51 has as many as 22 levels below ground and the secret base was brought to the forefront involving UFOs when Bob Lazar claimed to have been there to back engineer a UFO propulsion system in another area of the base known as S-4 at Papoose Lake. No real evidence of this has come to light and Lazar has been seriously questioned on his credibility.

Rumours:



A Secret Underground Complex?

Surrounding Area51 are the Nevada Test Site and Nellis Air Force Range, again locations at which strange craft have been sighted by many hundreds of witnesses. Those who have managed to get close enough to the base to take

photographs of it, have brought back many tantalizing images of the area in general, showing nothing more than a few hangars and other small buildings and surface structures. It is now believed that Area 51 actually stretches miles down underground as part of a huge subterranean military complex..

Extraterrestrials:

A common rumour about Area 51 is that it is the housing place for a total of nine recovered alien crafts and that these are being reverse engineered in order to discover their

secrets. The rumours of extraterrestrial beings and vehicles are endless; a simple search on an internet search engine turns out hundreds of thousands of results. Area 51 has been thought to be the test centre of captured UFOs because of the lights in the night sky.

Faking Of Lunar Landing:

Another belief is that Area 51 was used to fake the Lunar Landings beginning with the first landing in 1969. It is believed that the sand type is similar to that on the lunar surface. If you speed up the astronauts moon walking by $\frac{1}{2}$ x speed they appear to be running round in the same way we do on earth.

So what is the truth?

Well you might as well make your own mind up, because it's going to be a long time before the truth comes out... if ever it comes out! All someone can say for sure is that they are doing something that they don't want even their own public to be made aware of, and will authorize deadly force for anyone that tries to get to close.

POKHRAN
Test site for India's Nuclear Weapon Detonation.

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Pokhran : *Pokhran (also spelled Pokaran) is a city and a municipality located in Jaisalmer district in the Indian state of Rajasthan. It is a remote location in the Thar Desert region and served as the test site for India's first underground nuclear weapon detonation.*

Pokhran shot into the international limelight on 7 September 1974 when the then Indian Prime Minister Indira Gandhi authorized scientists at the Bhabha Atomic Research Centre (BARC), Trombay to detonate an indigenously designed nuclear device. Throughout its development, the device was formally called the "Peaceful Nuclear Explosive", but it was usually referred to as the Smiling Buddha.

Team of Scientists and Engineers: The team was Headed by Rajagopala Chidambaram. The team consisted of Dr. A. P. J. Abdul Kalam (Tamil Nadu), P. K. Iyengar (Kerala), Rajagopala Chidambaram (Tamil Nadu), Nagapattinam Sambasiva Venkatesan (Andhra Pradesh) and Dr. Waman Dattatreya Patwardhan (Maharashtra). The project employed no more than 75 scientists and engineers from 1967-1974. Keeping it small served to aid in the preservation of secrecy, according to the researcher Jeffrey Richelson.

Atomic Devices: The device used a high explosive implosion system, developed at the Defence Research and Development Organisation (DRDO)'s Terminal Ballistics Research Laboratory (TBRL), Chandigarh, based on the American design from World War II. But the Indian design was simpler and less sophisticated than the American system. The detonation system to detonate implosion devices was developed at the High Energy Materials Research Laboratory (HEMRL) of DRDO at Pune. The 6 kg of plutonium came from the CIRUS reactor at BARC, Trombay, Mumbai (then Bombay). The neutron initiator was a polonium-beryllium type (again like those used in early U.S. bombs of the Fat Man type) code-named "Flower." The complete core was assembled in Trombay before transportation to the test site.

Theoretical yield of Atomic Bomb: The fully assembled device had a hexagonal cross section, 1.25 m in diameter and weighed 1400 kg. The device was detonated at 8.05 a.m. in a shaft 107 m under the army Pokhran test range in the Thar Desert ,Rajasthan.

Officially the yield was reported at 12 kt, though outside estimates of the yield vary from 2 kt to 20 kt.

Pokhran as a Nuclear Site: The Atomic Energy Commission of India detonated its first underground nuclear weapon there on 18 May 1974. The Indian government, however, declared that it was not going to make nuclear weapons even though it had acquired the capacity to do so. It claimed that the Pokhran explosion was an effort to harness atomic energy for peaceful purposes and to make India self-reliant in nuclear technology.

Pokhran-II : OPERATION SHAKTI:

Pokhran-II refers to test explosions of five nuclear devices, three on 11 May and two on 13 May 1998, conducted by India at the Pokhran test range. These nuclear tests resulted in a variety of sanctions against India by a number of major states, and were followed by nuclear testing under the codename Chagai-I on May 28th and Chagai-II on May 30, by its neighboring and arch-rival country Pakistan.

On 18 May 1974 India exploded its first nuclear device code named Smiling Buddha. After about a quarter century, on Buddha Jayanti, 11 May 1998, Operation Shakti was carried out. Shakti (SHAKTI in Sanskrit meaning 'Strength'), is also the name of the Hindu Goddess of strength. **Shakti was the codename for Pokhran-II.**

POKHRAN: OPERATION SHAKTI INFORMATION



Country	India
Test Site	Pokhran
Period	May 1998
Number of Tests	5
Test Type	Underground nuclear testing
Device Type	Fission/Fusion
Max. Yield	~58kt
Previous Test	Pokhran- I

image of Shaft III named Shakti

A total of five nuclear weapons were detonated at Pokhran during Operation Shakti. They were:

Shakti I : A two stage thermonuclear device with a boosted fission primary, its yield was downgraded from 200 kt (theoretical) to 40 kt for test purposes.

Shakti II : A pure fission device using the Plutonium implosion design with a yield of 15 kt. The device tested was an actual nuclear warhead that can be delivered by bombers or fighters and also mounted on a missile. The warhead was an improved, lightweight and miniaturized version of the device tested in 1974. Scientists at BARC had been working to improve the 1974 design for many years. Data from the 1974 test was used to carry out computer simulations using the indigenous Param supercomputer to improve the design. The 1998 test was intended to prove the validity of the improved designs.

Shakti III : An experimental boosted fission device that used reactor grade Plutonium for its primary with a yield of 0.3 kt. This test device was used to test only the primary stage. It did not contain any tritium required to boost the fission. This test was designed to study the possibility of using reactor grade plutonium in warheads and also to prove India's expertise in controlling and damping a nuclear explosion in order to achieve a low (sub-kiloton) yield.

Shakti IV : A 0.5 kt experimental device. The test's only purpose was to collect data about the explosion process and to study the performance of various bomb components.

Shakti V : A 0.2 kt experimental device that used U-233, an isotope of uranium not found in nature and produced in India's fast breeder reactors that consume Thorium. This device too was used to collect data

Detonations:

The three devices (Shakti I,II & III) were detonated simultaneously at 10:13:44.2 UCT), as measured by international seismic monitors. Seismic data collected by stations outside India have placed the total magnitude of the first event at 5.3 (+/- 0.4), making it one of the largest seismic events in the world during the 24 hr period during which it occurred. The measured seismic center of the triple event was located at 27.0716 deg N latitude, and 71.7612 deg E longitude, which places it only 2.8 km from the 1974 test site. The combined force of the three blasts lifted an area about the size of a cricket ground to a few metres above the earth kicking up dust and sand into the air. Three craters were sunk on the desert surface.

Just two days later on 13 May, at 6:51 UCT , the two sub-kiloton devices were detonated underground. This event was not detected by any seismic stations as they were of very low yield. With the five explosions, India declared the series of tests to be over.

REACTIONS IN INDIA TO TESTS:

Shortly after the tests, a press meet was convened at the Prime Minister's residence in New Delhi. Prime Minister Vajpayee appeared before the press corps and made the following short statement: "Today, at 1545 hours, India conducted three underground nuclear tests in the Pokhran range. The tests conducted today were with a fission device, a low yield device and a thermonuclear device. The measured yields are in line with expected values. Measurements have also confirmed that there was no release of radioactivity into the atmosphere. These were contained explosions like the experiment conducted in May 1974. I warmly congratulate the scientists and engineers who have carried out these successful tests". News of the tests were greeted with jubilation and large-scale approval by the society in India. The Bombay Stock Exchange registered significant gains.. More significantly, all doubts were erased from the minds of people who questioned India's nuclear capability after the testing in 1974.

REACTIONS FROM ABROAD TO TESTS:

The most vehement reaction to India's nuclear test was Pakistan's. Great ire was raised in Pakistan, which issued a severe statement blaming India for instigating a nuclear arms race in the region. Pakistani Prime Minister Nawaz Sharif vowed that his country would give a suitable reply to the Indians. The Pakistan Atomic Energy Commission (PAEC) carried out five underground nuclear tests at the Chagai test site just fifteen days after India's last test. The yield of the tests were reported to be 40 kt.

The reactions from abroad started immediately after the tests were advertised. On June 6 the United Nations Security Council adopted Resolution 1172 condemning the test and that of Pakistan's. The United States issued a strong statement condemning India and promised that sanctions would follow. The American establishment was embarrassed as there had been a serious intelligence failure in detecting the preparations for the test.

China issued a vociferous condemnation calling upon the international community to exert pressure on India to sign the NPT and eliminate its nuclear arsenal. With India joining the group of countries possessing nuclear weapons, a new strategic dimension had emerged in Asia, particularly South Asia.

Israel issued a statement praising India's tests and declaring that India's reasons for carrying out nuclear tests were the same as Israel's.

Test yields :

The yields from the three tests on the 11th of May 1998 were put at 58 kilotons by the BARC based on seismic data obtained at the test site 3 km from the test shafts. The tests were defined as a complete success, and it was determined that all the devices and their components had performed flawlessly. To remove all doubts, the senior scientists involved in the Pokhran operations addressed the press on the 17th, May. In this press meet the scientists claimed that the fission device produced a yield of 15 kt and .3 kt was obtained from the low yield device. They also claimed that the thermonuclear device gave a total yield of 45 kt, 15 kt from the fission trigger and 30 kt from the fusion process and that the theoretical yield of the device (200 kt) was reduced to 45 kt in order to minimize seismic damage to villages near the test range.

Legacy :

May 11 has been officially declared as National Technology Day in India to commemorate the first of the five tests that were carried out on May 11, 1998. The day was officially signed by the then Prime Minister of India. The day is celebrated by giving awards to various individuals and industries in the field of science and industry.

Reactions in India.

The end of drink-driving?

Gayathri.P

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Cars that won't start if you've been drinking because they can smell alcohol on your breath. New drunk driving detection system may be coming to all cars.



It seems that the new stricter laws regarding drunk driving have done little to curb that gravely irresponsible habit, so harsher measures may be on the way in the form of in-car breathalyzers. The National Highway Traffic Safety Administration (NHTSA) may be requiring such devices, though not any time soon.

A new device, called Drive Alcohol Detection System for Safety (DADSS), is being designed to make it easier for court-ordered users to start up their cars. The new system works in one of two ways to detect alcohol levels on the driver. A touch-based system uses tissue spectrometry that can detect blood alcohol levels when placing a finger to a touchpad, not unlike a fingerprint scanner.

The other method is like a breath-analyzer, however it's not very similar the current systems requiring one to blow into a tube. Instead, the system works using distant spectrometry; likely to detect specific molecules associated with alcohol on the breath. The sensor detecting those particles works using infrared.

Basically, the system will be able to detect what makes up the drivers breath without any need to blow towards it. Completely under the radar. Its hassle-free operation could make it easy for NHTSA to require the system for all cars in the future. The DADSS system is still roughly ten years away, though, so it won't be in next year's vehicles.



Will police breathalysers be a thing of the past? Scientists have developed a alcohol-detection prototype that is built into cars and is able to instantly gauge whether a driver has been drinking. It could be one of the most significant breakthroughs in car history. Scientists have developed a built-in alcohol-detection prototype that is able to instantly gauge whether a driver has been drinking. One sensor analyses a driver's breath - without using a breathalyser. Other sensors measure blood alcohol content through the driver's skin and are placed strategically on the steering wheel and door locks.

Should a driver be over the legal drink-drive limit then the car's engine will not start. It could be fitted in cars within ten years.

Unlike current alcohol ignition interlock systems, the device from QinetiQ is unobtrusive and doesn't require a driver to blow into a breath-testing device before the car can operate. Instead, it uses sophisticated sensors placed around the driver's seat that can immediately determine whether a person has been drinking. Both the breath and skin tests would eliminate the need for drivers to take any extra steps, and those who are sober would not be delayed in getting on the road, researchers said.



Campaigner: Laura Dean Mooney, of the U.S. organisation Mothers Against Drunk Driving, holds up a photo of her late husband as Transportation Secretary Ray LaHood stands behind her during a news conference at QinetiQ.

NHTSA's U.S. Transportation Secretary Ray LaHood said, "[DADSS] may be another means – like lane departure warnings and adaptive cruise control – to help avert crashes, injuries, and fatalities before they occur." LaHood did comment that they weren't going to force automakers to install the system and that, "DADSS is not designed to prohibit people from enjoying a glass of wine with dinner or a beer at the game."

As long as it is made with safety in mind and to prevent those with a higher than .08 ABV from driving, the system should be welcomed by consumers with open arms. In the long run, it could save thousands of lives.

The technology is 'another arrow in our automotive safety quiver', said Mr LaHood, who emphasised the system was envisioned as optional equipment in future cars and voluntary for U.S. car manufacturers.

QinetiQ's research is called Driver Alcohol Detection Systems for Safety - or Dadss.

David Strickland, head of the National Highway Traffic Safety Administration (NHTSA), estimated the technology could prevent as many as 9,000 fatal alcohol-related crashes a year in the U.S alone. He also acknowledged that it was still in its early testing stages and might not be commercially available for eight to ten years.

Critics, such as Sarah Longwell of the American Beverage Institute, a restaurant trade association, doubt if the technology could ever be perfected to the point that it would be fully reliable and not stop some completely sober people from driving. She added: 'It's going to eliminate the ability of people to have a glass of wine with dinner or a beer at a ball game and then drive home, something that is perfectly safe and currently legal.

Mr LaHood disputed that the technology would interfere with moderate social drinking, and said the threshold in cars would never be set below the legal limit.

TSUNAMI WARNING SYSTEM TO MOBILE

B. Durga Bhavani

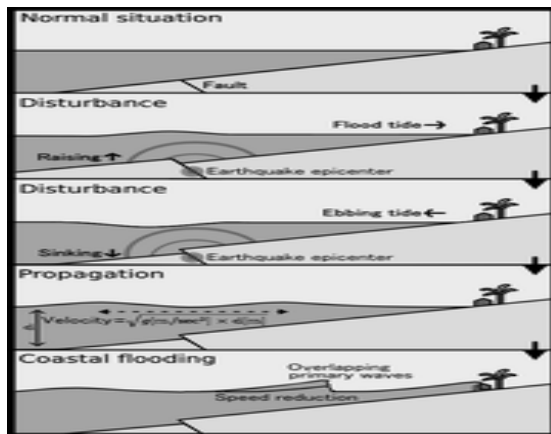
2ndECE

The term *tsunami* originates from Japanese and means “harbour wave”. It is a series of waves when a body of water. Tsunamis cannot be prevented or precisely predicted, but there are many systems being developed to warn and save the people of regions with a high risk of tsunamis before the wave reaches land.

Our paper focusses on the **TSUNAMI WARNING SYSTEM TO MOBILE**.

WHAT IS A TSUNAMI ?

The term **tsunami** comes from the Japanese language Destructive tsunami meaning *harbour* ("tsu") and *wave* ("nami"). The term was created by fishermen who returned to port to find the area surrounding their harbour devastated, although they had not been aware of any wave in the open water. A tsunami is a series of waves when a body of water, such as an ocean is rapidly displaced on a massive scale. Earthquakes, mass movements above or below water, volcanic eruptions and other underwater explosions, and large meteorite impacts all have the potential to generate a tsunami. The effects of a tsunami can range from unnoticeable to devastating.



CAUSES

Tsunamis can be generated when the sea floor abruptly Generation of a tsunami deforms and vertically displaces the overlying water. Such large vertical movements of the Earth's crust can occur at plate boundaries. Subduction earthquakes are particularly effective in generating tsunamis. As an Oceanic Plate is subducted beneath a Continental Plate, it sometimes brings down the lip of the Continental with it. Eventually, too much stress is put

on the lip and it snaps back, sending shockwaves through the Earth's crust, causing a tremor under the sea, known as an Undersea Earthquake.

not necessary that they are symmetrical; tsunami waves may be much stronger in one direction than another, depending on the nature of the source and the surrounding geography.

.TSUNAMI WAVE

Ocean waves are normally divided into 3 groups, characterized by depth:

- Deep water
- Intermediate water
- Shallow water

Even though a tsunami is generated in deep water (around 4000 m below mean sea level), tsunami waves are considered shallow-water waves. As the tsunami wave approaches the shallow waters of shore, its time period remains the same, but its wavelength decreases rapidly, thus causing the water to pile up to form tremendous crests, in an effect known as "shoaling".

TSUNAMI WARNING SYSTEM TO MOBILE

HOW CELL RECEIVES WARNING ?

The ability to broadcast messages has been around since the GSM Phase 2 Technology Specification was introduced in 1995. The ability to broadcast The "Cell Broadcast" or "Area Information System" was originally designed to let network operators offer location based services, but is now rarely used.

To turn it into an early warning service, a customised PC needs to be installed at the headquarters of each network operator. This contains the geographical co-ordinates of all phone masts, enabling operators to target emergency messages to all phones in the required region.



As these messages are delivered separately from other traffic, they ought to get through even when a network is jammed with normal traffic. Unlike voice communications, text messages still get through with a weak and inconsistent signal. Another project reverses the use of text messages in emergencies, allowing those on the ground to send calls for help to a single number, which would then be routed via the internet to the relevant authority. Travellers and coastal residents can now be warned in time of catastrophes like the tsunami, that occurred 2004 in Asia, with the world-wide unique tsunami alarm system for everybody. In every reachable place in the world, coastal inhabitants, tourists, business travellers,

employees, who are deployed in such regions, and tour guides can receive a message on their mobile phone in case there is a threat to their lives in places where they are. They only have to register their mobile phone with the Tsunami Alarm System and in the event of an alarm it will send a message that cannot be ignored.

THE POTENTIAL OF CELL BROADCAST TECHNOLOGY

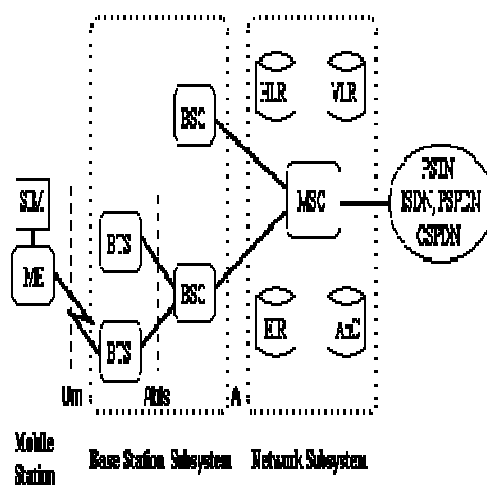
The ability to broadcast messages has been around since the GSM Phase 2 Technology Specification was introduced in 1995. In today's handsets, selecting a channel can be a tedious task. Another helpful GSM feature is "Over the Air programming of the SIM card." Potentially, subscribers could select their preferred channels on the carrier's Web site and have them downloaded onto the SIM card in their handsets via this technology (under full control of the carrier). The warnings, for terrorist attacks or natural disasters such as hurricanes, are intended to be of use to both emergency responders and the general public. In many cases, the text messages sent to mobile phones will alert the reader to check TV stations for more information. By nature, all radio systems are multi point to multi point systems, unless you force them not to be so, by adding elaborate protocols. Cellular phone networks are radio networks and are therefore naturally suited to Broadcasting. Nevertheless the fact remains that signals are broadcast from a base station, but reception is intentionally limited by means of protocols resident in the terminal (the phone). A simple change in those protocols would enable any terminal to pick up Broadcasts from any base station. By now all

GSM phones and base stations have the feature latent within them, though sometimes it is not enabled in the network.

In today's Nevertheless the fact remains that signals are broadcast from a base station, but reception is intentionally limited by means of protocols resident in phone. A simple change in those protocols would enable any terminal to pick up Broadcasts from any base station.

NETWORK STRUCTURE

The network behind the GSM system seen by the customer is large and complicated in order to provide all of the services which



SIM: Subscriber Identity Module	BSC: Base Station Controller	MSC: Mobile services Switching Center
ME: Mobile Equipment	HLR: Home Location Register	ER: Equipment Identity Register
BTS: Base Transceiver Station	VLR: Visitor Location Register	AUC: Authentication Center

are required.

The network is divided into a number of sections , namely :

- Mobile station .
- the Base Station Subsystem (the base stations and their controllers).
- the Network and Switching Subsystem (the part of the network most similar to a fixed network). This is sometimes also just called the core network.

MOBILE STATION

The mobile station (MS) consists of the mobile equipment (the terminal) and a smart card called the Subscriber Identity Module (SIM). The SIM provides personal mobility, so that the user can have access to subscribed services irrespective of a specific terminal. By inserting the SIM card into another GSM terminal, the user is able to receive calls at that terminal, make calls from that terminal, and receive other subscribed services.

SAFETY PRECAUTIONS AT THE COAST

The first rule: The mobile telephone should always be with us . The mobile phone should be within earshot and switched on .It is to be checked from time to time that it is actually logged on to a GSM network. This should be done in particular before going to sleep. In areas with weak network coverage we may discover that we do not always have network signals at all points within our room. In such an event it could be helpful to move the telephone few meters or to put it on a window sill.

The second rule: One must act immediately when an alarm is received . We must trust that the alarm that arrives on our mobile phone is genuine - even if other people around us appear to be unconcerned. Based on the tsunami alarm message, we must check whether we are in the region of the tsunami. The rescue procedures consist of moving immediately a few kilometers to the interior, away from the coast, and if possible to higher grounds. With the Tsunami Alarm System we and the people who are with us have the advantage of this critical pre-warning period.

It is better to act in vain than to be hit by a Tsunami unprepared. When the Tsunami arrives it will already be too late.

ADVANTAGES OF CELL BROADCAST

There are four important points to recall about the use of Cell Broadcasting for emergency purposes.

- It is already resident in most network infrastructure and in the phones, so there is no need to build any towers, lay any cable, or write any software or replace terminals.

- It is not affected by traffic load; therefore it will be of use during a disaster, when load spikes tend to crash networks, as the London bombings 7/7 showed. Also it does not cause any significant load of its own, so would not add to the problem.
- It is geo scalable, so a message can reach hundreds of millions of people across continents within a minute.
- It is geo specific, so that government disaster managers can avoid panic and road jamming, by telling each neighborhood specifically, if they should evacuate or stay put.

In short, it is such a powerful national security asset, that it would be inexcusable not to seize the chance to put an existing technology, to the benefit of the safety of citizen.

TSUNAMI WARNING SYSTEM

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In light of the events of the 2004 tsunami in South Asia, there has been an increasing concern about future tsunami threats, and with it, growing interest in tsunami detection and prevention systems. A **Tsunami Warning System (TWS)** is a system to detect [tsunamis](#) and issue warnings to prevent loss of life and property. It consists of two equally important components: a network of sensors to detect tsunamis and a communications infrastructure to issue timely alarms to permit evacuation of coastal areas.

There are two distinct types of tsunami warning systems: **international** and **regional**. Both depend on the fact that, while tsunamis travel at between 500 and 1,000 km/h (around 0.14 and 0.28 km/s) in open water, earthquakes can be detected almost at once as seismic waves travel with a typical speed of 4 km/s (around 14,400 km/h). This gives time for a possible tsunami forecast to be made and warnings to be issued to threatened areas, if warranted.

What is a tsunami?

A tsunami is “a series of long waves generated by rapid, large scale disturbances of the sea-the sudden displacement of a large volume of water, generally from the raising or falling of the seafloor caused by undersea earthquakes” (The Bridge). In December of 2004, a 9.0 earthquake occurred in the Indonesian ocean, causing a vast number of tsunamis that hit Southeast Asia and parts of Africa. Around 275,000 lives were lost from these tsunamis and a great deal of damaged was caused.

What is a tsunami warning system?

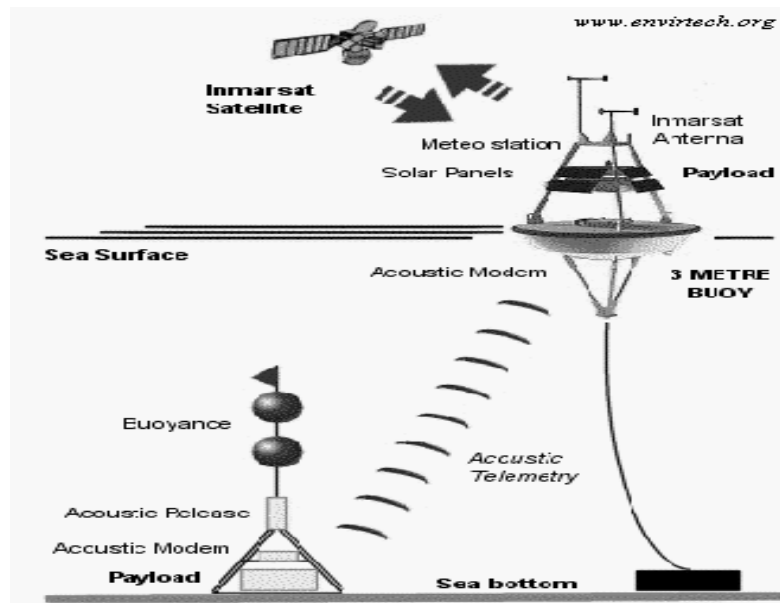
In 1985, the Pacific Marine Environmental Agency in Seattle, WA began research on tsunamis and detection by putting what they call a “tsunameter” in the bottom of the ocean. This device is a buoy that uses bottom-pressure recorders (BPR's) to measure and detect as little an amplitude of 1 centimeter in 6,000 centimeters of water. Tsunamis can travel at over 800 miles per hour and take a long time to lose speed. The deeper the water, the greater the speed of the tsunami. NOAA (the National Oceanic and Atmospheric Administration) is in the process of creating a newer, more accurate tsunami system that lasts longer.

How important is it to warn of a tsunami?

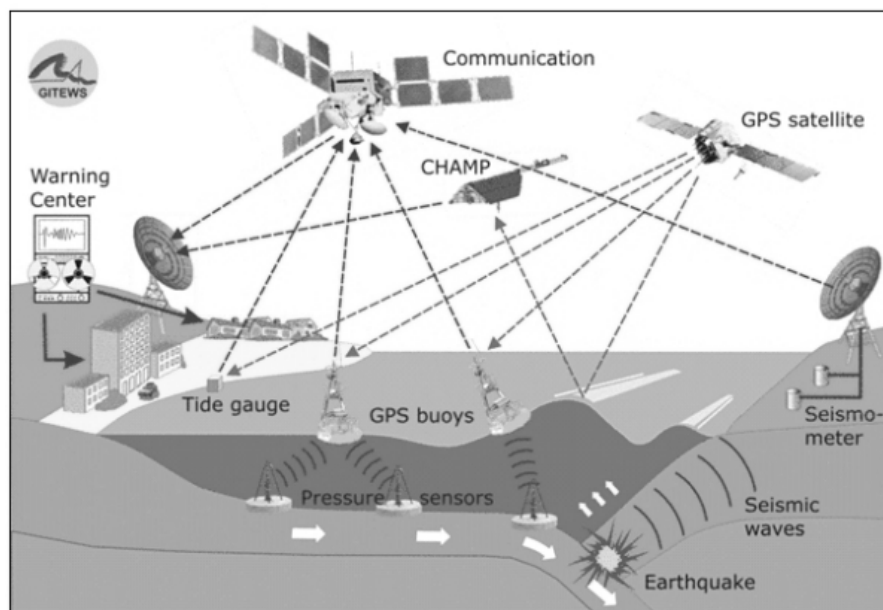
We know that over 275,000 lives were lost in the tsunami that occurred in Southeast Asia. The development of these warning systems is crucial to the future survival of those who may be affected by a tsunami. It is important to teach those who live in coastal regions what to do if a tsunami happens, so they have a higher chance of surviving it. The most important thing that needs to be focused on is the development of more accurate tsunami warning systems. If people can be warned ahead of time of a possible tsunami and they have time to react by evacuating, it may be possible to save every life. It would be a shame to see so many lives lost again due to a tsunami because their country had no way of knowing it was about to hit.

Methods & Instruments:

The best method for detecting tsunamis is to precisely measure the pressure of the water at the bottom of the ocean. Envirotech has developed an instrument that uses a pressure depth sensor, and a computer with an acoustic modem to communicate this information to a surface buoy. The data are then relayed via Inmarsat-C satellite link to Land stations, which forward the signals for immediate dissemination to Warning Centers. Each deep sea station is designed to detect and report tsunamis on its own, without instructions from land. The tsunami detection algorithm in the instrument's software works by first estimating the amplitudes of the pressure fluctuations within the tsunami frequency band and then testing these amplitudes against a threshold value. The high accuracy of measurement is due to a quartz crystal resonator whose frequency of oscillation varies with the pressure.



We have determined that the system that seems the most effective and the most feasible is a bottom pressure recorder (BPR)-buoy system. This system is the one currently being used in the coasts of Japan and the Pacific coast of the United States (the DART system), with slight variations.



Buoy-Bottom Pressure Recorder System:

The BPR uses a quartz crystal resonator to measure ambient pressure and temperature (the temperature data is important, as it affects the pressure measurement). The resonator uses a thin quartz crystal beam, electrically induced to vibrate at its lowest resonant

mode. It communicates these measurements to the surface buoy through an acoustic modem. The tsunameter can be deployed down to a depth of 6000 meters. The tsunameter's battery packs allow it a projected work life of four years on the ocean bottom.

If the tsunameter takes a measurement within the tsunami threshold, it will change to “Event Mode” and send data more frequently, as to trace the movement of the wave. It will continue sending data until the detection threshold is no longer exceeded.

The surface buoy relays information and commands between the tsunameter and the satellite network the system links up to. The buoy's transducers are protected by a baffle of steel, lead and foam, and are cushioned by rubber pads. It has two identical systems as a fail-safe for the relaying of the data. Generally, only one system will be transmitting data at a time, but once the “Event Mode” is triggered, both systems will transmit the data simultaneously. The surface buoy is moored to the ocean bottom, to maintain it within the transmission cone of the tsunameter's modem. Its batteries allow it a projected work life of two years.

Satellite Detection System

As the name states, this system would use satellites to detect tsunamis. Though the movement of the December 2004 tsunami in South Asia was recorded by satellites, and the aircraft could determine the speed of the waves, it was sheer luck that the satellites observed the phenomenon, and it took 5 hours to process the images and information, which is quite obviously much longer than would be a feasible amount of time for warning about a tsunami.

When speaking of a satellite detection system, it would be imperative to mention the current initiative to set up this satellite network, the Global Earth Observation System of Systems (GEOSS). Though not much has been completely established, the GEOSS will be a system of systems to collect data on meteorological and climate change and allow nations quick and easy access to this information. This system, once properly researched and set up, would include a tsunami detection system.

However, there is much research that still needs to be done when it comes to the use of satellites in tsunami detection. Also, the initial cost of setting up a satellite network is high. However, once the research is done, it would be an effective backup and would provide information to complement that of a BPR-buoy system. It is highly unlikely that satellites

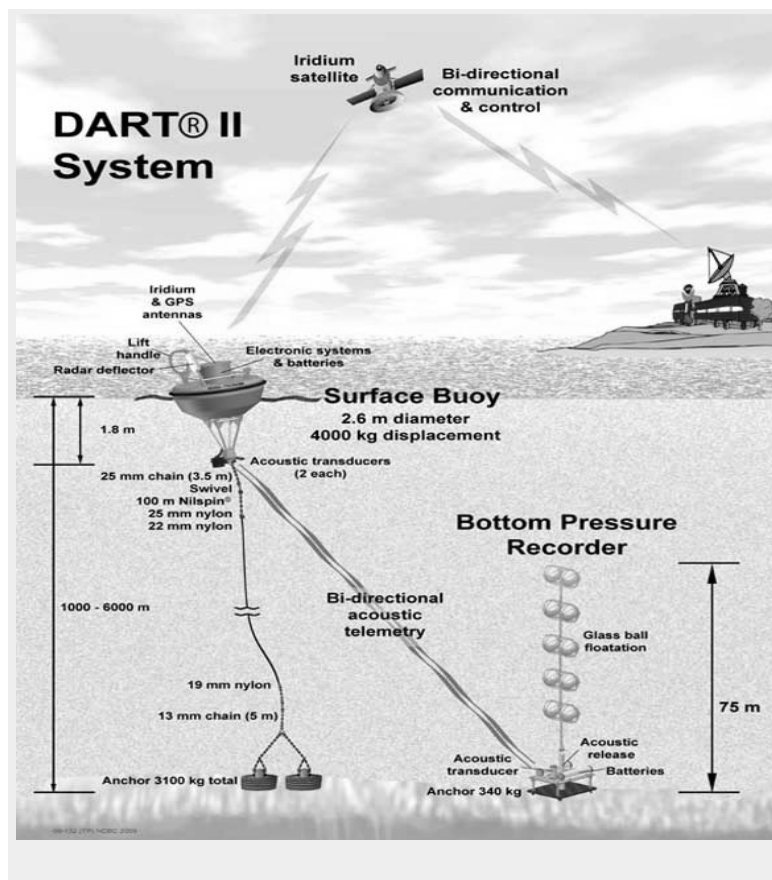
will absolutely replace the buoy systems, but it is not out of the question to do this once the technology and the knowledge are advanced enough.

How Japan's Earthquake and Tsunami Warning Systems Work?

(The world's only earthquake warning system likely helped limit damage and loss of life.)

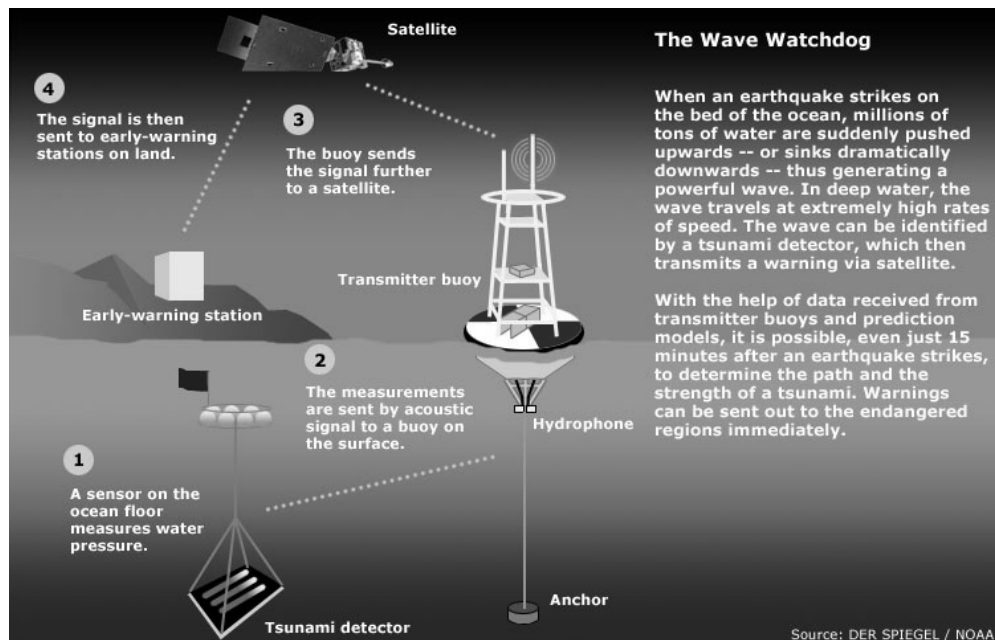
The earthquake that struck Japan 11 march 2011early morning was the worst seen in that country for over 300 years (with a local magnitude of 8.9). Hundreds have been killed and injured so far, but the loss of life was likely limited by two vital early warning technologies: a new earthquake alert system, and ocean-based tsunami warning system.

The earthquake warning system, which has never been triggered before, automatically issued alerts via television and cell phones shortly after the first, less harmful, shock wave was detected, providing time for many people to prepare for the more powerful shock wave that followed. It also caused many energy and industrial facilities, and transportation services to shut down automatically. A string of detection buoys in the Pacific Ocean detected the tsunami that resulted from the earthquake, sending warnings of possible catastrophe to many different nations.



Credit: NOAA

The graphic above shows how the Deep-ocean Assessment and Reporting of Tsunami (DART) tsunami buoys work.



UNCERTAINTY FOR NUCLEAR POWER

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As workers battle to cool down damaged Fukushima Daiichi nuclear power plant reactors after the devastating earthquake and tsunami that struck Japan on 11 March, the potential environmental impact from the release of radioactive material remains uncertain. Already political fallout from the disaster has spread to Europe and will no doubt have a lasting impact on nuclear power policy and research funding.

Four days after the earthquake, German chancellor Angela Merkel announced that seven nuclear power plants, that began operating before 1980, will be shut down for safety review until at least June. The closures reverse a controversial decision made last year by Merkel's coalition government to extend the life of older nuclear power plants. And France, where nuclear power provides 80 per cent of total electricity supply, announced safety tests on its 58 reactors.



Radioactive contamination by the nuclear reactor problems at Fukushima Daiichi nuclear power plant are not as serious as Chernobyl

Some experts fear the severity of the Fukushima Daiichi accident could approach the level of the Chernobyl nuclear plant disaster in the Ukraine. In April 1986 during a routine systems test a power surge followed by an attempted emergency shutdown triggered a series of explosions and the release of radioactive fallout over a large area. Yoshihito Watanabe, a chemist and vice president at Nagoya University in Japan, tells *Chemistry World* that, thus

far, 'radioactive contamination by the nuclear reactor problems are not so serious.' Depending on the outcome of the attempts to cool down Fukushima Daiichi nuclear power plant, the major problem now is the physical damage from the earthquake and tsunami, he says.

Toyota, Honda, and other automotive manufacturers have had to stop production due to automotive part shortages. It is far too early to speculate what the effect might be on Japanese research, he says, adding: 'The first priority for the government to consider right now is how to support the recovery of the earthquake area, including the lifeline, construction of houses, reconstruction of factories, offices and so on.'

The future for nuclear power policy in Japan also remains uncertain, he says. 'Currently, people even who are against the nuclear power policy are quiet on this issue, because so many people are working hard to stop the current troubles at Fukushima Daiichi nuclear power plant under very dangerous and risky conditions.'

The Japanese people are highly appreciative of the global outpouring of support and sympathy in the wake of the earthquake, he says, adding that the embattled nation will persevere.

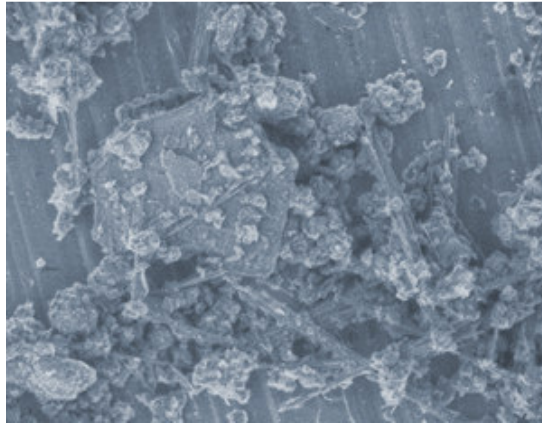
Cleaning up nuclear storage ponds

UK scientists have analysed the chemistry taking place in storage ponds at nuclear power sites, such as Sellafield, to come up with a way to remove radioactive waste as nuclear regulatory bodies are pressing on the nuclear industry to clean up the ponds.

Storage ponds are used to store spent Magnox rods, which are uranium fuel rods covered by a magnesium-aluminium alloy cladding. The rods contain large amounts of fission products, which are highly reactive. The ponds are maintained to minimise corrosion of the rods, but the cladding corrodes in water, creating fine particle sludge. 'The sludge in one of these ponds is estimated to contain tonnes of fuel debris including considerable quantities of plutonium,' says Stephen Parry from the University of Manchester.

Parry, together with his colleagues, made a model of Magnox storage pond liquor to study how plutonium interacts with the corroded Magnox sludge to find a way of removing the plutonium before the ponds are emptied.

Their pond consisted of plutonium, a sludge simulant, sodium carbonate, polyelectrolyte and silica to replicate real conditions. One component of the sludge is brucite (magnesium hydroxide), which sequesters plutonium, forming a colloid. This is soluble at neutral and acidic pH, meaning that the plutonium's mobility in the ponds is enhanced.



A magnified image of nuclear storage pond sludge showing brucite crystals, which sequester plutonium, making it difficult to remove from the mixture.

'One potential problem is the risk that disturbing the sludge will release fine, plutonium-containing particles in the effluent from the ponds. Pond effluents are treated before discharge into the sea under authorisation, but we need to be sure that the treatment process will effectively remove plutonium from the effluents before we can start to empty them,' explains Parry.

The team found that a low carbonate concentration, high CMS concentration and high polyelectrolyte concentration resulted in almost all of the plutonium being filtered.

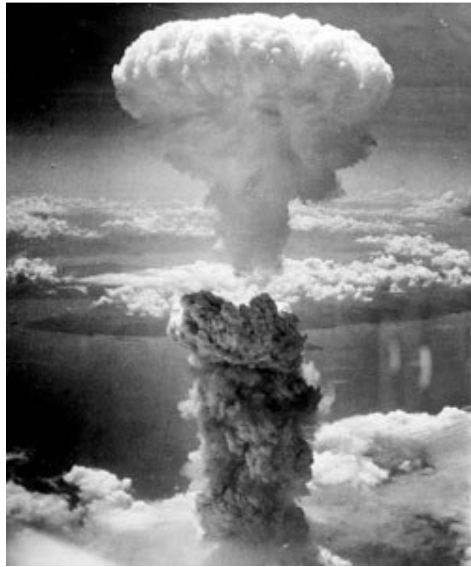
'The work we have done shows that it is possible to optimise effluent treatment and also which steps in the treatment process are the most important in ensuring efficient plutonium removal, helping to open the way to removal of the sludge,' concludes Parry.

Nuclear power without radioactivity

Radiation-free nuclear fusion could be possible in the future claim of a team of international scientists. This could lead to development of clean and sustainable electricity production. Despite the myriad of solutions to the energy crisis being developed, nuclear fusion remains the ultimate goal as it has the potential to provide vast quantities of sustainable and clean electricity. But nuclear energy currently comes with a serious environmental and health hazard side effect - radiation. For fusion to gain widespread acceptance, it must be able to produce radiation-free energy but the key to this has so far remained elusive.

Conventionally, the fusion process occurs with deuterium and tritium as fuel. The fuel is spherically compressed - meaning compression occurs from all directions - with laser irradiation to 1000 times its solid state density. This ignites the fuel, producing helium atoms, energy and neutrons which cause radiation.

Fusion is also possible with hydrogen and boron-11, and this could produce cleaner energy as it does not release neutrons. But this fuel requires much greater amounts of energy to initiate and so has remained unpopular.



The power of nuclear fusion has yet to be tamed

Now, a team led by Hora has carried out computational studies to demonstrate that new laser technology capable of producing short but high energy pulses could be used to ignite hydrogen/boron-11 fuel using side-on ignition. The high energy laser pulses can be used to create a plasma block that generates a high density ion beam, which ignites the fuel without it needing to be compressed, explains Hora. Without compression, much lower energy demands than previously thought are needed. 'It was a surprise when we used hydrogen-boron instead of deuterium-tritium. It was not 100 000 times more difficult, it was only ten times,' says Hora.

'This has the potential to be the best route to fusion energy,' says Steve Haan, an expert in nuclear fusion at Lawrence Livermore National Laboratory in California. However, he also points out that it is still only potential at this point, 'there's a fair amount of work to do before this technology is at hand.'

Hora agrees that much more work is needed to fully understand this radical new approach. Its achievement will depend on continued advances in laser optics, target physics and power conversion technology, he concludes.

Visvesvaraya, an engineer of modernity

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3rd ECE.

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Sir M.Visvesvaraya, the oldest surviving icon from 20th century Karnataka, occasions sentiments. Enthusiasts image as a high-tech city see in him an early champion of modern industry. Whereas those sick of the corruption in public life cherish him as a symbol of probity. Whatever the ends of invocation, Sir M.Visvesraya's charisma has proved durable.

Born to a poor Brahmin family in Muddenahalli in 1860, Sir M.Visvesvaraya (Sir MV) completed school in Chikballapura and Bangalore. After completing his B.A. at Central College in Bangalore in 1881, he studied engineering at the College of Science in Pune. Upon graduation in 1883, he started his career as an Assistant Engineer in the Public Works Department, Government of Bombay, where he put in 25 years of distinguished service. After a short stint of work for the Nizam of Hyderabad, when he helped control the Musi river floods, he became the Engineer of Mysore in 1909. Three years later, he became Dewan of Mysore and stayed in office until 1918.

Achievements

Sir MV resigned in 1918 in protest over the Maharaja's decision to set aside state jobs for "non-Brahmins." By this time he had helped establish the University of Mysore, the State Bank of Mysore, Mysore Chamber of Commerce, among others. Popular memory in Karnataka views the Bhadravati Iron Works and the Krishnarajasagar Dam (KRS) across the Cauvery river as two of Sir MV's major achievements. Both these projects stood as marvels of state planning. Despite incurring losses for the first 15 years, the iron plant was sustained by the state.

After stepping own as Dewan, Sir MV took up intermittent government projects in Karachi, Bombay, Orissa, and Hyderabad as adviser and consultant. He travelled in Europe and the United States a few times as part of delegations of industrialists. He was awarded the Bharata Ratna in 1955.

Many early 20th century Kannada literary figures have written eulogistic poems about Sir MV. Their admiration for him, however, seems to rest less on an engagement with his thought than in the purity of his intentions. He acquired popular fame as a person who strove selflessly to develop the country and make it modern. The excerpt below from a hit song

from the 1972 blockbuster, “Bangarada Manushya (Man of Gold”)), the longest running movie in Kannada film history, is illustrative:

If Visvesvaraya had not toiled

And allowed Cauvery to flow

And not built Kannambadi?

Would this precious land have harvested gold?

Prosperous Kannada land, our prosperous Kannada land?

Sir MV’s enchantment with modern industrial civilization is sure-footed. Not a trace of self-doubt exists. His legacy is best commemorated by bringing to it all the ethical questions that modern Indians have offered on the issue of development.

ZIGBEE

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ZigBee is the name of a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4 standard for wireless personal area networks (WPANs). ZigBee operates in the industrial, scientific and medical (ISM) radio bands; 868MHz in Europe, 915 MHz in the USA and 2.4 GHz in most jurisdictions worldwide. The technology is intended to be simpler and cheaper than other WPANs such as Bluetooth. The most capable ZigBee node type is said to require only about 10% of the software of a typical Bluetooth or Wireless Internet node, while the simplest nodes are about 2%. However, actual code sizes are much higher, more like 50% of Bluetooth code size. ZigBee chip vendors have announced 128-kilobyte devices.

What is Zigbee?

Zigbee is a wireless networking standard that is aimed at remote control and sensor applications which is suitable for operation in harsh radio environments and in isolated locations. It builds on IEEE standard 802.15.4 which defines the physical and MAC layers. Above this, Zigbee defines the application and security layer specifications enabling interoperability between products from different manufacturers. In this way Zigbee is a superset of the 802.15.4 specification.

The 802.15.4 standard is primarily aiming at monitoring and control applications. Low power consumption is the most important feature that makes battery operated devices operates for a long time. The amount of data throughput (bandwidth) is relatively low compared to wireless LAN for example, but with 250kbps for many applications more than enough. The distance between 2 nodes can be up to 50 meters but be aware the each node can relay data to the next making a very big network, covering significant distances, possible. Hardware (Physical and MAC layers).The 2.4GHz frequency band is a license free band, so a ZigBee product may be used all over the world. All current products seem to be using the 2.4GHz band at the moment. Take a look at the next table for a few differences between the bands:

Frequency	Bandwidth
868 MHz	20 kbps
915 MHz	40 kbps
2.4GHz	250 kbps
SVECW No. of channels 1,3,10,16	

In all bands DSSS (Direct sequence spread spectrum) is used. 868 MHz and 915 MHz are using Binary Phase Shift Keying and 2.4GHz uses O-QPSK (Offset Quadrature Phase Shift Keying). Like in any network data is transmitted in packets. ZigBee's packets have a maximum size of 128 bytes including protocol overhead. In total there is room for a maximum of 104 bytes. For real time features, ZigBee has the possibility to define high priority messages. This is achieved by use of a guaranteed timeslot mechanism so that the high priority messages can be sending as fast as possible. ZigBee uses 2 kinds of addressing. There is a 64 bit IEEE address that can be compared to the IP address on the internet. There is also a 16 bit short address. The short addresses are used once a network is setup so this makes a total of

$2^{16} = \sim 64000$ nodes within one network possible. This is enough for almost anything imaginable.

Layers in Zigbee:

The layers above that what 802.15.4 specifies is what we call the ZigBee standard. Many aspect of the network are specified in this layer, like: Application profiles, security settings and the messaging. ZigBee is known because of its mesh network architecture but it does also support a star topology or cluster tree or hybrid architecture. Depending on the application or situation each kind of topology has its own advantages and disadvantages. A star topology is very simple, all nodes directly communicate with one central node (like a star...). The mesh topology is more complicated, each node may communicate with any other node within range. It's easy to understand that this gives many possible routes through the network; this makes it a very robust topology because bad performing routes can be ignored. The cluster tree topology is basically a combination of star and mesh.

Software and hardware:

The software is designed to be easy to develop on small, cheap microprocessors. The radio design used by ZigBee has been carefully optimized for low cost in large scale production. It has few analog stages and uses digital circuits wherever possible. Even though the radios themselves are cheap, the ZigBee Qualification Process involves a full validation of the

requirements of the physical layer. This amount of concern about the Physical Layer has multiple benefits, since all radios derived from that semiconductor mask set would enjoy the same RF characteristics. On the other hand, an uncertified physical layer that malfunctions could cripple the Battery lifespan of other devices on a Zigbee Network. Where other protocols can mask poor sensitivity or other esoteric problems in a fade compensation response, ZigBee radios have very tight engineering constraints: they are both power and bandwidth constrained. Thus, radios are tested to the ISO-17025 standard with guidance given by Clause 6 of the 802.15.4-2003 Standard. Most vendors plan to integrate the radio and microcontroller onto a single chip.

Why choose ZigBee?

Reliable and self healing

supports large number of nodes

Easy to deploy

Very long battery life

Secure

Low cost

Can be used globally the 802 Wireless Space

ZigBee specification

The ZigBee Alliance is an association of companies working together to enable reliable, cost-effective, low-power, wirelessly networked, monitoring and control products based on an open global standard.

Data Reliability:

Reliable data delivery is critical to ZigBee applications. The underlying 802.15.4 standard provides strong reliability through several mechanisms at multiple layers. For example, it uses 27 channels in three separate frequency bands.

IEEE 802.15.4 provides three frequency bands for communications. Global utility, propagation, path loss, and data rate differences let ZigBee profile developers optimize system performance.

The 2.4 GHz band is used worldwide and has 16 channels and a maximum over-the-air data rate of 250 Kbps. Lower frequency bands are also specified. The information is coded onto the carrier with direct sequence spread spectrum (DSSS), an inherently robust method of improving multipath performance and receiver sensitivity through signal processing gain. The receiver sensitivity and selectivity is well suited for inexpensive silicon processes, with

most vendors promising to meet or beat the standard. The size of the data payload ranges from 0 to 104 bytes, more than enough to meet most sensor needs. The data packet is one of four packet structures provided in 802.15.4 ZigBee. In the MAC protocol data unit, the data payload is appended with source and destination addresses, a sequence number to allow the receiver to recognize that all packets transmitted have been received, frame control bytes that specify the network environment and other important parameters, and finally a frame check sequence that lets the receiver verify that the packet was received uncorrupted. This MAC frame is appended to a PHY synchronization and PHY header, which provides a robust mechanism for the receiver to quickly recognize and decode the received packet. After receiving a data packet, the receiver performs a 16-bit cyclic redundancy check (CRC) to verify that the packet was not corrupted in transmission. With a good CRC, the receiver can automatically transmit an acknowledgement packet (depending on application and network needs), allowing the transmitting station to know that the data were received in an acceptable form. If the CRC indicates the packet was corrupt, the packet is dropped and no acknowledgement is transmitted. When a developer configures the network to expect acknowledgement, the transmitting station will retransmit the original packet a specified number of times to ensure successful packet delivery. If the path between the transmitter and receiver has become less reliable or a network failure has occurred, ZigBee provides the network with self-healing capabilities when alternate paths (if physically available) can be established autonomously.

Battery Life

In many applications, you can afford to make regular trips back to a sensor to change the battery. Ideally, the sensor is good for the life of the battery. The basic 802.15.4 node is fundamentally efficient in terms of battery performance. You can expect battery lifetimes from a few months to many years as a result of a host of system power-saving modes and battery-optimized network parameters, such as a selection of beacon intervals, guaranteed time slots, and enablement/disablement options. Star networks are the most common, basic structure with broad utility. For larger physical environments, the cluster tree is a good way to aggregate multiple basic star networks into one larger network. Some applications will make best use of the mesh structure, which provides alternate route flexibility and the capability for the network to heal itself when intermediate nodes are removed or RF paths change.

Transmission Range

The standard specifies transmitter output power at a nominal 3dBm (0.5mW), with the upper limit controlled by the regulatory agencies of the region in which the sensor is used. At 3 dB output, single-hop ranges of 10 to more than 100 m are reasonable, depending on the environment, antenna, and operating frequency band.

Data Rate

Higher data rates at a given power level mean there is less energy per transmitted bit, which generally implies reduced range. But both 802.15.4 and ZigBee value battery life more than raw range and provide mechanisms to improve range while always concentrating on battery life.

Data Latency

Sensor systems have a broad range of data-latency requirements. If sensor data are needed within tens of milliseconds, as opposed to dozens of seconds, the requirement places different demands on the type and extent of the intervening network. For many sensor applications, data latency is less critical than battery life or data reliability. For simple star networks (many clients, one network coordinator), ZigBee can provide latencies as low as ~16 ms in a beacon-centric network, using guaranteed time slots to prevent interference from other sensors. Data latency can also affect battery life.

Size

As silicon processes and radio technology progress, transceiver systems shrink in physical size. In the case of ZigBee systems, the radio transceiver has become a single piece of silicon, with a few passive components and a relatively non critical board design.

Data Security

It's important to provide your sensor network with adequate security to prevent the data from being compromised, stolen, or tampered with. IEEE 802.15.4 provides authentication, encryption, and integrity services for wireless systems that allow systems developers to apply security levels as required. The

ZigBee security toolbox

It consists of key management features that let you safely manage a network remotely.

APPLICATIONS

Zigbee protocols are intended for use in embedded applications requiring low data rates and low power consumption.

- ZigBee's current focus is to define a general- purpose, inexpensive, self-organizing, mesh network that can be used for industrial control, embedded sensing, medical data collection, smoke and intruder warning, building automation, home automation, etc.
- ZigBee standard addresses the unique needs of most remote monitoring and control applications:
- Enables the broad based deployment of simple, reliable, low cost wireless network solutions
- Provides the ability to run for years on inexpensive primary batteries
- Provides the ability to inexpensively support robust mesh networking technologies.
- Home Automation
- Building Automation
- Industrial Automation

ZigBee is all set to provide the consumers with ultimate flexibility, mobility, and ease of use by building wireless intelligence and capabilities into every day devices. ZigBee technology will be embedded in a wide range of products and applications across consumer, commercial, industrial and government markets worldwide. For the first time, companies will have a standards-based wireless platform optimized for the unique needs of remote monitoring and control applications, including simplicity, reliability, low-cost and low-power.

Vision of GMRIT

"To be among the most preferred institution's for engineering and technological education in the country...
An institution that will bring out the best from its students, faculty and staff- to learn, to achieve, to complete and to grow-among the very best...
An institution where ethics excellence and excitement will be the work religion and improvement, innovation and impact,

Mission of GMRIT

To turn out disciplined and competent engineers, with sound work and life ethics

To meet the challenge and paucity of high quality teaching talent in engineering and technology in our country through the use of information technology

To keep the curriculum industry friendly, with due regard to the university curriculum.

