

VOLUME I
ISSUE 1

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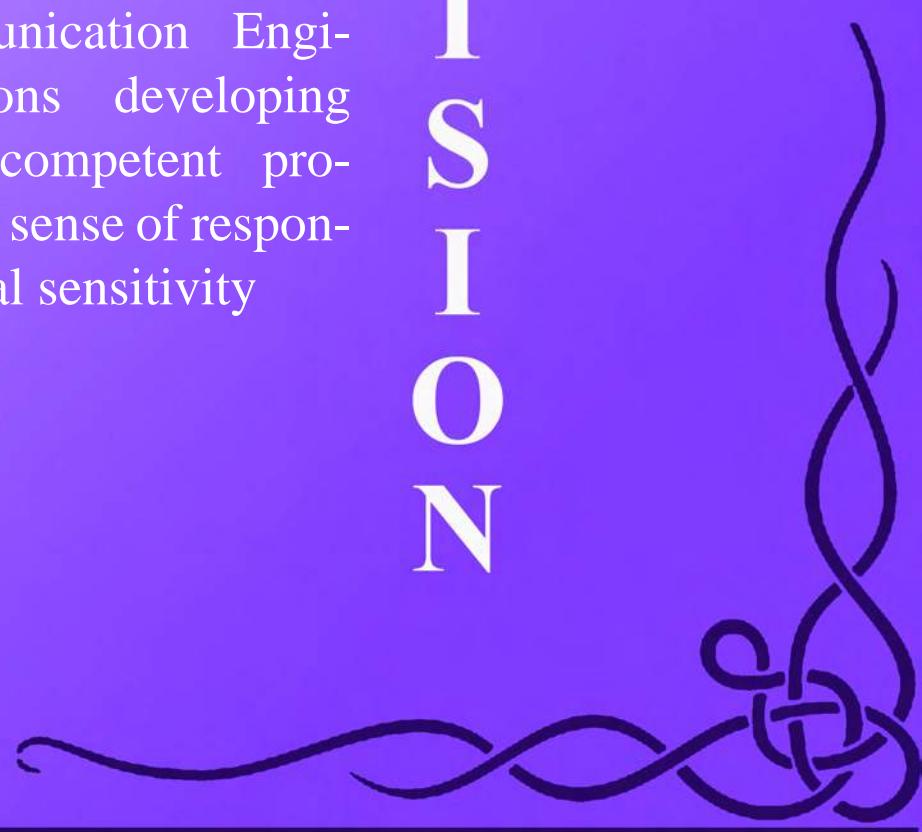




M I S S I O N

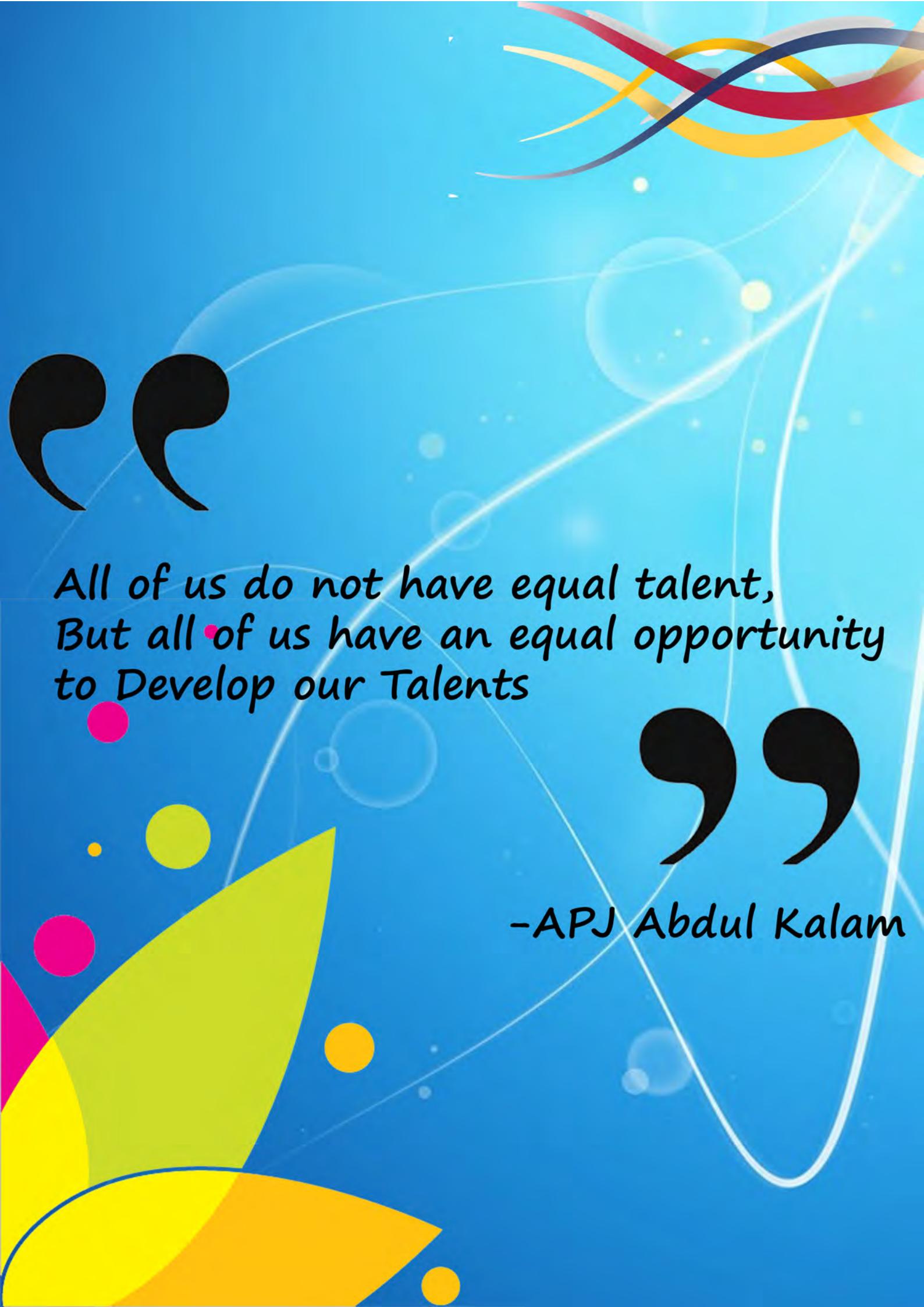
To impart professional education endowed with human values using active learning techniques, to transform the students to be competent and committed engineers meeting the current and future demands and capable of providing engineering solutions with social sensitivity.

The department of Electronics and Telecommunication Engineering envisions developing internationally competent professionals with a sense of responsibility and social sensitivity



V I S S I O N

MESSAGES



All of us do not have equal talent,
But all of us have an equal opportunity
to Develop our Talents

-APJ Abdul Kalam

DEAN'S MESSAGE



**-Dr. Lochan Jolly
Dean,R&D**

Pickup any day's newspaper, you will come across similar news.....violence there, corruption here, scandals, murder, woman/child abuses in capital.. and so on. Of course a few soul searching articles you will also find like sacred space, speaking tree, a thought for the day besides some neutral sport news etc.

The culture change and exposure to foreign media TV channels, fashion shows, sites on internet etc. has polluted the gentle mind of young ones on the whole.

Basically everything revolves around the MIND-Thoughts. Thoughts are the things which we create by brooding over them.

A thought is the first main factor which creates the chain reactions of events. Normally our minds are turned outwards and it flows towards objects of our liking without discrimination. If mind is left to its own it will flow towards negativity. It is programmed like this. Its nature is similar to water which flows downwards and requires pumping to lift it up to overhead tanks. Similarly mind requires moral training to lift it up and make it positive. Religion is one such source of moral values which helps to differentiate right from wrong.

These day many schools, colleges and corporate have introduced courses in their organization to boost the morale of students and staff. Studies reveal the positive effects of such training. I also appeal to all of you to join such course which will not only make you a good human being but also a happy soul as it helps to develop detachment towards objects.

Let us look what Shri Krishna says in Bhagwat Gita- Chapter II verse 62-63 regarding "Stairway to destruction"

ध्यायतो विषयान्पुंसः सङ्गस्तेषूपजायते ।
सङ्गात्संजायते कामः
कामात्कोषीऽभिजायते ॥२-६२॥
क्रोधाद्वव्वति संमोहः संमोहात्समृतिविभ्रमः ।
समृतिभ्रमशबुद्धिनाशो बुद्धिनाशात्प्रणश्यति
॥२-६३॥

Pondering over objects, one gets attached to them. Attachment breeds desire, from desire anger is born. Anger leads to delusion, from delusion memory gets clouded. From clouding of memory the intellect gets destroyed, when the intellect goes one is destroyed.

Think it over.

HOD'S MESSAGE



**-Dr. Vinitkumar Dongre
HOD,EXTC**

I would like to appreciate the efforts taken voluntarily by the students as well as the teachers of the editorial team. A special mention goes to the team for their hard work and turning the vision of ABHIVARG into a reality.

Now a day's students show great enthusiasm towards academic and co-curricular activities conducted in our college. ABHIVARG is not just a magazine; in fact it is an initiative to evoke the habit of reading in students which is very important to survive in today's world where every minute there is something new to learn. I don't expect ABHIVARG to change the world. The main purpose of this magazine is to inspire at least few minds. Because in the end, amplifying one mind is what that matters.

FACULTY INCHARGE-ABHIVARG



**-Mrs. Megha Gupta
Asst. Prof. EXTC**

THERE is a quote which says, “UNITED WE STAND AND DIVIDED WE FALL.”

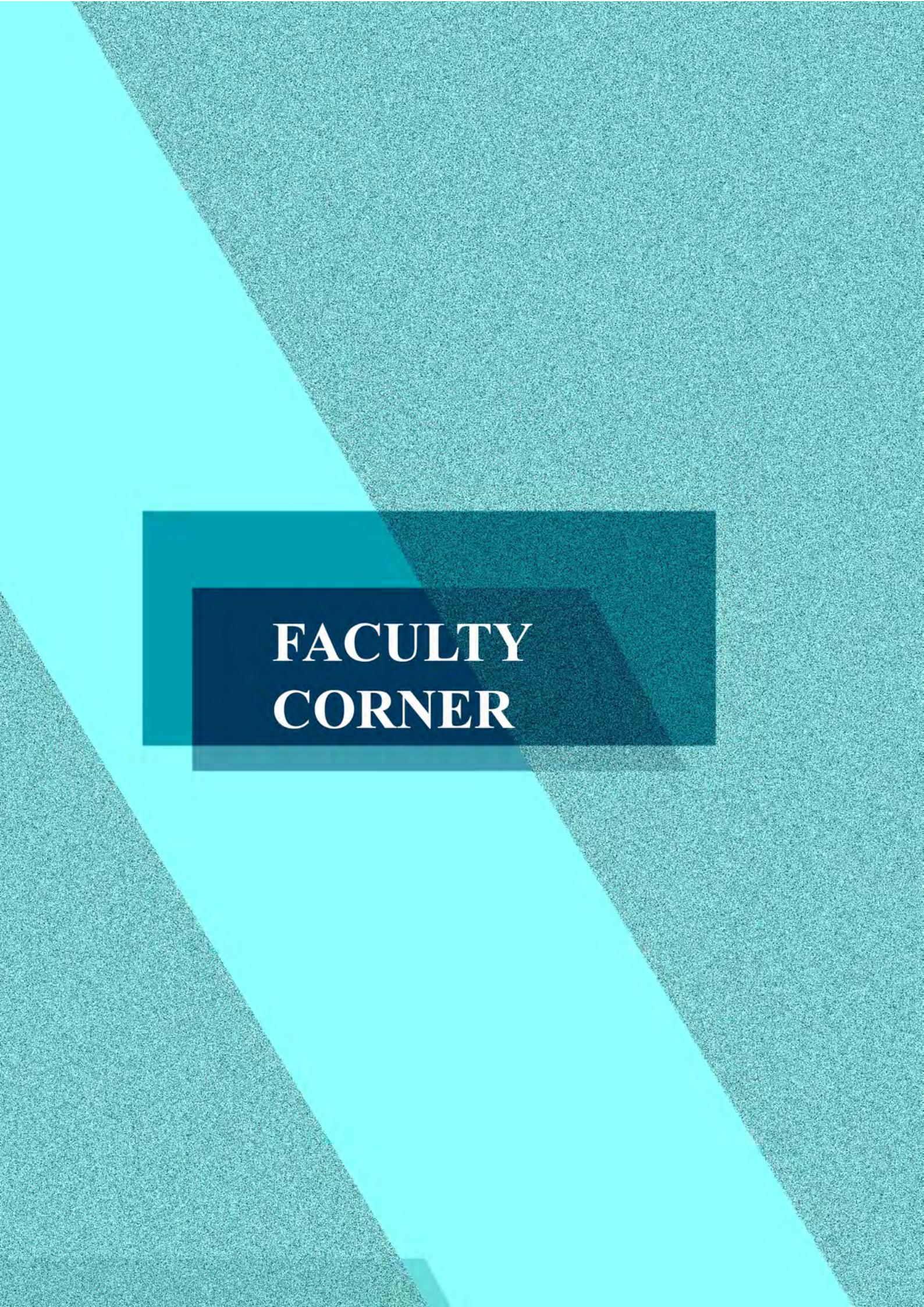
I truly agree to the statement, because everyone including Faculty and Students have dedicated their souls and their precious time so as to ensure that the magazine gets published. I'd also like to take a moment to thank all the other people who have supported us during these times in some way or the other.

The Magazine surely does act as a platform to showcase the talents of the hidden writers amongst us. Students get to express their views on any technical topic they feel like without the fear of being judged. Perhaps, what I feel is that the Magazine acts a bridge so as to increase the bond of students to the technical topics the world is dealing with right now.

There are numerous technical related topics in the magazine which are written by different people, it helps us to understand about the different perceptions of people on a certain topic. There are also topics written by the faculty members and the people who work in the industry and have vast experiences in their field. These articles will throw a light on how students must work and will surely change their outlook regarding certain aspects of life.

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FACULTY CORNER



Introduction to Ultra Low Power (ULP)

Wireless Technologies

Many innovative new wireless applications are now being made possible with the introduction of ultra-low-power wireless chipsets. Until recently, the only way to achieve data transfer between a sensor and a client has been to use wires, or manually collect data from a logging device. Wireless technologies have been available for decades. However, they tend to use significant amounts of power and need specialized equipments to establish communications. Most target markets are characterized by periodic transfer of small amounts of sensor information between sensor nodes and a central device. Some identified end products which may implement a low-power radio system include cell phones, health and fitness devices, home automation, heating, ventilating, and air conditioning (HVAC), remote controls, gaming, human interface devices (HID), smart meters, payment, and many others. These applications are all constrained by the following critical key requirements: ultra-low-power, low cost, and compact physical size. The ultra-low-power requirement is mainly due to the need of targeted devices to operate for extended periods of time from coin cells or energy scavenger technology. Apart from the obvious advantages of a low chipset cost, overall product expense is largely affected by the power source. This paper introduces various low power wireless technologies and leaves it up to the reader to decide which technology is most suitable for their intended product.

Bluetooth

Bluetooth is a short range wireless technology originally intended to replace the cable(s) connecting portable and/or fixed electronic devices. It's a technology standard using short range radio links. Named after the Danish king, Harold Bluetooth was the first to emerge, several devices like mobile phones, PDAs, headsets, keyboards, mice, medical equipment and even cars now come with this feature. Due to its low cost, manufacturers are willing to implement this technology in most devices. Bluetooth operates Frequency Hopping Spread Spectrum (FHSS) to avoid any interference. Bluetooth radios operate in the unlicensed ISM band at 2.4 Gigahertz using 79 channels between 2.402 GHz to 2.480 GHz. A data channel hops randomly 1600 times per second between the 79 RF channels. Each channel is divided into time slots of 625 microseconds long. The range of Bluetooth communication is 0-100 meters, dependent upon power of devices. Every Bluetooth device is classified in three classes (class 1, class 2, and class 3) dependent upon its range. There are two types of data transfer between devices: SCO (Synchronous Connection Oriented) and ACL (Asynchronous Connectionless). Bluetooth Special Interest group (SIG) has developed the Bluetooth Protocol stack. Main objective of this specification is to achieve interoperability between different device manufacturer companies. There are many

Bluetooth profiles like A2DP, AVRCP, DUN, PAN, HFP, HSP, FTP, PBAP, SDP, MAP, HID, HDP, OPP, OBEX, BPP, BIP etc. Every profile is defined for specific purpose. For example A2DP profile is used to listen audio.

Bluetooth Low Energy (LE) (Bluetooth Smart)

LE started life as a project in the Nokia Research Centre with the name Wibree. In 2007, the technology was adopted by the Bluetooth Special Interest Group (SIG) and renamed Bluetooth Ultra-Low-Power and then Bluetooth low energy. The aim of this technology is to enable power sensitive devices to be permanently connected to the Internet. LE sensor devices are typically required to operate for many years without needing a new battery. They commonly use a coin cell, for example, the popular CR2032. LE technology is primarily aimed at mobile telephones, where it is envisaged that a star network topology, similar to Bluetooth, will often be created between the phone and an ecosystem of other devices. LE is also known as Bluetooth v4.0 and is part of the public Bluetooth specification. As a result of being a standard, LE benefits from all the advantages of conformance and extensive interoperability testing at unplug fests. A device that operates Bluetooth v4.0 may not necessarily implement other versions of Bluetooth; in such cases it is known as a single-mode device. Most new Bluetooth chipsets from leading Bluetooth silicon manufacturers will support Bluetooth and the new LE functionality.

Infrared

Infrared allows devices to communicate via short-range wireless signals. Through infrared, devices can transfer data bidirectionally. Infrared networks were designed to support direct two connections only, created temporarily as the need arises. Infrared have a frequency in the electromagnetic spectrum in the range just below that of red light. It has been implemented in portable devices as mobile phones, laptops, cameras, printers, medical devices and many more. Main characteristics of this kind of optical wireless communication is physically secure data transfer, Line-of Sight (LOS) and very low bit error rate (BER) that makes it very efficient. Infrared, a direct or incoming network connection to a remote access server using an infrared port. Infrared technology is the use of the lesser frequency of light for electronic purposes. It needs the hindsight of touch or nearness. Infrared technology is used mainly in television remotes and low budget mobiles. The general distance between the transmitter and receptor needs to be less than 10 meters. Infrared radiation is traditionally divided into four categories based on the wavelength. Near Infrared: 750- 1500 nanometers. Middle Infrared: 1500-6000 nanometers. Far Infrared: 6000-40,000 nanometers. Far far Infrared: 40000 nanometer to 1 millimeter. The Infrared Data Association (IrDA) is an industry driven interest group that was founded in 1993 by around 50 companies. IrDA provides specifications for a complete set of protocols for wireless infrared communications and the name "IrDA" also refers to that set of protocols. . IrDA has recently announced an ultra-high-speed connectivity version, yielding 1



Gbps. However, it only works over a distance of less than 10 cm. One of the main problems with infrared (IR) is its line-of-sight requirement.

Near Field Communication (NFC)

Near Field Communication (NFC) is a set of standards for smart phones and similar devices to establish radio communication with each other by touching them together or bringing them into close proximity, usually no more than a few centimeters. NFC used in wide range including contactless transactions, data exchange and use other wireless technology like Bluetooth, Wi-Fi in easier way. Communication is also possible between an NFC device and an unpowered NFC chip called a "tag". NFC builds upon Radio-frequency identification (RFID) systems by allowing two-way communication between endpoints, where earlier systems such as contactless smart cards were one-way only. Since unpowered NFC "tags" can also be read by NFC devices, it is also capable of replacing earlier one-way applications. NFC is set of short-range wireless technologies, typically requiring a distance of 4 cm or less. NFC operates at 13.56 MHz on ISO/IEC 18000-3 air interface and at rates ranging from 106 Kbit/s to 424 Kbit/s. NFC always involves an initiator and a target; the initiator actively generates an RF field that can power a passive target. NFC peer-to-peer communication is possible, provided both devices are powered. NFC tags contain data and are typically read-only but may be rewriteable. They can be custom-encoded by their manufacturers or use the specifications provided by the NFC Forum, an industry association charged with promoting the

technology and setting key standards. The tags can securely store personal data such as debit and credit card information, loyalty program data, PINs and networking contacts, among other information. The NFC Forum defines four types of tags which provide different communication speeds and capabilities in terms of configurability, memory, security, data retention and write endurance. Tags currently offer between 96 and 4,096 bytes of memory.

Wireless Fidelity (Wi-Fi)

Wireless Fidelity (Wi-Fi) is a generic term that refers to the IEEE 802.11 communications standard for wireless local area networks (WLANs). Wi-Fi network connect computers to each other, to internet and to the wired network. The 802.11 standard has been developed to enable wireless local area networking in either the 2.4 GHz or 5.2 GHz ISM bands (Industrial, Scientific, and Medical band) which is qualified by Federal Communications Commission (FCC). Specifically, the frequencies used by 802.11 fall in the unlicensed bands, these are frequency bands which anyone can use for radio communication (without a license). The exact frequencies used (and how they are used) depends on whether the system follows 802.11b, 802.11a, or 802.11g. There are many security methods available, which is used to prevent Wi-Fi from unauthorized access or security threat. Most common security methods are Wireless Equivalent Privacy (WEP) and Wi-Fi Protected Access (WPA). WEP is one of the least secure methods, which is replaced by WPA. WPA2 is advance version of WPA, which is more secure than WPA.

ZigBee

ZigBee is a low-power wireless specification based on the Institute of Electrical and Electronics Engineers (IEEE) Standard 802.15.4-2003 and was established in 2002 by a group of 16 companies. It introduces mesh networking to the low-power wireless space and is targeted towards applications such as smart meters, home automation, and remote control units. ZigBee channels are similar to those for LE in that they are 2 MHz wide. However, they are separated by 5 MHz, thus wasting spectrum somewhat. ZigBee is not a frequency hopping technology, therefore and requires careful planning during deployment in order to ensure that there are no interfering signals in the vicinity. ZigBee devices are often used in mesh network form to transmit data over longer distances, passing data through intermediate devices to reach more distant ones. ZigBee is targeted at applications that require a low data rate, long battery life, and secure networking. ZigBee has a defined rate of 250kbit/s, best suited for periodic or intermittent data or a single signal transmission from a sensor or input device. Applications include wireless light switches, electrical meters with in-home-displays, traffic management systems, and other consumer and industrial equipment that requires short-range wireless transfer of data at relatively low rates. ZigBee is a low-cost, low-power, wireless mesh network standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications. Low power-usage allows longer life with smaller batteries. Mesh networking provides high reliability and more extensive range. ZigBee chip

vendors typically sell integrated radios and microcontrollers with between 60 KB and 256 KB flash memory. ZigBee devices are of three types – ZigBee Coordinator (ZC), ZigBee Router (ZR), and ZigBee End Device (ZED). ZigBee Alliance is a group of more than 300 companies including industry majors like Philips, Mitsubishi Electric, Epson, Atmel, Texas Instruments etc. which are committed towards developing and promoting this standard. The manufacturers which are members of the Alliance provide software, hardware and reference designs to anyone who wants to build applications using Zigbee.

ANT and ANT+

ANT is a low-power proprietary wireless technology which operates in the 2.4 GHz spectrum. It was established in 2004 by the sensor company Dyna stream. It is a Wireless Sensor Network (WSN) RF protocol for short range wireless communication of ultra-low power networking applications – from simple point-to-point to complex mesh networks. ANT is meant to run with low cost, low power microcontrollers (MCUs) and transceivers operating in the Industrial, Scientific and Medical (ISM) band. Its primary goal is to allow sports and fitness sensors to communicate with a display unit, for example a watch or cycle computer. It also typically operates from a coin cell. Similar to LE, ANT devices may operate for years on a coin cell. ANT devices are not subject to the extensive conformance and interoperability testing applied to other standardized technologies. ANT+ is introducing a new certification process in 2011 which will be chargeable and a prerequisite for using ANT+ branding. ANT+ has taken the ANT

protocol and made the devices interoperable in a managed network, thereby guaranteeing that all ANT+ branded devices work seamlessly. ANT actually is the most promising technology in more applications for collection, automatic transfer and tracking of sensor data within sports, wellness management and home health monitoring. Current ANT+ Device profiles include heart rate monitors, Bicycle speed and power Typical ANT applications, Heart rate monitors, Speed and distance monitors, Bike speed and cadence sensors, Bike power sensors, Weight scales for the measuring of BMI (Body Mass Index), Fitness equipment data sensors, Temperature sensors, and weight scales and stride/speed/distance. Device profiles are managed by the ANT+ Alliance.

RF4CE

Radio Frequency for Consumer Electronics (RF4CE) is based on ZigBee and was standardized in 2009 by four consumer electronics companies: Sony, Philips, Panasonic, and Samsung. Two silicon vendors support RF4CE: Texas Instruments and Freescale Semiconductor, Inc. RF4CE's intended use is as a device remote control system, for example for television set-top boxes. The intention is that it overcomes the common problems associated with infrared: interoperability, line-of-sight, and limited enhanced features.

NIKE+

Nike+ is a proprietary wireless technology developed by Nike and Apple to allow users to monitor their activity levels while exercising. Its power consumption is relatively high, returning

only 41 days of battery life from a coin cell. Being a proprietary radio, it will only work between Nike and Apple devices. Nike+ devices are shipped as a single unit: processor, radio, and sensor. In this article, we therefore evaluate this technology as a single entity. The design is a two-chip solution, consisting of a processor and a Nordic nRF2402 radio transceiver integrated circuit (IC).

60 GHz Protocol

This category of wireless protocols operates in a signaling band from 57 to 64GHz. These frequencies are significantly higher than those used by other wireless protocols, such as LTE (0.7 GHz to 2.6 GHz) or Wi-Fi (2.4 GHz or 5 GHz). This key difference results in 60 GHz systems having some technical advantages compared to other network protocols like Wi-Fi but also some limitations.

60 GHz protocols utilize very these high frequencies to increase the amount of network bandwidth and effective data rates they can support. These protocols are especially well-suited for streaming of high-quality video but can be used for general-purpose bulk data transfers also. Compared to Wi-Fi networks that support maximum data rates between 54 Mbps and about 300 Mbps, 60 GHz protocols support rates above 1000 Mbps. While high-definition video can be streamed over Wi-Fi, it requires some data compression that negatively affects video quality; no such compression is required on 60 GHz connections.

In return for increased speed, 60 Gbps protocols sacrifice network range. A



typical 60 Gbps wireless protocol connection can only function at distances of 30 feet (about 10 meters) or less. Extremely high frequency radio signals are not able to pass through most physical obstructions and so indoor connections are also generally limited to a single room. On the other hand, the greatly reduced range of these radios also means that they are much less likely to interfere with other nearby 60 GHz networks, and makes remote eavesdropping and network security break-ins much more difficult for outsiders.

An industry group created the first standard 60 GHz protocol, **Wireless HD**, specifically to support high-definition video streaming. The 1.0 version of the standard completed in 2008 supported data rates of 4 Gbps, while version 1.1 improved supports to a maximum of 28 Gbps. *UltraGig* is a specific brand name for WirelessHD standard-based technology from a company called Silicon Image.

The **WiGig** 60 GHz wireless standard (also known as *IEEE 802.11ad*) completed in 2010 supports data rates up to 7 Gbps. In addition to video streaming support, networking vendors have used WiGig as a wireless replacement for cabling of video monitors and other computer peripherals. An industry body called the Wireless Gigabit Alliance oversees WiGig technology development.

WiGig and WirelessHD are widely perceived as competing technologies. Some believe WiGig may even replace Wi-Fi technology someday, although this would require solving its range limitation issues.

UWB

Ultra-wideband (UWB) technology offers a solution for the bandwidth, cost, power consumption, and physical size requirements of next-generation consumer electronic devices. UWB enables wireless connectivity with consistent high data rates across multiple devices and PCs within the digital home and the office. With the support of industry workgroups, such as the wireless universal serial bus (WUSB) workgroup, and technology leaders, like Intel, UWB technology promises to make it easy to create high-speed WPANs that can connect devices throughout the home. UWB differs substantially from conventional narrowband radio frequency (RF) and spread spectrum technologies (SS), such as Bluetooth Technology and 802.11a/g. UWB uses an extremely wide band of RF spectrum to transmit data. In so doing, UWB is able to transmit more data in a given period of time than the more traditional technologies. RF design engineers typically have little control over the bandwidth parameter, because this is dictated by FCC regulations that stipulate the allowable bandwidth of the signal for a given radio type and application. Bluetooth Technology, 802.11a/g Wi-Fi, cordless phones, and numerous other devices are relegated to the unlicensed frequency bands that are provided at 900 MHz, 2.4 GHz, and 5.1 GHz. Each radio channel is constrained to occupy only a narrow band of frequencies, relative to what is allowed for UWB. UWB radios can use frequencies from 3.1 GHz to 10.6 GHz. Each radio channel can have a bandwidth

of more than 500 MHz, depending on its center frequency. To allow for such a large signal bandwidth, the FCC put in place severe broadcast power restrictions. By doing so, UWB devices can make use of an extremely wide frequency band while not emitting enough energy to be noticed by narrower band devices nearby, such as 802.11a/g radios. This sharing of spectrum allows devices to obtain very high data throughput, but they must be within close proximity. Strict power limits mean the radios themselves must be low power consumers. Because of the low power requirements, it is feasible to develop cost-effective CMOS implementations of UWB radios. With the characteristics of low power, low cost, and very high data rates at limited range, UWB is positioned to address the market for a high-speed WPAN. UWB technology also allows spectrum reuse. A cluster of devices in proximity (for example, an entertainment system in a living area) can communicate on the same channel as another cluster of devices in another room (for example, a gaming system in a bedroom). UWB-based WPANs have such a short range that nearby clusters can use the same channel without causing interference. An 802.11g WLAN solution, however, would quickly use up the available data bandwidth in a single device cluster, and that radio channel would be unavailable for reuse anywhere else in the home. UWB Applications UWB technology can enable a wide variety of WPAN applications. Examples include:

- Replacing IEEE1394 cables between portable multimedia CE devices, such as camcorders, digital cameras, and portable MP3 players, with wireless connectivity
- Enabling high-speed wireless universal serial bus (WUSB) connectivity for PCs and PC peripherals, including printers, scanners, and external storage devices
- Creating ad-hoc high-bit-rate wireless connectivity for CE, PC, and mobile devices.

MyriaNed

MyriaNed is a wireless sensor network (WSN) platform developed by Dev Lab. It uses an epidemic communication style based on standard radio broadcasting. This approach reflects the way humans interact, which is called gossiping. Messages are sent periodically and received by adjoining neighbors. Each message is repeated and duplicated towards all nodes that span the network, it spreads like a virus (hence the term epidemic communication).

Nodes can be added, removed or may be physically moving without the need to reconfigure the network. The GOSSIP protocol is a self-configuring network solution. The network may even be heterogeneous, where several types of nodes communicate different pieces of information with each other at the same time. This is possible due to the fact that no interpretation of the message content is required in order to be able to forward it to other nodes.



Message communication is fully transparent, providing a seamless communication platform, where new functionality can be added later, without the need to change the installed base. Furthermore, MyriaNed is enabled to update the wireless sensor nodes software by means of “over the air” programming of a deployed network.

During radio communication a TDMA (Time Division Multiple Access) scheme is used to overcome collisions during broadcast communication. Current implementations run on 2.4 GHz and 868 MHz radios. The concept of MyriaNed is however not restricted to these frequencies.

-Biju Balakrishnan

Asst. Prof. EXTC

Need Of Computer Aided Design For Gan HEMT

Owing largely to high electrical breakdown field and high electron sheet charge density, GaN HEMTs are capable of amplifying and delivering significantly larger power density signals than the currently used MMIC technologies. The wide band gap and absence of ionized impurities in the un-doped hetero-structure are expected to have a positive effect on the oscillator noise properties. These fundamental physical factors make GaN HEMTs an attractive option for microwave sources. Apart from this, due to high dopant concentration, the break down voltage is lower which reduces the collisions and scattering in the structure and the carrier saturation velocity is increased and this could improve the device performance at higher frequencies. These factors have created a bridge between past modeling and characterization technologies and what is needed today.

GaN HEMTs are the preliminary requirements for the next-generation high-performance technologies that will revolutionize the RF industry. But for the secondary round of technologies, computer-aided-design (CAD) techniques must rapidly advance.

The complexity and performance of GaN HEMT devices is currently limited by two main factors: the ability to effectively design circuits that will make full use of the technology's capability, and the ability to flow enough thermal energy

from GaN transistors to operate these devices at peak performance. Sophisticated modeling and characterization techniques can aid in the design process of HEMT devices, potentially mitigating the effects of these limitations.

Aspect	Physical Models	Compact Model	Behavioral Model
Convergence	4	5	3
Optical range	6	4	2
Extrapolation accuracy	6	4	2
Physical insight	6	4	2
Modeling process simplicity	1	4	6
Circuit design viability	2	5	4

Table 1. The various model and the level of benefits at each stage of designing.



Hence a comprehensive model GaN HEMT should be considered which should yield a better understanding of the operation of the device and provide an insight on how one might optimize its performance and remove the current limitations. To accomplish the level of detail, efficiency, and accuracy required to perform this type of value-added simulations, the latest test and measurement and modeling techniques must be employed as shown in fig2. The important features of the model should be:

1. The device should be capable of operating in any desirable biasing mode (active or beyond pinch off).
2. The application of the device as an optical oscillator should be characterized.



**Figure 2: Different measurement approaches Vs varying degree of model extraction
(AMCAD Engineering)**

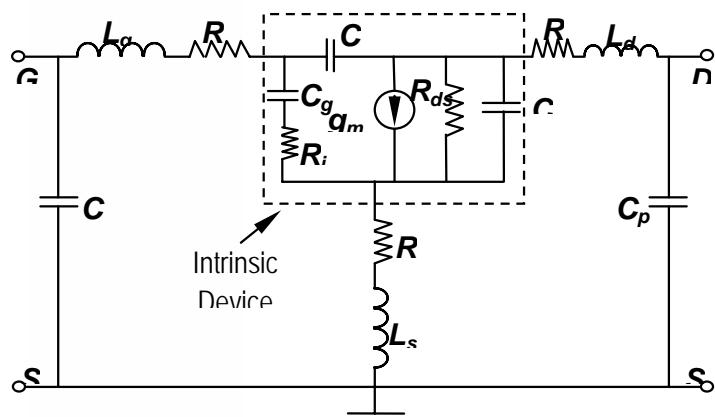
These models need to go further than just predicting I-V characteristics and output-power levels. In order to optimize

overall amplifier efficiency, the models need to provide simulations that accurately reflect the active-device input and output impedances. Given the high-end performance of GaN HEMT technology, even minute inaccuracies in a design can significantly impact the overall performance of the final devices.

“One high-performance technique used to characterize GaN transistors are based on the I-V characterization system,” explains Dr. Christophe Charbonnaud, deputy director and compact modeling leader for *AMCAD*. “The I-V method was originally developed for gallium-arsenide (GaAs) devices and has been extended to GaN devices. Such a model is shown in fig3.

Principal evolutions are concerned with the increase of voltage, current swing, and commutation times when dealing with high voltages and currents.”

Using I-V characterizations demands the generation of certain measurements, which could enable the extraction of isodynamic equations. The trapping characteristics and thermal parameters that function as a product of the quiescent bias conditions are isodynamic parameters. If those parameters are characterized properly, they will enable the modeling of GaN transistors closer to real-world bias conditions and behavior.



**Figure 3: AMCAD small signal Model
for HEMT**

This process reveals two areas where the detail of the data would limit the ability to effectively simulate device behavior: the quality of the measurement information on the device parameters and the model error that scales with the need to extrapolate on the fitted model data.

-Ms. Sonia Behra

Asst. Prof. EXTC



PLASTIC OPTICAL FIBER

Plastic optical fiber (POF) has been used for 30 years in specialized applications that require low data rates and cabling runs less than 100 meters long. But now, because of new developments, POF is on the verge of gaining wide acceptance in high-bandwidth communications markets, such as industrial control, telecommunications, and home network.

Most POF is called step index fiber (SI-MMF), which has a fiber diameter of 1 millimeter, or 1,000 micrometers, and a core diameter of 980 micrometers. Generally, polymethacrylate (PMMA) and acrylic resins are used as the core material, and fluorinated polymer is used as the clad material. One manufacturer offers a premium POF with a core of high-purity polymethyl methacrylate and a cladding made of special fluorinated polymer.

POF can be cut with a razor blade, and the cut end can be polished without much effort. Plastic fiber can be terminated by a variety of methods. One popular method involves heating the fiber end and pushing it against a mirrored surface.

The material can withstand rough treatment, and if the ends of the fiber are somewhat damaged or if the light axis is a bit off-center, it will still transmit light. The large diameter of the core makes it easy to insert into the fiber a large amount of light from a relatively inexpensive light source. POF optical transceiver modules typically use a 650-nanometer red LED as the light source. In addition, typical POF connectors cost substantially less than those for glass fiber.

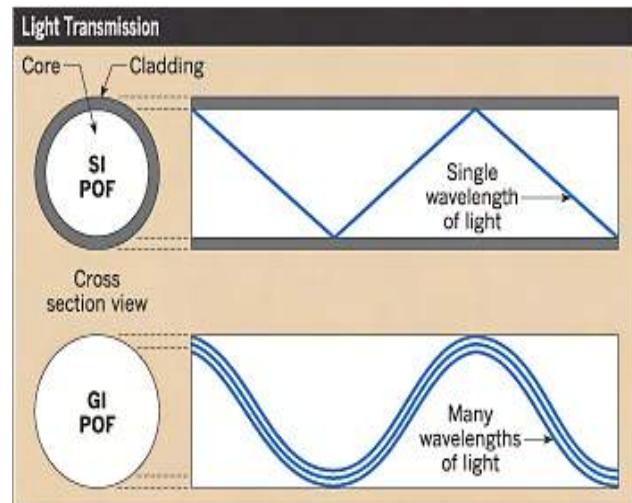


Figure 1

SI-MMF has a loss of 0.15-0.2 decibels per meter with a 650 nanometer light source. Bandwidth is limited by the large numerical aperture of the core and the step-index profile. All of these parameters restrict SI-MMF fiber to relatively short links at low data rates. But the recent development of low-loss, high-bandwidth graded-index POF (GI-POF), which can offer 2 GHz of bandwidth at extended distances, should allow plastic to challenge glass optical fiber. Not only that, GI-POF could become a contender in applications like fiber-to-the-desk, fiber-to-the-home, and other short-haul links.

The advancements in GI-POF and low-cost transceivers that use red and green LEDs and economical laser diodes are driving renewed interest in many types of POF data links. Several companies in Japan and one U.S. firm have introduced improved SI-POF and the new family of GI-POF. A number of semiconductor companies have also introduced suitable transmitter diodes.

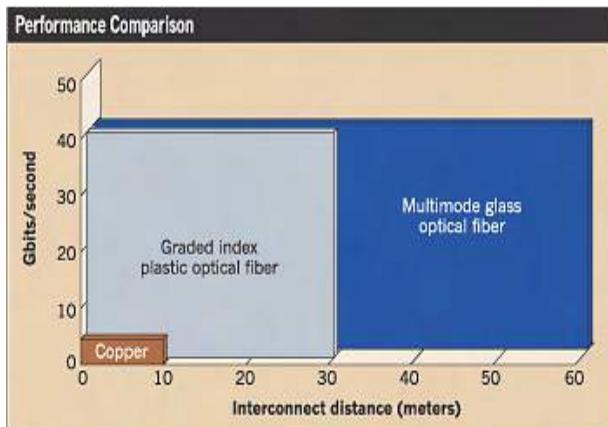


Figure 2

Home networks could become an important market for POF. The demand for high-speed Internet access and the wide use of digital devices, such as DVD players and video surveillance systems, requires a residential network that can interconnect computers, printers, digital cameras, music recording equipment, and all of the appliances of the future.

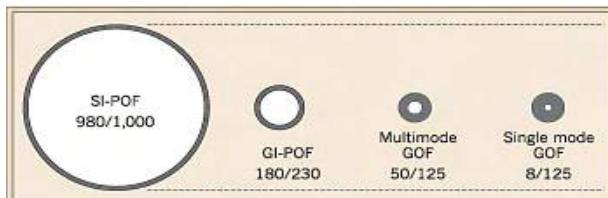


Figure 3

POF cabling continues to be a popular choice for low-cost, point-to-point links in noisy EMI/RFI instrumentation and factory environments. Additionally, the industrial networking segment, which has been a strong market for low-speed, step-index, POF links, is adopting the Industrial Ethernet standard. The industrial control networking market is moving from the 12-Megabits- to 16-Megabits-per-second Profibus and SERCOS standards to the 100-Megabits-per-second Industrial Ethernet standard. The next step is the integration of the Ethernet standard with field bus standards. And looking to the future, the industry is studying Gigabit Ethernet to further lower manufacturing costs in plants. Higher performance GI-POF should find application here.

In the telecommunications interconnect industry, GI-POF can also provide lower cost network components at a time when carriers are looking for cost savings in their network infrastructures. While maintaining the performance associated with glass optical fiber, GI-POF allows the use of less expensive transceivers and connectors. Most of this increased tolerance is in the transceiver, where important cost reductions can be achieved.

As a result, the overall cost of new interconnection equipment in data/telecom networks can be reduced as much as 75% with GI-POF, and it will be possible to meet the demand for 10-Gigabit-per-second speed over distances less than 30 meters. An example of a high-capacity, ultra-short distance connection is found in a server farm environment.

	Core	Cladding	Attenuation (dB/km)	Application
All silica optical fiber	Silica	Silica	0.5	Long distance data communication (telecom line)
Polymer clad optical fiber	PCF	Silica	10	Short-Mid distance data communication (~500m)
	HPCF	Silica	5	Mid distance data communication (~2km)
Compound glass optical fiber	Glass	Glass	15	Short-Mid distance data communication (~300m)
Plastic optical fiber	PMMA	Fluorinated polymer	140	Short distance data communication (~50m)

Table 1

Additionally, in the next few years, wide uses of 40-Gigabit-per-second optical interconnect systems is expected. The individual component alignment tolerance of plus or minus one-tenth the diameter of the glass fiber, or five microns, requires expensive components in connectors and transceivers. The 180-micrometer diameter of POF, which is three times the diameter of multimode GOF, affords a total alignment tolerance of plus or minus 85 micrometers, compared to a plus or minus 20-micrometer alignment tolerance for glass in a typical link. This makes it possible to use less expensive designs for all components.

In addition, placing optical fibers in parallel within a single ribbon cable offers a connection design that is less expensive, has more relaxed tolerances, and makes field installation easier. This type of GI-POF cable can meet the needs of existing OC-192 and emerging OC-768 optical transmission speeds for carriers.

Four connector styles are available for terminating plastic optical fiber: simplex, simplex latching, duplex, and duplex latching. The latching connector is designed for rugged applications that require greater retention force than non-latching connectors. Duplex connectors are keyed to ensure proper orientation. For extreme temperature environments, the cable/connector attachment can be strengthened with an RTV adhesive.

Similar to glass fiber, POF test equipment includes optical power meters, stabilized 660-nanometer LED light sources, and a family of interface adapters.

Several worldwide industry organizations are boosting the awareness of POF applications. The most important is the POF Trade Organization, which has a Web site that offers information on suppliers of POF equipment and services to end-users and designers. Other organizations include the POF Consortium in Japan, the POF Applications Center at the University of Applied Sciences in Germany, and POF organizations in the United Kingdom, France, and Brazil

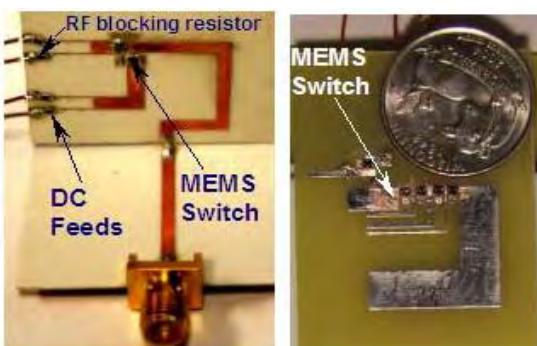
-Ms. Rashmita Kumari Mohapatra

Asst. Prof. EXTC

Reconfigurable Antennas

Reconfigurable antennas have emerged as a key component for advanced wireless communication systems. Future systems will employ reconfigurable and adaptive radio technologies that provide agility in dynamic channel environments, increased capacity and spectrum efficiency as well as cost-effective solutions. For example, cognitive radio is a new revolutionary concept in control and management of the electromagnetic spectrum for future communication systems, which places immense challenges on the antenna design and technology. Another example is the need for millimeter-wave antennas with beam steering capabilities for the successful deployment of short range GBps wireless networks as well as future 5G mobile communication systems. The antenna elements will be required to electronically reconfigure their characteristics in terms of, for example, radiation patterns, polarization and wideband frequency tuning. Such requirements become even more challenging at millimeter wave frequencies due to the limitations in available technologies. Moreover, the underutilized millimeter-wave spectrum offers huge opportunities for numerous applications such as multi-GBps communications, satellite links, automotive radar, security imaging, non-destructive testing and medical imaging.

Reconfigurable antennas, with the ability to radiate more than one pattern at different frequencies and polarizations, are necessary in modern telecommunication systems. The requirements for increased functionality (e.g., direction finding, beam steering, radar, control, and command) within a confined volume place a greater burden on today's transmitting and receiving systems. Reconfigurable antennas are a solution to this problem. This paper discusses the different reconfigurable components that can be used in an antenna to modify its structure and function. These reconfiguration techniques are either based on the integration of radio-frequency micro electromechanical systems (RF-MEMS), PIN diodes, varactors, photoconductive elements, or on the physical alteration of the antenna radiating structure, or on the use of smart materials such as ferrites and liquid crystals. Various activation mechanisms that can be used in each different reconfigurable implementation to achieve optimum performance are presented and discussed. Several examples of reconfigurable antennas for both terrestrial and space applications are highlighted, such as cognitive radio, multiple-input-multiple-output (MIMO) systems, and satellite communication.

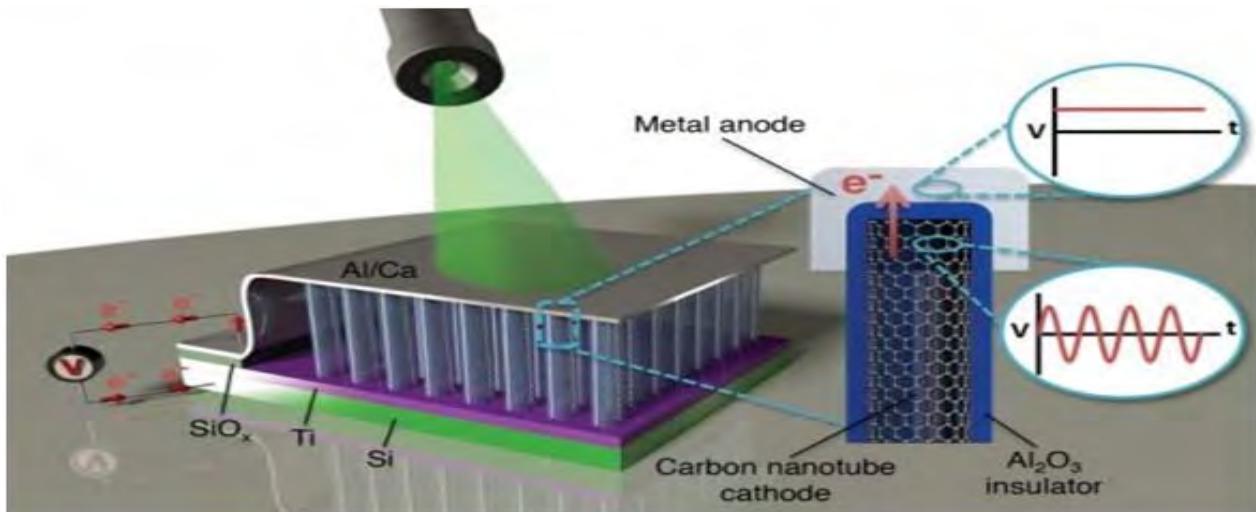


-Mr. Nikhil Tiwari

Asst. Prof. EXTC



Rectenna



Optical rectenna schematic. This schematic shows the components of the optical rectenna developed at the Georgia Institute of Technology.

Credit: Thomas Bouge

Using nanometer-scale components, researchers have demonstrated the first optical rectenna, a device that combines the functions of an antenna and a rectifier diode to convert light directly into DC current.

Based on multiwall carbon nanotubes and tiny rectifiers fabricated onto them, the optical rectennas could provide a new technology for photo detectors that would operate without the need for cooling, energy harvesters that would convert waste heat to electricity -- and ultimately for a new way to efficiently capture solar energy.

In the new devices, developed by engineers at the Georgia Institute of Technology, the carbon nanotubes act as antennas to capture light from the sun or other sources. As the waves of light hit the nanotube antennas, they create an oscillating charge that moves through rectifier devices attached to them. The rectifiers switch on and off at record high

petahertz speeds, creating a small direct current.

Billions of rectennas in an array can produce significant current, though the efficiency of the devices demonstrated so far remains below one percent. The researchers hope to boost that output through optimization techniques, and believe that a rectenna with commercial potential may be available within a year.

"We could ultimately make solar cells that are twice as efficient at a cost that is ten times lower, and that is to me an opportunity to change the world in a very big way" said Baratunde Cola, an associate professor in the George W. Woodruff School of Mechanical Engineering at Georgia Tech. "As a robust, high-temperature detector, these rectennas could be a completely disruptive technology if we can get to one percent efficiency. If we can get to higher efficiencies, we could apply it to energy conversion technologies and solar energy capture."



The research, supported by the Defense Advanced Research Projects Agency (DARPA), the Space and Naval Warfare (SPAWAR) Systems Center and the Army Research Office (ARO), is scheduled to be reported September 28 in the journal *Nature Nanotechnology*.

Developed in the 1960s and 1970s, rectennas have operated at wavelengths as short as ten microns, but for more than 40 years researchers have been attempting to make devices at optical wavelengths. There were many challenges: making the antennas small enough to couple optical wavelengths, and fabricating a matching rectifier diode small enough and able to operate fast enough to capture the electromagnetic wave oscillations. The potential of high efficiency and low cost kept scientists working on the technology.

"The physics and the scientific concepts have been out there," said Cola. "Now was the perfect time to try some new things and make a device work, thanks to advances in fabrication technology."

Using metallic multiwall carbon nanotubes and nanoscale fabrication techniques, Cola and collaborators Asha Sharma, Virendra Singh and Thomas Boughey constructed devices that utilize the wave nature of light rather than its particle nature. They also used a long series of tests -- and more than a thousand devices -- to verify measurements of both current and voltage to confirm the existence of rectenna functions that had been predicted theoretically. The devices operated at a range of temperatures from 5 to 77 degrees Celsius.

Fabricating the rectennas begins with growing forests of vertically-aligned

carbon nanotubes on a conductive substrate. Using atomic layer chemical vapor deposition, the nanotubes are coated with an aluminum oxide material to insulate them. Finally, physical vapor deposition is used to deposit optically-transparent thin layers of calcium then aluminum metals atop the nanotube forest. The difference of work functions between the nanotubes and the calcium provides a potential of about two electron volts, enough to drive electrons out of the carbon nanotube antennas when they are excited by light.

In operation, oscillating waves of light pass through the transparent calcium-aluminum electrode and interact with the nanotubes. The metal-insulator-metal junctions at the nanotube tips serve as rectifiers switching on and off at femtosecond intervals, allowing electrons generated by the antenna to flow one way into the top electrode. Ultra-low capacitance, on the order of a few attofarads, enables the 10-nanometer diameter diode to operate at these exceptional frequencies.

"A rectenna is basically an antenna coupled to a diode, but when you move into the optical spectrum, that usually means a nanoscale antenna coupled to a metal-insulator-metal diode," Cola explained. "The closer you can get the antenna to the diode, the more efficient it is. So the ideal structure uses the antenna as one of the metals in the diode -- which is the structure we made."

The rectennas fabricated by Cola's group are grown on rigid substrates, but the goal is to grow them on a foil or other material that would produce flexible solar cells or photo detectors.



Cola sees the rectennas built so far as simple proof of principle. He has ideas for how to improve the efficiency by changing the materials, opening the carbon nanotubes to allow multiple conduction channels, and reducing resistance in the structures.

"We think we can reduce the resistance by several orders of magnitude just by improving the fabrication of our device structures," he said. "Based on what others

have done and what the theory is showing us, I believe that these devices could get to greater than 40 percent efficiency.

Reference:

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Mr. Shailendra S. Shastri

Asst. Prof. EXTC

INDUSTRY INVOLVEMENT

The Power Lines Are Singing...!

In today's world when a candidate receives his graduation certificate in hand, many don't realize what's waiting out there for them. The opportunities received by the student are limited to a handful of segments from the industry mainly like I.T. and Finance. But, there are other fields in the industry like Power Sector, Heavy Machinery, and Aerospace etc. I will be highlighting one of the above here i.e., Power Sector.

This is one of the core Electrical fields in the whole industry and we don't realize how it touches everyone's life daily. Every industry is known to a common person by its finished goods, like for example an automobile industry is known by cars, trucks, etc., and so likewise the product of the power sector is the electricity which we consume in our residence and offices daily. In power sector there are many stages the electric supply goes through before reaching our homes and offices as shown in the figure below, right from generation till distribution. The product is always manufactured by using the raw materials, and the raw material in the power sector depends on the type of the generation plant. Let's take an example of a Hydro-power plant where the raw material is water for the electricity generation. The beauty of the hydro power plant is in its simplicity. It follows a simple principle and procedure which takes place by conversion of energy from one to another and finally into work. Mostly the fast moving water (kinetic energy) strikes the turbines and they start moving (mechanical energy) and then this energy is used to run electric generators. The transference of the energy takes place from one form to another. Now instead of water wheels water falling from a vertical height is used which has stored potential energy in it due to its position and the water is then passed through gate or vessels which take the water to turbines which convert potential energy into mechanical energy. There are four parts of the hydropower plant which are Dams, Turbines, Generators, Rotor & Stators and then transmission. The rotor having the field

pole rotates on a specific speed. When it rotates it passes the field poles across the stator to make sure it has the same effect of the electric field. The water should keep moving constantly to make sure that the amount of electricity produced is great. Remember, static water cannot generate electricity.

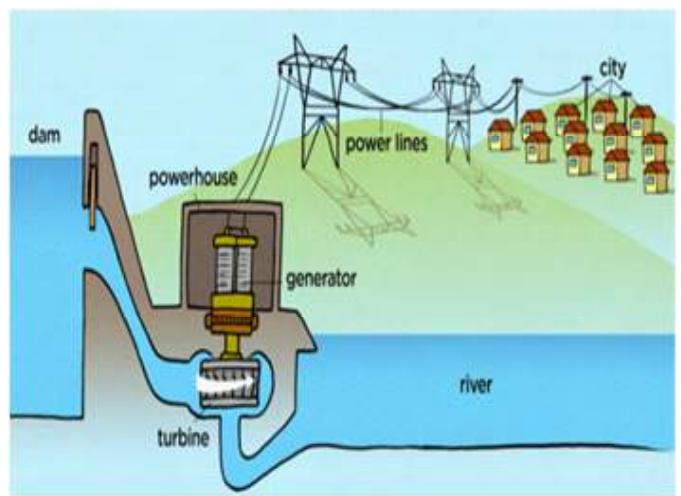


Figure 1

The generated power (electricity) via power lines or transmission lines is transferred to a substation which provides it to the consumers. This transmission lines are also called as HVAC (High Voltage AC) or EHT (Extra High Tension) lines as they carry very high voltage usually 132KV and above till 765KV at transmission level and 11KV/33KV at the distribution level. The transmission of electricity can also be done in DC form as well and such lines are called HVDC line. There is a big network of the power lines also called as grid in India and it's still expanding as we see the electricity reaching to the rural and interior parts of our country. These lines are installed on the big towers which we all have seen in cities as well as in villages. These lines are of 3-phase i.e., R, Y and B with a ground wires running at the top.

11KV/33KV at the distribution level. The transmission of electricity can also be done in DC form as well and such lines are called HVDC line. There is a big network of the power lines also called as grid in India and it's still expanding as we see the electricity reaching to the rural and interior parts of our country. These lines are installed on the big towers which we all have seen in cities as well as in villages. These lines are of 3-phase i.e., R, Y and B with a ground wires running at the top.

The infrastructure cost involved in such a deployment is huge and as we know that this lines pass through vicinity where human reside, there is a great risk involved in case of any faults or physical damage due to natural calamities as this high voltage could also cost a human life. Modern electric power systems put increasingly stringent demands on the protection system. Faults on transmission lines must be cleared in the shortest possible time in order to protect the primary system from damage, and to preserve the stability of the power grid. For the clearing of line faults in the shortest possible time, reliable teleprotection – i.e. protection using telecommunications – plays a vital role. In short: when the proper functioning of the protection signaling is not granted, the line has to be taken out of service!

The communication technologies used for implementation of protection are Power Line Carrier Communication (PLCC) and Fiber Optic Communication (FOC). Power line carrier links are particularly well suited for the transmission of protection commands. Not only do they constitute the shortest and most direct communication link between the ends of the protected line, they also use the most rugged and solid communication path for transmission – the power line itself. The ruggedness of PLC communication has even proven to provide

the service during and after catastrophic incidents when other media failed and their restoration was not possible in due time. So, these lines are not only carrying our 50Hz power frequency but they also carry other high frequencies which are used for teleprotection. The FOC uses an optical fibers present within the ground wire. This type of ground wires are special and called as Optical-Ground Wire (OPGW) as the information in the form of light (usually a wavelength of 1310nm & 1550nm is used) is transmitted through fiber cables present in it. The PLCC communication operates in the range of 50 KHz to 500 KHz in India, in a layman language we even say the two communication equipment's are talking from a distance with each other using this frequency. Though these signals are not audible to human ears, they are always there performing the important function of protection of the high cost infrastructure and most importantly human lives.

Imagine the connection of our lives with the source of electricity we are consuming to charge a smart phone, tablet, laptop, power banks, etc. or for normal usage like lights, fan, Air-conditioning, Refrigerator etc.. Now whenever you connect any adaptor or cable in the power socket you know virtually you have a connection with the source like hydro power plant and some communication systems which are present making sure uninterrupted power is supplied to us and protecting us. To do so the communication system uses high frequencies. This corresponds to the "Singing" of power lines.

-Bhargav Thakar
Sr. Engg- Communication Network
ABB India Ltd

Evolution in Telecommunication

World has shrink in few years, not in aspect of any natural cause but because of communication. Communication has made world to be accessed in the simple and fastest way. It was considered that as the distance increases the time to reach out someone also increase, but now day's communication has become so elegant that with your tip of our finger you are able to contact any person at any place in the world no matter how far you are geographically separated from him. Communications not limited to voice, it has been embedded with features like video calling, watching movie, live streams, using various applications.

Humans need and mind is never still. As his need increases, his urge to complete his need increase making his mind to think and focus on various thought and all together giving a beautiful output named INVENTION, as it is always said 'necessity is the mother of all inventions'. Same thing has happened with communication technology. A decade before it was just that only voice call was important. Then people came to know about internet, as people started slowly exploring about internet there was need for accessing the internet which requires data (data is nothing but nomenclature used to represented information in the form of binaries in network). These data needed to travel from one end to other in the network so the information like text, video even voice can be accessed. Earlier data was introduced in mobile network at a very low rate, which is if we wanted to open Google search page it would have taken about 2-3 min. with data came various feature of video

calling, video conferencing, accessing various video, online gaming, live streaming, navigation etc. These features required large data rate, if the data rate is low this access these features it would take lot of time. So demand in data increase. It was seen that the demand of voice in mobile communication was less than the demand of data, and it is increasing at the surprise rate day by day.

In order to access various feature there was need of high data rate and as people got aware of more and more technology, making them indulged in these technology and thus increasing the number of customer for certain services. It was a need to find the alternatives to the technology to increase the rate data along with to need the capacity to handle more number of customers.

There came many generation of mobile communication 1G, 2G, 3G and 4G. The main difference in this technology is the data rate. 1G dint had data service, in 2G data service was introduced for sending SMS. GPRS (General Packet Radio Service) was introduced it is also known as 2.5G the data rate was 56-115 kbps which introduced the services like MMS and WAP and then 2.75G was introduced using EDGE (Enhanced Data rate for GSM Evolution) having a data rate of up to 236.8kbps. Then came 3G which provided the data rate of 384kbps to 2Mbps and in India 4G is also introduced proving a data rate of 2Mbps to 14 Mbps.



Figure 1

The information needed to be send through cable, micro wave is also an alternative to send information wireless but the disadvantage of sending through microwave was more than through cable. Copper cable was used earlier and also now to send this information from one end to other. But these have some limitation for data rate, it failed to meet the increasing demand so there was need to use fiber cable which have high data rate in laboratory condition a data rate in Peta bits have been recorded by using fiber.

In India Reliance Jio Infocomm Limited is taking efforts to build a 4G network that can provide a high data rate to their customer, these 4G services are based on LTE (Long Term Evolution) technology. This company is led by Mr. Mukesh Ambani who is the one of the richest man in India. RJIL is using fiber in their network so that such a high demand of data can be achieved with very less time. RJIL is situated in Navi-Mumbai and it is still in prelaunch

phase, its services are been tested and verified by expertise before it is given to the customer in India. The launch of Reliance Jio 4G services is expected in this year. Like other operator RJIL is not planning to launch its 4G services in just few parts of India, It has already planned and implemented their devices in various parts to covered whole India. even though the fiber is used in backhaul but the mobile to the primary node in the network is connected wirelessly of certain frequency, these frequency has to be purchased from the government of India, RJIL has been approved the frequency band of 2300-2400 MHz of frequency range by TRAI.

When network comes into picture there are not just fiber various devices used in the network so that these data can be monitored, routed, charged, tracked, keeping records of customer identity, providing the services opted by various customer and many more. Earlier in 2G there was BTS used, in 3G node B is used and now in 4G its eNodeB (Evolved node), this node has the function of BTS, BSC and function of MSC too. Various routers are used in the network for routing purpose. A question arises by router is used?? Answer to that is the LTE technology used is purely a data network if the voice call has to be made then we needed to convert the voice into data packet and send to within the network. As the router came into picture it is clear that IP technology is used. Other than IP, MPLS (Multi-Protocol Label Switching) is the other technology that is also considered in the network. MPLS technology helps in reducing the overhead of the router and also

help in increasing the data rate, in short MPLS can be explained as representing the long IP address by a particular label number, each packet is assigned a IP address and when this IP add packet is encapsulated with a label header then router just need to analyze this label number rather than long IP add thus reducing the processing time of router and if router processing time is reduced then data rate is increased. With a particular range using router is appropriate but when it comes to the larger geographical area to be covered we needed to use other techniques. RJIL uses DWDM (Dense Wave division Multiplexing) and OTN (Optical Transport Network) technology for nation long distance. This long distance is also named as transport session in the network. Transport layer contains multiplexing devices.

DWDM is the multiplexing technology used to combine different signals together. It is a categorized under WDM (wave division multiplexing). Signal light source can carry a some amount of information different light source have different wavelength, but if different wavelength can be combined then we can have much more information carried without interfering with each other and in a signal fiber. So by using DWDM technology we can increase the data rate. It is possible in laboratory condition to combine 160 wavelengths by use of DWDM technology. But DWDM doesn't have a particular frame structure that can make it manageable to work within different network.

OTN is also used by RJIL in transport layer. The technology came in advance to SDH technology which was used in 2G and 3G. SDH had a drawback that it can't handle high data rate, but it had an advantage of proper frame structure which was essential in inter and intra network communication. OTN has the advantage of SDH and DWDM. OTN is able to handle high rate with a particular frame structure and it also have the technology of multiplexing wavelength.

I am currently pursuing my ME and also doing my project with help of RJIL. The technology used by RJIL is the latest technology used by world for mobile communication. RJIL not only developed its network for mobile communication purpose but also various video calling, live TV, service like FFTX(fiber to the X) and many more with high clarity and quality with least wait time. I am here doing my project related to Transport layer, some basic terminology I have tried to cover related to my project, I have aimed to provide a scope of improvisation in there transport layer so that company doesn't have to compromise there services by even a fraction.

-Rahul Gopi

RANCORE Trainee

Reliance Jio Infocomm Ltd.(RJIL)

ALUMNI DESK

Acceptable Signal Levels for Cable Modem

Abstract:

When measuring signal levels , maintaining, or troubleshooting a DOCSIS® cable modem , one important task is to make certain that the 64- or 256-QAM digitally modulated carrier's average power is correct.

Many of today's signal level meters, spectrum analyzers, and quadrature amplitude modulation (QAM) analyzers support the measurement of both analog TV channels and 64- and 256-QAM digitally modulated carriers. TV channel signal level or amplitude generally refers to the channel's visual carrier amplitude, which is defined as the root mean square (rms) value of the instantaneous synchronizing peak. Digitally modulated carrier amplitude is a measure of the signal's average power.

Body:

Downstream Receive Power Level:

This is the amount of signal received by the cable modem from the transmitter in the cable company head-end.

For all modems:

-15 dBmV to +15 dBmV maximum.

-12 dBmV to +12 dBmV recommended.

0 dBmV is the “optimal” level.

Upstream Transmit Power (Return Signal) level:
This is the amount of signal transmitted by the cable modem to reach the receiver in the cable company head-end.

+8 dBmV to +58 dBmV maximum for QPSK.
(DOCSIS 1.x)

+8 dBmV to +55 dBmV maximum for 8 QAM and 16 QAM. (DOCSIS 1.x)

+8 dBmV to +54 dBmV maximum for 32 QAM and 64 QAM. (A-TDMA DOCSIS 2.0)

+8 dBmV to +53 dBmV maximum for S-CDMA DOCSIS 2.0 modulation rates.

Recommended upstream signal levels are +35 dBmV to +52 dBmV.

A cable modem running a higher upstream modulation rate may downgrade itself to a lower modulation rate (i.e. 64 QAM to 16 QAM or 16 QAM to QPSK) if the upstream transmit level is higher than the maximum signal level allowed for the higher modulation rate and the CMTS is configured to allow such a change. This downgrade can cause slow speed, packet loss, and connection loss issues depending on the condition of the upstream channel.

A house or drop amplifier will NOT fix upstream signal problem because most house amplifiers don't amplify the upstream signals, they only pass the upstream signal through with some loss.

SNR (signal to noise ratio) :

This is how clear the signal is at either the modem receiver (downstream SNR) or the receiver in the cable company head-end (upstream SNR).

DOCSIS specifications list minimum CNR (carrier to noise ratio) levels not SNR levels. The SNR levels listed here are based on commonly recommended MER levels for digital cable signals. Not all QAM demodulator chipsets accurately calculate SNR levels that approximate actual MER levels, so these levels may vary depending on which chipset and/or firmware is used in the equipment.

QPSK: 12 Db minimum. 15 Db or higher recommended. (often used in upstream channels)

16 QAM: 18 Db minimum. 21 Db or higher recommended. (often used in upstream channels)

64 QAM: 24 Db minimum. 27 Db or higher recommended. (often used in downstream channels)

256 QAM: 30 Db minimum. 33 Db or higher recommended. (often used in downstream channels)

There is no upper SNR limit, although in practice 40 Db is about the highest seen.

Downstream SNR levels are read at the modem on the downstream data channel and can be viewed using the modem diagnostic screens.

Upstream SNR levels are read at the CMTS on the upstream data channel, not the modem or the modem diagnostic screens. The end-user cannot get the upstream SNR directly. Only the provider can read the upstream SNR level, directly from the CMTS. Also, the upstream SNR level provided by most CMTSs is not specific to any single modem, but is an averaged, aggregate level from all modems on that upstream channel.

Conclusion:

Signal levels not within the specifications listed above can cause slow speeds, connection problems, and connection loss due to packet errors, packet loss, and/or constant packet retransmission.

It's recommended to have the modem's signal levels at least 3Db away from the maximum/minimum levels listed above due to normal temperature related signal variation. If the modem's signal levels are at the maximum or minimum limits, they may be out of spec if the temperature changes significantly. Signal levels that vary more than 3 Db in a 24-hour period usually indicate a problem that should be looked into.

Most cable systems are designed such a way that the optimal signal levels for the modem are achieved if the modem is connected to a dedicated "homerun" RG-6 grade cable line straight to a 2-way splitter at the demarcation or ground point. This is then connected to the "drop" line connected to the cable tap on the utility pole or at the street. Like this:

Modem ←RG-6 coax→ 2-way Splitter ←RG-6 coax→ Cable tap

Excess splits, bad connectors, and/or poor quality cabling will certainly effect cable signal levels and will cause problems. Make the cable run to the modem as clean as possible, the less junk in the way the better.

Poor signal levels should not affect latency, so if your “ping” is 300ms with a downstream level of -14.0 dB mV, it is not going to get any better if your signal is increased to +1.0 dB mV. Latency is caused by a combination of physical network distance and network equipment “packet handling” time, not signal levels.

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Hathway training material.

-Tanveer Singh Champawat

**Technical Executive at
Hathway data firm and Pvt. LTD**

STUDENTS CONTRIBUTION



ELECTRONIC OXYGEN TREE

Abstract— Trees naturally convert the carbon dioxide into oxygen. But today because of Greed Selfish Humans are cutting trees and forests and on that place we humans are building white cement forest. Population is increasing and number of trees are decreasing , just like mad society people are cutting trees after trees , even they are cutting hills to build a building to earn money. Co2 is not good for humans but Trees convert water into oxygen which we humans need to survive. This will lead to Global warming problems, Acid Rain, respiratory disease many more. But do not worry now Artificial Trees will do this Job in future. If you're not getting enough air, you might want to spend time sitting under a newly designed artificial tree that converts day light into electricity using solar modules connected as leaf on tree for electrolysis process of waste water into oxygen & hydrogen. Oxygen will be released to air and hydrogen can be used to fuel vehicles of future. As well as LED lights connected on tree leaf will radiate light in night time acting as a street light.

Oxygen tree is a revolutionary urban lighting concept that represents a perfect symbiosis between pioneering design and cutting-edge eco-compatible technology. Solar Tree opens up new prospects for urban lighting in that it satisfies today's most pressing environmental, social, cultural and aesthetic demands.

Keywords—Green Technology; smart emission of oxygen; smart emission of hydrogen

I. Introduction

This project is based on electrolysis process of water. In this project we are performing the electrolysis

process of water and we produces oxygen and hydrogen and also we are consuming the solar energy and producing the street light and advertisement on display. This will help to reduce the consumption of electricity and for other purpose like in advertisement on display etc.

The main aim of this project is to produce oxygen and hydrogen from waste water. This is done by electrolysis process in water. By considering the above factors our project is being made. As India being a highly populated country with lots of pollution our project will play the most important role. So considering the



Figure 1: Prototype reduction in consumption of electricity and producing the oxygen and hydrogen our project will be useful.

Oxygen tree is a revolutionary urban lighting concept that represents a perfect symbiosis between pioneering design and cutting-edge eco-compatible technology. So we are making this project by considering the above factors which will be useful in development of country.



II. Need Of Oxygen Tree

As the earth's population ever growing, air pollution and air quality is a major issue for many countries around the world. Air pollutants can lead to respiratory related illnesses in humans and animals, create acid rain, and deplete the ozone layer. Actions such as carpooling, reducing the use of fossil fuels, and simply turning off a light when leaving a room are all ways that reduce harmful CO₂ levels in our atmosphere. There is also a natural source that eats away at harmful CO₂ gases and that source is trees. These trees help us in making our surrounding greenery. It produces oxygen and hydrogen gases. It also helps us in producing street lights. It also allows the power consumption with the help of solar panels. We get all the above mention gases by making the use of waste water. It was first implemented in Europe.



Figure 2 Need Of This Tree



III. Design



Figure 3: Implementation



Figure 4: Implementation

IV. Applications

City highway and any internals Road Housing Society, Residential Buildings Corporate Buildings, Office Buildings, School, College, Library, University building National Highway, State Highway .Village, rural areas, Forest, sea faces, Beaches, Border aria .Hotels, public places, bus stop, Railway stations, airport .Tourist places, Temples, Government Buildings, etc. It is useful in producing oxygen for human beings. It emits light used for street lighting. It is used for display advertisement. It is used for artificial greenery. It is used for decoration purpose.



V. ADVANTAGES

1. It can be Replace conventional tree in city areas.
2. The steady structure cannot fall like natural trees.
3. Like a natural trees it can produce the oxygen for freshening environment.
4. It creates the Hydrogen Gas For fuel.
5. It can avoid water pollution by west water electrolysis.
6. It works as street light.
7. Its structure is decorative and attractive.
8. By advertisement display it will make income.
9. It does not create any type pollution.
10. Its create electricity from sun light.

VI. DISADVANTAGES

1. Implementation Cost is high.
2. It required some maintenance.
3. If overheating occurs it require some time to be again in stable state.
4. It can be planted only where the water supply is available.

VII. FUTURE ENHANCEMENT

1. Smart power control for charging a battery.
2. Street light control in case of low power back-up.
3. Smart emission of oxygen.



Figure 5: Future design

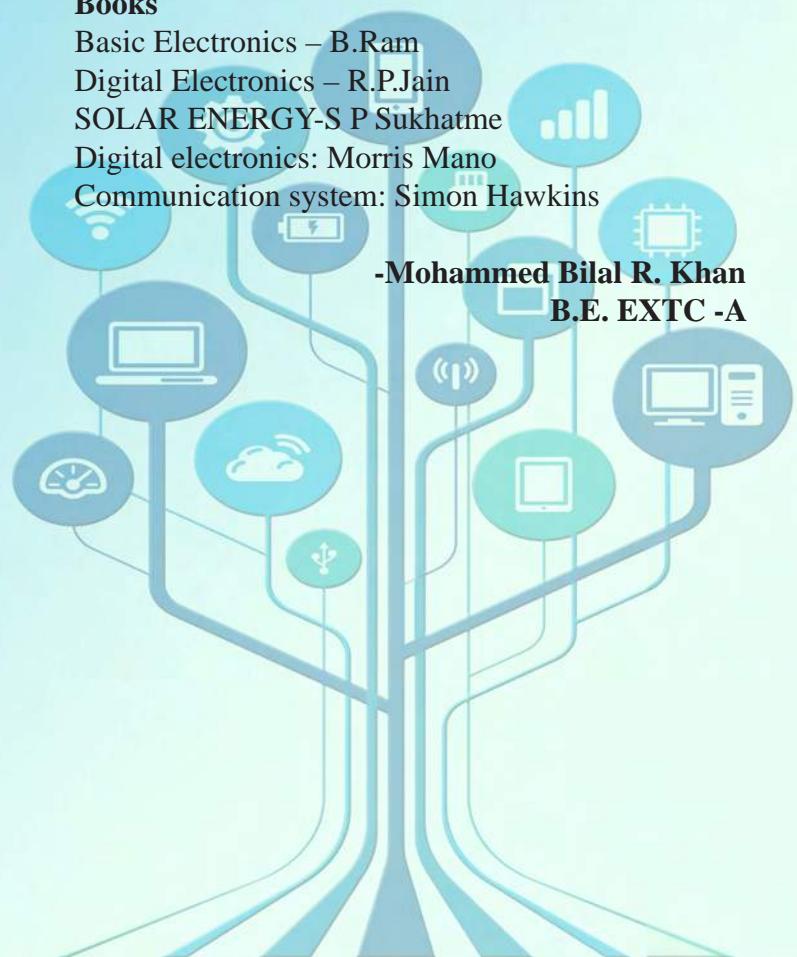
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Biometric Multimodal Security System

INTRODUCTION

Now days, Security has become one of the major concerns with the growing technology. Biometrics has recently become one of the highly secure techniques for protection. Every biometric has its own set of pros and cons, therefore, instead of using single biometric , combination of two or more will help to increase the efficiency as well as the security level. This System implements a web application where the access will be granted only when the user will complete 3 levels of biometric security check instead of simply using the passwords or pin numbers for login. It can be used in various applications like online payments or taking attendance in classrooms and many more. Firstly, the user will have to read out a “captcha” sentence generated by the device. This kind of text generation preserves expressions and style from the original text to some degree and produces text that is statistically similar to the original text. In this system, the sentences are generated by means of a using Dynamic Time Warping and Mel-Frequency Cepstral Coefficients

Algorithms, using literary works in the public domain as input. After this the user has to complete finger print recognition in which a minutiae based finger print recognition algorithm is used which is based on Neighbourhood Distinctiveness. After completion of these two levels the user will have to go through face recognition mechanism where the face image will be verified with the face image stored in memory. PCA and LDA algorithms with Eigen Face average Image and training set is used for the same. Also use a shadow compensation method that compensates for illumination variation in a face image so that the image can be recognized under normal illumination condition. After passing all these levels the user will be granted access to the system.

Origin of the research problem:

In Today's technically advanced world biometric security systems has become mandatory in high level security areas but single stage biometric is not alone sufficient to achieve the required level of security as biometrics like Face and Voice can easily be hoaxed . Thus Multimodal Biometrics will alleviate the problems as user will have to clear different levels of biometric tests.

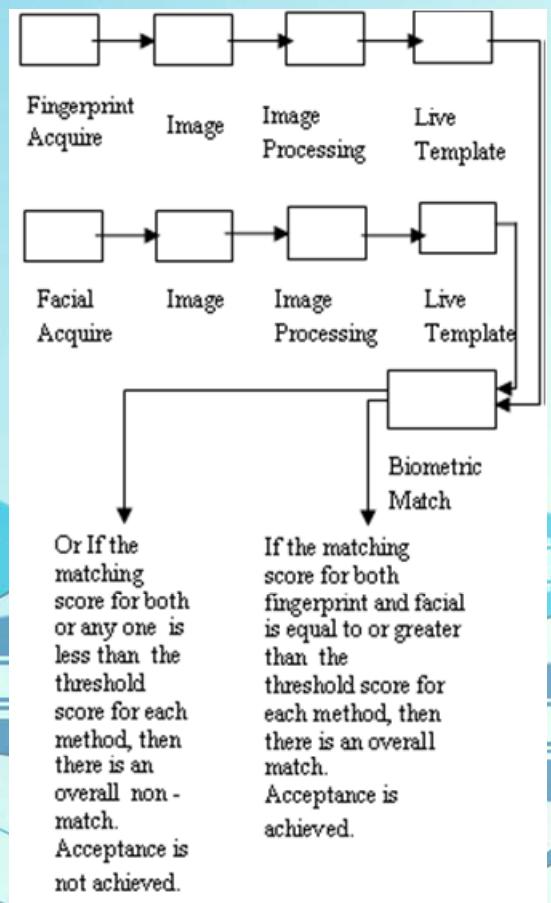


Figure 1

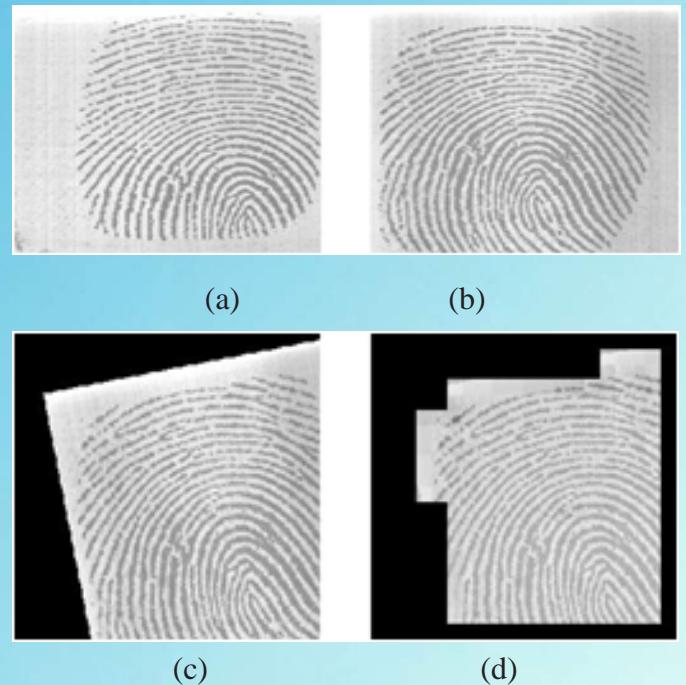


Figure 2.

Objectives: This 3-stage security system using biometric identification technology will provide more accurate identification, more accountability, versatility, time saving along with a lot of ease and safety.

3. THE HYBRID MATCHING APPROACH FINGER PRINT RECOGNITION

The matching technique described here is referred to as the “hybrid” technique because it combines minutiae information available in a fingerprint with the underlying texture information in local regions to perform the matching.

3.1. Image Alignment

Minutiae points from both the input and template images are extracted using the algorithm. The algorithm provides the following two outputs: (a) A set of minutiae points, each characterized by its spatial position and orientation in the fingerprint image. (b) Local ridge information in the vicinity of each minutiae point. The two sets of minutiae points are then matched using a point matching algorithm. The algorithm first selects a reference minutiae pair (one from each image) and then determines the number of corresponding minutiae pairs using the remaining set of points. The reference pair that results in the maximum number of corresponding pairs determines the best alignment.

An exhaustive evaluation of all point correspondences is avoided due to the availability of local ridge information at every minutiae point. Once the minutiae points are aligned by this method, the rotation and translation parameters are computed. The estimated rotation parameter is the average of the individual rotation values of all corresponding minutiae pairs. The translation parameters are computed using the spatial coordinates of the reference minutiae pair that resulted in the best alignment. The results of the alignment of two impressions of the same finger and two impressions of different fingers are shown in Figure 3. For the purpose of visualization, the thinned ridge map of each impression has been shown.



3.2. Image Tessellation

Background regions of the input fingerprint image are not used in the feature extraction and matching stages of the algorithm (Figure 4). The input and template images are normalized by constructing equal-sized non-overlapping windows over them and normalizing the pixel intensities within each window to a constant mean and variance. Each normalized image is tessellated into equal-sized non-overlapping rectangular cells of predefined dimensions (30 30). The dimensions of the cell were chosen after observing that two neighboring ridges span over approximately 30 pixels. For a 300x300 image, this results in 81 tessellated cells.

3.3. Feature Extraction

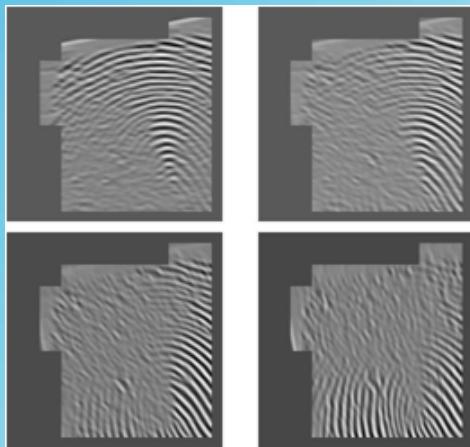


Figure 3.

Result of applying Gabor filters to Fig 4(d). Filtered images for orientations 0O, 22:5O, 45O, and 67:5O are shown.

A bank of 8 Gabor filters is applied to each of the tessellated cell. All the 8 Gabor filters used for feature extraction have the same frequency, but different orientations (0O to 157:5O in steps of 22:5O).

This frequency is chosen based on the average inter-ridge distance in the fingerprints (which is 10 pixels). This particular filtering results in a set of 8 filtered images for each cell. Four of the filtered images are show in Figure 5. The absolute aver-age deviation of intensity in each filtered cell is treated as a fea-ture value (Figure 6). Thus there are 8 feature values for each cell in the tessellation. The feature values from all the cells are concatenated to form a 648-di-mensional (81 8) feature vector. Feature values that reside in the masked regions of the input image are not used in the matching stage of the process, and are marked as missing values in the feature vector.

4. APPROACH SPEAKER RECOGNITION

For text—dependent speaker recognition, different types of speaker models have been studied. Hidden Markov models (HMM) have become the most popular statistical tool for this task. The best of result has been obtained using continuous density HMM (CHMM) for modeling the speaker characteristics. For the text—Independent task, the temporal sequence modeling capability of the HMM is not required. Therefore, one state CHMM, also called a Gaussian mixture model (GMM), has been widely used as a speaker model. The use of GMM for modeling speaker identity is motivated by the fact that the Gaussian components represent some general speaker—dependent spectral shapes and the capability of Gaussian mixtures to model arbitrary densities. In this paper, we use GMM to model speaker characteristics.

Several studies have indicated a large effort to directly model and incorporate the phase into the recogni-tion process [4, 5]. The importance of phase in hu-man speech recognition has been reported in [6, 7]. Especially, the phase may be important for speaker recognition, because it may convey

the source information. However, in conventional speaker recognition methods based on MFCC, it only utilize the magnitude of the Fourier Transform of the time—domain speech frames. This means that the phase component is ignored. The MFCC captures the speaker—specific vocal tract information. Feature parameters extracted from excitation source characteristics are also useful for speaker recognition [8, 9, 10, 11]. In this paper, the phase information is individually used to identify the speaker, and it is also integrated with the MFCC feature.

Phase Information Analysis

The spectrum N (in, I) of a signal is obtained by DFT of an input speech signal sequence

$$\sqrt{X^2(\omega, t) + Y^2(\omega, t)} \times e^{j\theta(\omega, t)},$$

However, the phase $\theta(x, I)$ changes depending on the cutting position even with a same frequency m. To overcome this problem, the phase of a certain basis frequency is kept constant, and the phase of other frequency is estimated relatively. where in the other frequency in' = $2\pi f'$ with this, the phase can be normalized then the real and imaginary part of Equation (3) becomes

$$\tilde{X}(\omega', t) = \sqrt{X^2(\omega', t) + Y^2(\omega', t)} \times \cos\{\theta(\omega', t)\}$$

Internet of Thing

internet including cars, televisions, printers, etc.

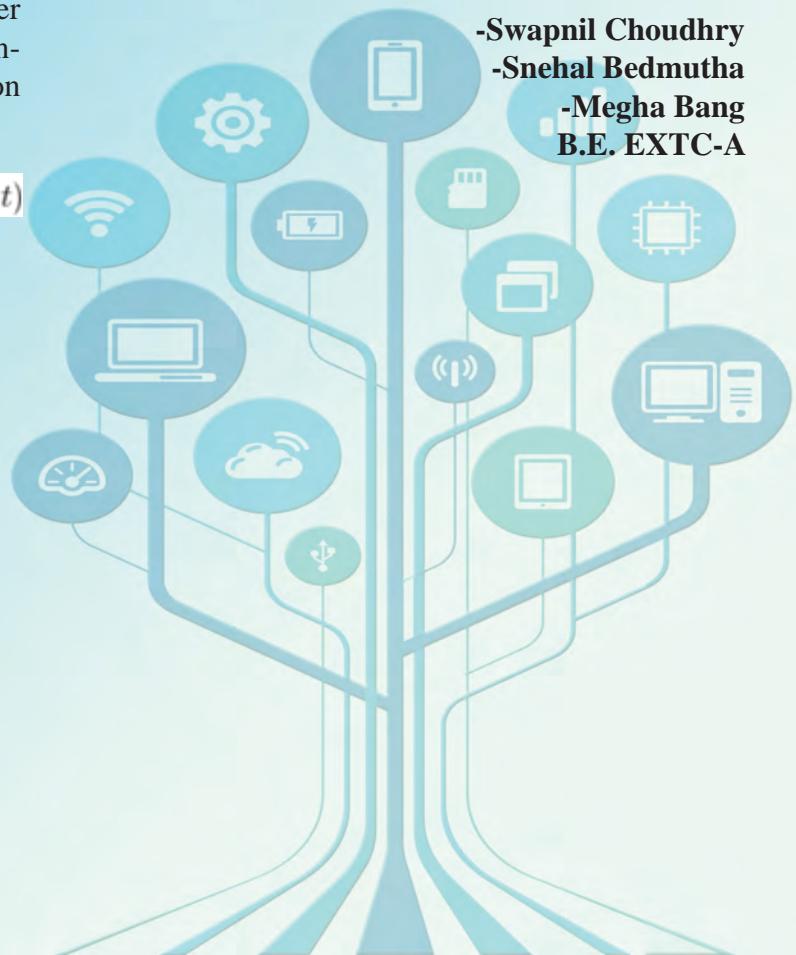
The **Internet of Things (IoT)** is the network of physical objects or "things" connected with electronics devices, software, sensors and network connectivity

In the experiments of this paper, the basis frequency x is set to $2s \times 1000$ Hz. To reduce the number of features parameters, we used only phase information in a sub band frequency range.

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Internet of Thing

Imagine, on one morning you woke up and your Coffeemaker is ready to serve you a cup of coffee and your Digital Calendar is all set with the list of meetings and appointments you have, wait-wait there your smart watch is vibrating and it's a reminder from your gym-trainer to do some physical exercise and morning walk. When you return back to home the warm water is ready for shower. And this is not the end, on your way to office you get the messages about updated traffic details which will help you to reach early at your destination.

While returning from the work a notification comes on your mobile with list of some fruits and eatables and it is from your Refrigerator. You pass on the same list to your nearest Wall-mart and the things are delivered to your doorstep before you reach to your home. Driving up to your house and your garage, lights, even music are aware that you're home. The lights turn on and the music starts playing what you were just playing a second ago. Imagine this kind of technology saving you both energy and money. And the system goes on reducing your work.

Sounds great doesn't it? This is what the future is. It is the next big thing named '**THE INTERNET OF THINGS (IoT)**'.

This is the next level of artificial intelligence, and it refers to all electronic devices being connected to the Internet, communicating to each other as we go about our daily lives. So far, there are a lot of products or "things" connected to the

internet including cars, televisions, printers, etc.

The **Internet of Things (IoT)** is the network of physical objects or "things" connected with electronics devices, software, sensors and network connectivity which allow these objects to collect and exchange data. This allows object to be sensed and collect the data and controlled remotely across existing network.



Figure 1

The IoT creates direct integration between the objects or thing and the computer-based system. Each devices will have its own unique identification such as IP address. Experts estimate that by 2020 around 30 billion devices will connect to this network. For such a huge number IoT will have to use IPv6 technique.

The Internet of Things is the next stage of the information revolution and referenced the inter-connectivity of everything from urban transport to medical



devices to household appliances. It could also be responsible for performing actions and not just sensing things and collecting data, such as intelligent shopping systems i.e. it provides offers and comforts to users depending upon their regular needs and purchases.



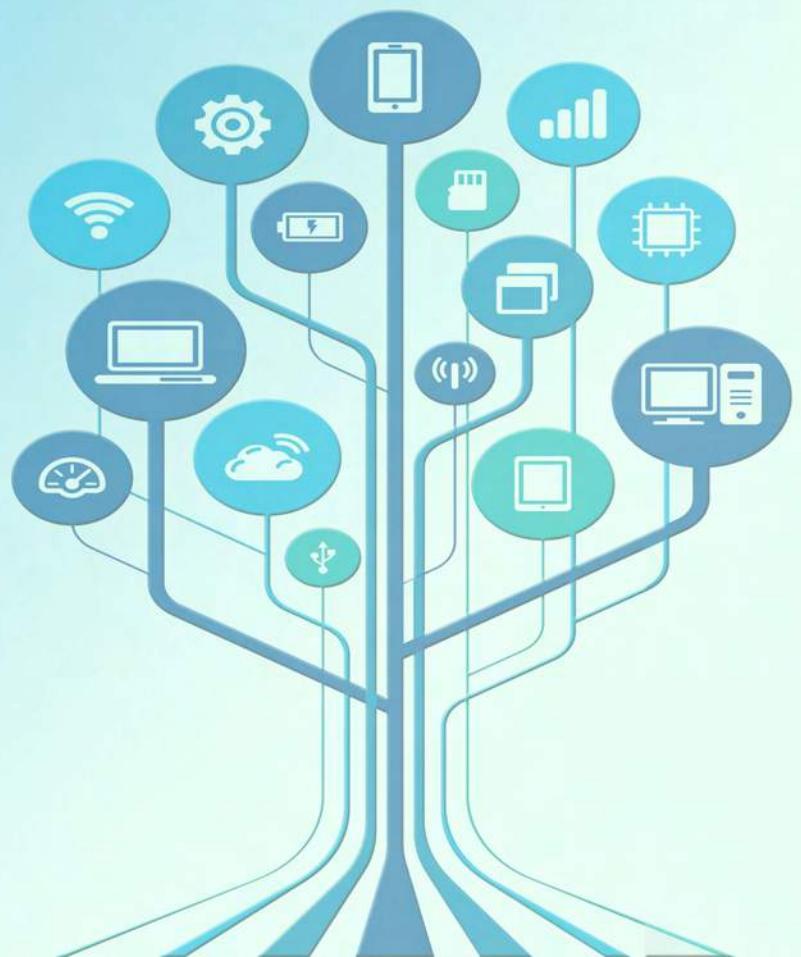
Figure 2

The IoT can have a WiFi enabled washing machine which allows remote control and programming. Another excellent application that the Internet of Things brings to the picture is home security solutions. Home automation is also a major step forward when it comes to applying IoT.

The application of IoT is not restricted to this. It has a vast application in media, environmental management, infrastructure management, manufacturing, energy management, Medical and healthcare services, building home automation, transportation, etc., and may more.

So, it's not like anything, it's **Internet of Things**.

-Singh Vivekkumar
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Water Pollution Detection

Water pollution is one of the key threats for the green globalization. Not only water as a resource is being contaminated, but water life forms and agriculture is also affected by water pollution. Water pollution is mainly caused in the rivers, canals and seas close to human population. Exposure of chemicals and other garbage in the water is harmful for fishes and usage of such water from rivers is not fruitful in agriculture. To prevent the water pollution, first we have to detect the pollutant. In earlier days, the water pollution was detected by chemical test or laboratory test. This system is stationary and samples are given to testing equipment. By this method, we do not get real time quick results. In order to increase the pervasiveness and portability, testing equipment can be placed in the river or canal water and detection of pollution can be made remotely.

The purity of water is to be tested on these 14 basic parameters. Among them the first 7 are the most important parameters. The parameters of the tested water should necessarily satisfy the basic parameters to be labeled 'safe to use'. The requirements of the parameter changes as per applications

The parameters are:

- | | |
|---------------------|----------------|
| 1. Acidity | 2. Alkalinity |
| 3. Conductivity | 4. Turbidity |
| 5. Colour | 6. Temperature |
| 7. Dissolved Oxygen | |

These 7 parameters essentially cover the water purity markers. Among the parameters conductivity ensures that the metal content in the water is below the harmful level. The turbidity is the amount of solid objects present in the water. Temperature and dissolved oxygen content are the two parameters which shows if life can sustain in the water. Acidity and alkalinity is the PH level of the water. It is important that the ph level of the water is near to 7(neither acidic nor alkaline). To ensure that the quality of the water is good to use, a device is necessary. For this, new technology has to be innovated. This innovation should allow a wireless device which can be used along a water body remotely and data can be transmitted to a control centre.

The idea is to use the sensors and interface them with a signal controller such as a microcontroller. Using a transceiver this data can be sent to short distances. For long range transmission of these signals GSM module can be used. The most important thing to implement in this idea is the accuracy as well as durability. Already, there are a lot of monitoring stations around India to ensure proper quality of water bodies. This idea will help the existing system to get better outcomes. As we can see from the survey given below, the government is increasing its efforts to reduce the water pollution in our country.

Prime minister of our country, Mr. Narendra Modi has emphasized on the idea of providing clean water to each and every

household. Also he has the 'Clean Ganga' project in mind. CLEAN water is a basic necessity, simple and innovative idea such

as this should be used to fulfill this necessity.

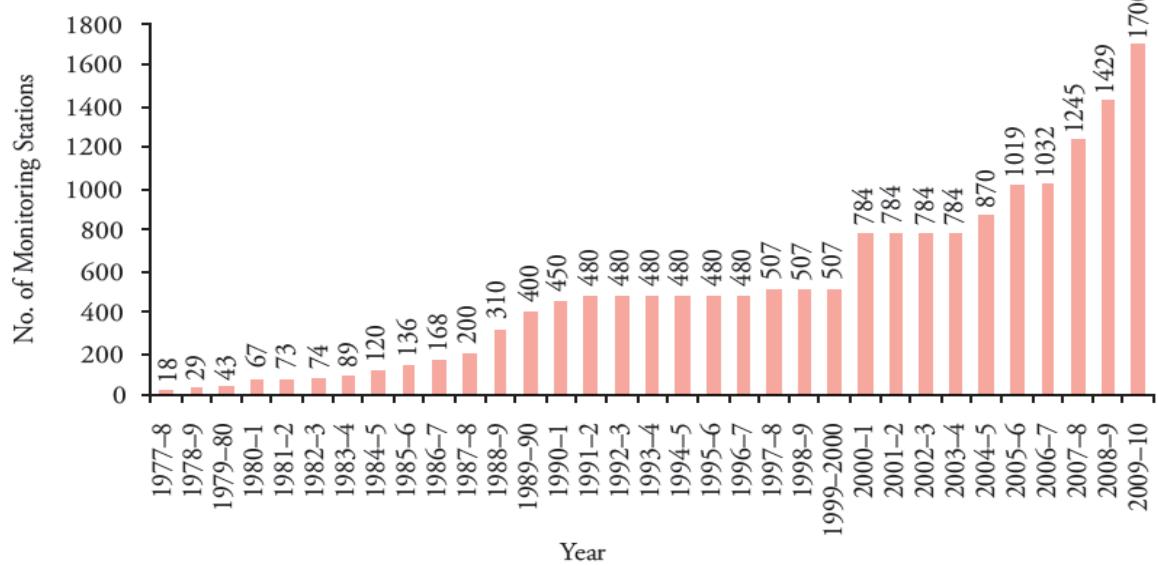


FIGURE 19.2 Growth of Water Pollution Monitoring Network in India

Source: CPCB (2009).

-Atharva Kulkarni
B.E. EXTC B



combine spatial and temporal signal copies. The signals are multiplexed in two data chains. After that, a signal replication is added to create the Altamonte space-time block code.

2. Spatial Multiplexing

Spatial multiplexing is not intended to make the transmission more robust; rather it increases the data rate. To do this, data is divided into separate streams; the streams are transmitted independently via separate antennas. Because MIMO transmits via the same channel, transmissions using cross components not equal to 0 will mutually influence one another. If transmission matrix H is known, the cross components can be calculated on the receiver. In the open-loop method, the transmission includes special sections that are also known to the receiver. The receiver can perform channel estimation. In the closed-loop method, the receiver reports the channel status to the transmitter via a special feedback channel. This makes it possible to respond to changing circumstances.

3) Beam forming

Antenna technologies are the key in increasing network capacity. It started with sectored antennas. These antennas illuminate 60 or 120 degrees and operate as one cell. In GSM, the capacity can be tripled, by 120 degree antennas. Adaptive antenna arrays intensify spatial multiplexing using narrow beams. Smart antennas belong to adaptive antenna arrays but differ in their smart direction of arrival (DoA) estimation. Smart antennas can form a user-specific beam. Optional feedback can reduce complexity of the array system. Beam forming is the method used to create the radiation pattern of an antenna array. It can be applied in all antenna array systems as well as MIMO systems. Smart antennas are divided into two groups: -Phased array systems

(switched beam forming) with a finite number of fixed predefined patterns
Adaptive array systems (AAS) (adaptive beam forming) with an infinite number of patterns adjusted to the scenario in real time

Switched beam formers electrically calculate the DoA and switch on the fixed beam. The user only has the optimum signal strength along the center of the beam. The adaptive beam former deals with that problem and adjusts the beam in real time to the moving UE. The complexity and the cost of such a system is higher than the first type.

MIMO Future Applications

1. LTE (3GPP Release 8)

UMTS Long Term Evolution (LTE) was introduced in 3GPP Release 8. The objective is a high data rate, low latency and packet optimized radio access technology. LTE is also referred to as E-UTRA (Evolved UMTS Terrestrial Radio Access) or EUTRAN (Evolved UMTS Terrestrial Radio Access Network). The basic concept for LTE in downlink is OFDMA (Uplink: SCFDMA), while MIMO technologies are an integral part of LTE. Modulation modes are QPSK, 16QAM, and 64QAM. Peak data rates of up to 300 Mbps (4x4 MIMO) and up to 150 Mbps (2x2 MIMO) in the downlink and up to 75 Mbps in the uplink are specified.

2. WiMAX™ (802.16e-2005)

Promises a peak data rate of 74 Mbps at a bandwidth of up to 20 MHz Modulation types are QPSK, 16QAM, and 64QAM. 802.16e-2005 standard specifies MIMO in WirelessMAN-OFDMA mode. This standard defines a large number of different matrices for coding and distributing to antennas. In principle, two, three or four TX antennas are possible. For all modes, the matrices A, B, and C are available. In the "STC encoder" block, the streams are multiplied by the selected matrix and mapped to the antennas



Smart Antenna Open Lanes for Wireless Highway

Abstract- Corporations are beginning to use wireless LANs to carry voice and video, increasing the need for speed, capacity and reliability. But because WLANs share a finite allocation of frequency spectrum, without increased spectral efficiency they will consume all the available frequency channels and interfere with one another - becoming victims of their own success.

Multiple Input Multiple Output (MIMO) is a smart antenna technique that increases speed, range, reliability and spectral efficiency for wireless systems.

Given the demands that applications are placing on WLANs, MIMO chipsets will figure prominently in new access points and network interface cards.

MIMO is one technology being considered for [802.11n](#), a standard for next generation 802.11 that boosts throughput to 100M bit/sec. In the meantime, proprietary MIMO technology improves performance of existing [802.11a/b/g](#) networks

Introduction

MIMO stands for multiple input/multiple output. It uses separate antennas at multiple transmitters and receivers to increase the speed of transmission generally the more transmitters and receivers used more is the speed of transmission. It uses technologies called spatial multiplexing, spatial diversity and beam forming

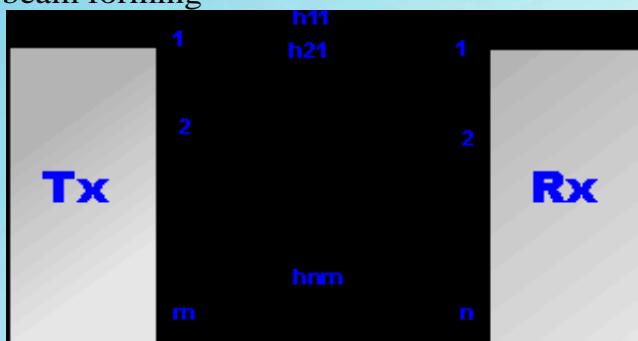


Figure 1

How It Works?

1. Spatial Diversity

The purpose of spatial diversity is to make the transmission more robust. There is no increase in the data rate. This mode uses redundant data on different paths

a) RX Diversity

RX diversity uses more antennas on the receiver side than on the transmitter side. The simplest scenario consists of two RX and one TX antenna (SIMO, 1x2). Because special coding methods are not needed, this scenario is very easy to implement. Only two RF paths are needed for the receivers. Because of the different transmission paths, the receiver sees two differently faded signals. By using the appropriate method in the receiver, the signal-to-noise ratio can now be increased. Switched diversity always uses the stronger signal, while maximum ratio combining uses the sum signal from the two signals

b) TX Diversity

When there are more TX than RX antennas, this is called TX diversity. The simplest scenario uses two TX and one RX antenna. In this case, the same data is transmitted redundantly over two antennas. This method has the advantage that the multiple antennas and redundancy coding is moved from the mobile UE to the base station, where these technologies are simpler and cheaper to implement. To generate a redundant signal, space-time codes are used.

Altamonte developed the first codes for two antennas. Space-time codes additionally improve the performance and make spatial diversity usable. The signal copy is transmitted not only from a different antenna but also at a different time. This delayed transmission is called delayed diversity. Space-time codes

3. WLAN (802.11n)

WLAN as defined by the 802.11n standard promises a peak data rate of up to 600 Mbps at a bandwidth of 40 MHz Modulation types are BPSK,QPSK, 16QAM, and 64QAM. It is backward compatible with the previous standards 802.11 a/b/g with up to four streams, it supports up to a maximum of four antennas.

4.3 GPP UMTS

The 3GPP mobile radio standard (UMTS) has undergone numerous phases of development. Starting with WCDMA, various data acceleration methods have been introduced, including HSDPA and HSUPA.

The newest releases cover HSPA+ and Long Term Evolution (LTE).

5. HSPA+ (3GPP Release 7/8)

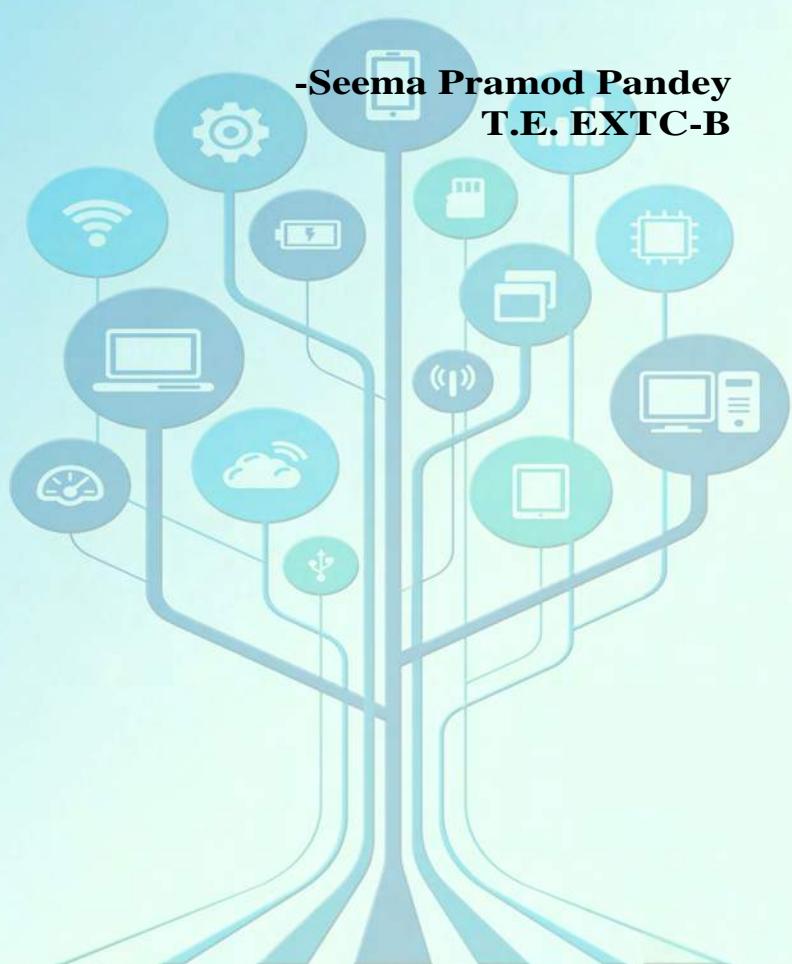
A transmit diversity mode had already been introduced in Release 99 (WCDMA). Release 7 of the 3GPP specification (HSPA+) expanded this approach to MIMO and again increased the data rate with respect to Release 6 (HSDPA). The introduction of 64QAM modulation and MIMO in the downlink makes a peak data rate of 28 Mbps possible.

In Rel. 7 MIMO and 64QAM cannot be used simultaneously. Since the simultaneous use is possible which leads to peak data rates up to 42 Mbps. MIMO was introduced in the form of a double transmit antenna array (DTxAA) for the high speed downlink shared channel (HS-DSCH). With D-TxAA, two independent data streams can be transmitted simultaneously over the radio channel using the same WCDMA channelization codes. The two data streams are indicated with blue and green color. After spreading and scrambling, preceding based on weight factors is applied to optimize the signal for transmission over the mobile radio channel.

Reference:

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-Seema Pramod Pandey
T.E. EXTC-B





Speed Break Power Generation

Electricity in India is a big problem which is faced by people who reside in the country. Generating electricity by speed breakers is innovative and useful concept. Electricity is the form of energy, Electricity is a basic part of nature and it is one of our most widely used forms of energy. We get electricity, which is a secondary energy source, from the conversion of other sources of energy, like coal, natural gas, oil, nuclear power and other natural sources, which are called primary sources. Many cities and towns were built alongside waterfalls that turned water wheels to perform work. Before electricity generation began slightly over 100 years ago, we use kerosene lamps,, and rooms were warmed by wood-burning or coal- burning stoves. Direct current (DC) electricity had been used in arc lights for outdoor lighting. In the late-1800s, Nikola Tesla pioneered the generation, transmission, and use of alternating current (AC) electricity, which can be transmitted over much greater distances than direct current. Tesla's inventions used electricity to bring indoor lighting to our homes and to power industrial machines. Electricity generation was first developed in the 1800's using Faradays dynamo generator. Almost 200 years later we are still using the same basic principles to generate electricity, only on a much larger scale. Next time on the roads, don't scoff at the speed- breakers. They could actually light up small villages off the highway. The rotor (rotating shaft) is directly connected to the prime mover and rotates as the prime mover turns. The rotor contains a magnet that, when turned, produces a moving or rotating magnetic field.

The Rotor is surrounded by a stationary casing called the stator, which contains the wound copper coils or windings. When the moving magnetic field passes by these windings, electricity is produced in them.

By controlling the speed at which the rotor is turned, a steady flow of electricity is produced in the windings. These windings are connected to the electricity network via transmission lines. A vehicle weighing 1,000 kg going up a height of 10 cm on such a rumble strip produces approximately 0.98 kilowatt power. So one such speed-breaker on a busy highway, where about 100 vehicles pass every minute, about one kilo watt of electricity can be produced every single minute. The figure will be huge at the end of the day. A storage module like an inverter will have to be fitted to each such rumble strip to store this electricity. The cost of electricity generation and storage per mega watt from speed-breakers will be nearly Rs 1 crore as opposed to about Rs 8 crore in thermal or hydro power stations.

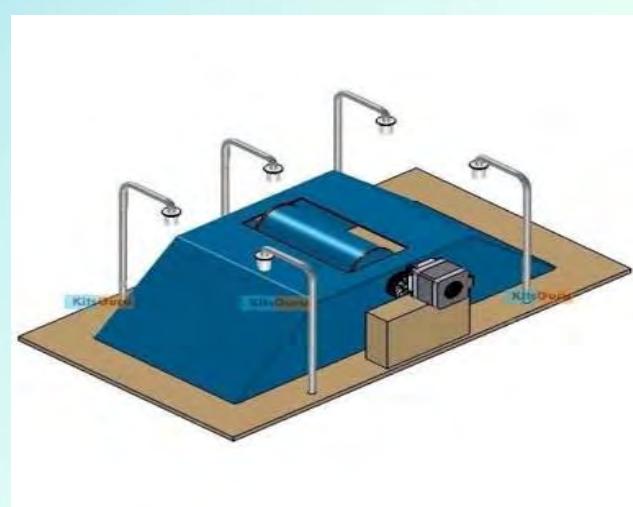


Figure 1



The functioning will be as follows:

1. The speed breaker on a busy road will be lifted to some height from one side and fixed to the road from other side.
2. Then there will be a shock absorber kind of mechanism beneath the speed breaker. The arrangement will be as in a cam and shaft arrangement.
3. The shaft of the generator placed below will be attached to the cam and the rod connected to the speed breaker vertically will be on cam. This arrangement will make one rotation of generator shaft as soon as a vehicle moves over speed breaker.
4. The rotations can also be increased using certain mechanism, like gears and all.
5. Then there will be a circuit storing the electricity generated during day time and the power generated will be used during night.

According to concept it is known as "reciprocating bump". The speed breaker designed is supported on springs. When a vehicle mounts the speed breaker, the load on the springs causes movement which is converted to a rotary motion by using a rack and pinion mechanism. The energy is generated and can be stored in batteries. The input for producing energy is the weight of the vehicle.

Now the question arises why only the speed breaker is used and not the rough road or plane road where the kinetic energy of the vehicle is more than what is getting on the speed breaker for answer to this question let look on one example: A car or any heavy vehicle is coming with a speed of 100 mph on the road and passing over this roller which is fitted at the level of the road then this roller is gaining the

speed nearly somewhere 90 mph (due to losses).

So now suppose a cycle is coming with a speed of 20 mph and is going to pass this roller (which is moving at a speed of 90 mph) due to this difference in the speed there will be a collision that is the main reason for using this concept on the speed breaker. Producing electricity from a speed breaker is a new concept that is undergoing research. The number of vehicles on road is increasing rapidly and if we convert some of the kinetic energy of these vehicle into the rotational motion of roller then we can produce considerable amount of electricity, this is the main concept.

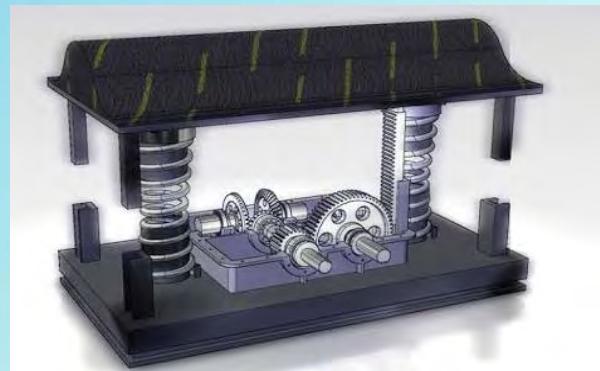


Figure 2

**-Sanmith Shetty
T.E. EXTC-B**



Wireless Transmission of Electricity

Transmission of electrical power was so far being done by conductors (physical matter). The example of means of transmission of power without conduction of any physical medium is solar radiations. Inspired from this example the concept of wireless transmission of electricity was born.

Nicola Tesla performed an experiment, transmitting electricity across 25 miles and lighting 2000 lamps by it but the facility was not completed. This experiment was based on transmitting electricity through natural media (air and ground). This theory says earth is a conductor. Atmosphere above the earth is also a conductor. The thin layer between the conducting earth and the atmosphere is called stratum which is insulating. If we set up a difference of potential at one point, then it will create fluctuating potential in the media. Nicola Tesla wanted to use the same principle to

transfer electricity through ground. He wanted to saturate the globe with electricity so that it is accessible to everyone and electricity could be drawn just by striking a wire in the ground. It would have approximately used electricity with a frequency of 100,000 alterations per second.

Electromagnetic induction is the most widely used process of wireless power transfer. Transformers and wireless chargers are most renowned examples for the same. Wireless power transfer through induction faces a great amount of resistive and radioactive losses.

Electromagnetic radiations have immense potential to become the method to transmit electrical power. Electromagnetic wave modulation (with certain specifications) can carry power through a large distance with great efficiency.

Electrostatic Induction

Electrostatic induction is a redistribution of electrical charge in an object, caused by the influence of nearby charges. In the presence of a charged body, an insulated conductor develops a positive charge on one end and a negative charge on the other end.

The electrostatic induction or the capacitive coupling is the passage of an electrical energy through dielectric. It is an electric field gradient or the differential capacitance in between the two or more insulated terminals, nodes, electrodes, or

plates which are elevated over conducting planes. Electric field is generated by charging the plates with high potential, and high frequency alternating current supply.

The electric energy transmitted by electrostatic induction could be utilized by receiving devices. Nikola Tesla demonstrated the radiance of the wireless lamps by energy taken from electric fields.

The purpose of the electrostatic induction is suitable to electrical conduction (wireless means).

Electrodynami c Induction

This method is the near field transmission of electric power (distance up to one-sixth of the wavelength used). It is essentially non radio active in nature yet

experimentally it was found to have radioactive losses.



It is commonly known as electromagnetic induction. The law of physics describing the process of electromagnetic induction is known as Faraday's law of induction and the most widespread version of this law states that the induced electromotive force in any closed circuit is equal to the rate of change of the magnetic flux enclosed by the circuit. Or mathematically,

$$\varepsilon = -\frac{d\phi_B}{dt},$$

Where ε is the electromotive force (EMF) and Φ_B is the magnetic flux. The direction of the electromotive force is given by Lenz's law. This version of Faraday's law strictly holds only when the closed circuit is a loop of infinitely thin wire, and is invalid in some other circumstances.

For a tightly wound coil of wire, composed of N identical turns, each with the same magnetic flux going through them, the resulting EMF is given by: -

$$\varepsilon = -N \frac{d\phi_B}{dt}$$

-Ashish Rawat

T.E. EXTC



Inside An ATM

The Automated Teller Machines or better known as ATMs are one of the most widely used machines in today's world. They are made by companies like NCR, Diebold, Wincor-Nixdorf, etc. Let us understand how they are made and what drives them.

Following are the Most Frequently Asked Questions which would help us understand these machines in a better way:

Q.1] Which hardware parts are used in an ATM?

A. Every ATM needs a CPU to control its functions. All ATMs have a magnetic chip or card reader. There is a PIN pad .There is a secure crypto processor, a display screen and there are function keys on the side of the display or the display is made touch screen. A Record Printer is used to print the receipts of the transaction or queries. There is a Vault where the money is kept and there are sensors and indicators.

Q.2] Do all ATMs require an ATM card?

A. Most ATMs are card operated but these days ATMs with Biometric access are getting manufactured.

Q.3] What are the advantages of Biometric operated ATMs?

A. All ATM cards require a particular PIN. This PIN can be stolen by anyone, which makes it vulnerable. If we use Biometric signatures like Retina or Fingerprint scan, we can increase the security of our account.

Q.4] What are the disadvantages of using Biometrics?

A. People are very greedy and will go to any lengths to get money. In South Africa there have been incidents where thieves have cut other people's thumbs and eyes to access their account through an ATM. Using Biometrics poses a threat directly to human life.

Q.5] Which software is used in an ATM?

A. Microsoft Windows is the most widely used Operating System used in ATMs. They are being replaced by better versions of LINUX .The programs are written on either JAVA or C++.

Q.6] How does the Hardware interact with the Software?

A. The Hardware and the Software interact through a layer in the program called as XFS. It is a standard layer used by all the companies.

Q.7] Can a bank buy Hardware from one company and Software from another?

A. Yes, the bank can. For example if the bank feels that the Software of NCR is good but Diebold has better Hardware, then they can buy it separately from both the companies. Companies must therefore produce software which interacts with the other company's hardware. Earlier Diebold's software could not interact with



hardware from other companies. It then created software called as Cross Vendor (XV) to interact with hardware of other companies.

Q.8] What are the challenges in an ATM industry?

A. The biggest challenge is continuous testing. It is not automated but manual. The attempts to create a Robot for thus very purpose have failed. There are a handful number of companies who produce ATMs, hence there are not a lot of people who have knowledge about this

industry. The industry is big and it has many opportunities for Engineers in the Software and Hardware side. The biggest challenge is to create a Robot for Testing of ATMs which only an Engineer can solve...

**-Dhruv Bal
S.E. EXTC-A**



Bio in Tech

New research from the University of East Anglia could one day help build computers from DNA.

Scientists have found a way to 'switch' the structure of DNA using copper salts and EDTA (Ethylene diamine tetra acetic acid) -- an agent commonly found in shampoo and other household products.

It was previously known that the structure of a piece of DNA could be changed using acid, which causes it to fold up into what is known as an 'i-motif'.

But new research published today in the journal *Chemical Communications* reveals that the structure can be switched a second time into a hairpin structure using positively-charged copper (copper cations). This change can also be reversed using EDTA.

The applications for this discovery include nanotechnology -- where DNA is used to make tiny machines, and in DNA-based computing -- where computers are built from DNA rather than silicon.

It could also be used for detecting the presence of copper cations, which are highly toxic to fish and other aquatic organisms, in water.

Lead researcher Dr Zoë Waller, from UEA's school of Pharmacy, said: "Our research shows how the structure of our genetic material -- DNA -- can be changed and used in a way we didn't realize.

"A single switch was possible before -- but we show for the first time how the structure can be switched twice.

"A potential application of this finding could be to create logic gates for DNA based computing. Logic gates are an elementary building block of digital circuits -- used in computers and other electronic equipment. They are traditionally made using diodes or transistors which act as electronic switches.

"This research expands how DNA could be used as a switching mechanism for a logic gate in DNA-based computing or in nano-technology."

-Richa Singh

S.E. EXTC-A



“Hear it all”

Gone are the days when we as students kept wondering if we could record our lectures just to replay them later and jot down things we missed in class, introducing our new friend 'LIVESCRIBE ECHO SMART PEN'.

A Live scribe smart pen is about the size and weight of a large pen (5/8" x 6 1/8"), and is equipped with a removable ball-point ink cartridge, a microphone to record audio, a speaker for playback, a small OLED display, an infra-red camera, and internal flash memory that captures handwritten notes, audio and drawings.

The user can choose to record audio in addition to the handwritten text. Recorded audio is kept indexed with the handwritten text—tapping on a written word starts playback of the recorded audio from that part of the recording.

The smart pen allows the installation of as many applications as there is memory, and ships with several applications. If tapped on the correct

images, it can function as a calculator, for example, or can translate words.

The Echo smart pen, released in July 2010, comes with 2 GB, 4GB or 8 GB of memory. Compared to the Pulse smart pen, it is lesser round in shape and uses more standardized connection ports. The Echo integrates with the Desktop software via a standard micro USB cable and can connect to headphones with a more common 3.5-millimeter jack.

All in all, this can prove to be a boon for people dealing with anxiety issues related to note-taking. A lot of schools in countries like US and UK allow students to issue such devices to improve their learning skills. Lastly, I would like to ask you. Wouldn't you love to own one?{isn't the answer very obvious:) }

-Sachin Manral

S.E. EXTC A



Intelligent Robots

Imagine Robots behaving as Humans!!! Serving us with coffee, playing chess, etc. Isn't it really amazing! It may be possible in dreamland only but, Scientists and Researchers has made it in reality and are in the process of further development. This behavior of Robots like humans is due to intelligence induced by humans in machines called as '**ARTIFICIAL INTELLIGENCE**'.

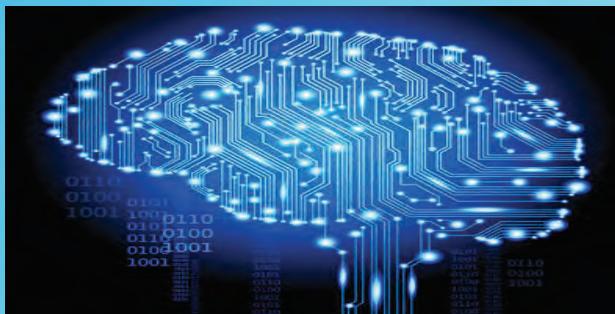


Figure 1

Nowadays it is becoming the most fascinating topic even in movies like 'Transcendence', 'Artificial Intelligence-AI'. This technology is continuously enhancing all over the world. It is science of making intelligent machines.

Experts predict that robots will replace humans in 1/3rd of today traditional professions by 2025. Number of discoveries is being done day by day:

- New social network named **ETER9**, (CEO Henrique Jorge) has been launched that offers users the chance to live forever through an AI counterpart that learns from user's thoughts and actions to post and interact even in his absence.
- Millions of fashion brands are being sorted by 'Donde Fashion'. It

uses visual search engines to make sure you find the right piece of clothing out of heap of millions.

- An automated camera system called **Insight** is being installed which monitors camera feeds and alerts the authorities if any unusual activity is spotted.
- An intelligent technique powered with ability to diagnose and treat diseases and for treatment, particular drug could be generated depending on diseases.
- MIT Researchers have developed "A Robot with Human Reflexes" being named as **HERMES**. It is a humanoid robot which takes cues from human reflexes in order to fluidly perform nuanced physical tasks.



Figure 2

In future, many more applications of AI will be discovered such as autonomous weapons will be created which searches and destroys the targets on its own. So let's start getting involved in field of AI being the future innovative engineers.

-Nikita Khatiya

S.E. EXTC-A



'Quantum Dot' Technology May Help Light The Future'

Advances at Oregon State University in manufacturing technology for "quantum dots" may soon lead to a new generation of LED lighting that produces a

The cost, environmental, and performance improvements could finally produce solid state lighting systems that consumers really like and help the nation cut its lighting bill almost in half, researchers say, compared to the cost of incandescent and fluorescent lighting.

The same technology may also be widely incorporated into improved lighting displays, computer screens, smart phones, televisions and other systems.

A key to the advances, which have been published in the *Journal of Nanoparticle Research*, is use of both a "continuous flow" chemical reactor, and microwave heating technology that's conceptually similar to the ovens that are part of almost every modern kitchen.

The continuous flow system is fast, cheap, energy efficient and will cut manufacturing costs. And the microwave heating technology will address a problem that so far has held back wider use of these systems, which is precise control of heat needed during the process. The microwave approach will translate into development of nanoparticles that are exactly the right size, shape and composition.

"There are a variety of products and technologies that quantum dots can be applied to, but for mass consumer use, possibly the most important is improved LED lighting," said Greg Herman, an

more user-friendly white light, while using less toxic materials and low-cost manufacturing processes that take advantage of simple microwave heating.

associate professor and chemical engineer in the OSU College of Engineering.

"We may finally be able to produce low cost, energy efficient LED lighting with the soft quality of white light that people really want," Herman said. "At the same time, this technology will use nontoxic materials and dramatically reduce the waste of the materials that are used, which translates to lower cost and environmental protection."

Some of the best existing LED lighting now being produced at industrial levels, Herman said, uses cadmium, which is highly toxic. The system currently being tested and developed at OSU is based on copper indium dieseline, a much more benign material with high energy conversion efficiency.

Quantum dots are nanoparticles that can be used to emit light, and by precisely controlling the size of the particle, the color of the light can be controlled. They've been used for some time but can be expensive and lack optimal color control. The manufacturing techniques being developed at OSU, which should be able to scale up to large volumes for low-cost commercial applications, will provide new ways to offer the precision needed for better color control.

By comparison, some past systems to create these nano particles for uses in



optics, electronics or even biomedicine have been slow, expensive, sometimes toxic and often wasteful.

Other applications of these systems are also possible. Cell phones and portable electronic devices might use less power and last much longer on a charge. Compounds with specific infrared or visible light emissions, could be used for precise and instant identification, including control of counterfeit bills or products.

OSU is already working with the private sector to help develop some uses of this technology, and more may evolve. The research has been supported by Oregon BEST and the National Science Foundation Center for Sustainable Materials Chemistry.

-Amit Mishra

S.E. EXTC-A



Microsoft Blocks 10 Million Spam Messages a Minute



Figure 1

Microsoft's cloud-based Exchange Online Protection service is the company's weapon in an escalating arms race with spammers. Each day, Microsoft prevents billions of spam messages from landing in customer inboxes. The software giant blocks 10 million such emails each minute on average, revealed the company's Exchange Online Protection (EOP) team in October 15 blog post. That adds up to more than 14 billion blocked messages per day. Spam is more than a nuisance, according to Microsoft program managers Shobhit Sahay, Levon Esibov and Terry Zink. In their jointly authored post, they detailed the dangers of a particularly dangerous form of spam."Phishing campaigns are looking to compromise the credentials of the company employees and take control of the resources of a company", explained the Microsoft staffers. "A popular type of phishing campaign is spear phishing, which targets the most valuable contacts within an organization."

To protect against phishing, and other email threats, Microsoft is bulking up its Exchange Online Protection product. Launched 18 months ago, Exchange

Online Protection guards against spam and malware at a cost of \$1 per user per month.

The service is bundled with Exchange Online and Office 365 plans that include a cloud-based email component. The group provided a behind-the-scenes look at Exchange Online Protection's multilayered filtering approach to giving spam the boot. First, a connection filtering technique blocks emails from low-reputation IP addresses. Next, emails are filtered according to sender reputation, the product of data from in-house and third-party sources. "Finally, EOP uses numerous filtering techniques to catch the leftover spam that you see in spam campaigns that involve more complex investigation," they wrote. Exchange Online Protection "also provides comprehensive malware and virus filtering, using three different industry-leading anti-virus (AV) engines," they revealed. And their work isn't over.

Microsoft is "making the largest investments ever in advancing threat protection in Exchange Online Protection," said Sahay, Esibov and Zink. "EOP is the Microsoft long-term solution to protect not only mailboxes in Office 365, but also tens of millions of mailboxes on premise mail servers of our customers."Over the next six to 12 months, Microsoft plans to release a bevy of new features and capabilities, all aimed at staying one step ahead of quick-to-adapt spammers. According to the group, the Exchange Online Protection roadmap includes advanced threat protection from, for example, emerging "Time of Click" and zero-day threats. Microsoft is implementing Domain Keys



Identified Mail (DKIM) and Domain-based Message Authentication, Reporting & Conformance (DMARC) sender authentication technologies. Plans also call for better protection against bulk mail (graymail), or unwanted advertising emails that clog up inboxes. Like Microsoft's global cloud data center footprint,

Exchange Online Protection is slated to get bigger in the coming month. The team said their company is preparing for an "expansion of EOP datacenters across different regions, further substantiating our promise of processing mail in the region of our customers."

-Elika Mhatre

S.E. EXTC-A



Trends in Satellite Communications

Recent years have seen a phenomenal growth in the field of satellite communications. Satcom systems offer many advantages which include wide area coverage, rapid deployment, flexible networking and long range service to moving platforms like ships, aircraft and vehicles. Major technological advances are anticipated in near future to realize high capacity, secure and survivable satcom systems.

Thirty years ago, the objective of the space sector was to be in space. Now, the main drive is to use space, to sell it, and to profit from it. The space sector is currently in the transition phase from being funded mostly by the public sector to raising funds from private shareholders; from being a purely research oriented activity to a commercial venture with such successful applications as satellite television, satellite navigation and satellite based mobile communications. This state of transition creates unrest, since structures are transformed; alliances modified, users become customers and their requirements change and have to be satisfied quickly. The communication needs of Earth observation satellites are steadily increasing. Within a few years, the data rate of such satellites will exceed 1 GBps, the angular resolution of sensors will be less than 1 μrad, and the memory size of onboard data recorders will be beyond 1 Tbyte.

The various trends seen now-a-days are:

Support for Manned Space Activity

The first private manned spacecraft exceeded an altitude of 100 km twice within a 14 day period. In the near future, people who have not undergone astronaut training will be able to travel into space in

space planes. High-speed Internet access should therefore be available in a space plane as well. In a manned space station like the International Space Station (ISS), the leisure available to the astronauts should reflect that available on the ground. For instance, to relieve stress, popular movies, audio, and multimedia contents should be available to astronauts in the ISS. A 1-Gbps optical communication link would enable us to send, e.g., the latest movies to the ISS within one minute. Another, may be more important aspect for the ISS, is data transmission of the many scientific missions to be performed. They produce massive scientific experimental data which, in many cases, should be downloaded instantaneously to a ground station. An optical communication link is the proper medium for such infrastructure in space.

Data Transmission from Observation Satellites

Many Earth observation satellites have been developed for weather forecasting and for probing our environment. For more accurate measurements, higher resolution will be required from onboard sensors and the frequency and area of the observations will increase. The data rates seem to drop with passing time for GEO. As recently launched commercial satellites at GEO have the total transponder bandwidth of about 1 GHz even in GEO, the communication capacity does not drop. For future, the data rate of some satellites will increase to several gigabits per second; the angular resolution of some satellites will be approximately 0.1 μrad,



corresponding to a resolution of several ten centimeters on Earth; the data storage capacity of onboard data recorders will be several terabytes; and the number of bits per pixel will be larger than 13. The acquired information will drastically increase with monitoring frequency, observation area and the resolution of the images. Monitoring from satellites will not only be done for special area but real-time observations of the entire world will take place. Gigabit-per-second-class direct links to ground stations will be necessary during the short download time of the direct communication link from a LEO satellite. Optical communication systems are preferable for this increasing communication demand.

Data Transmission from Deep Space Probes

In deep-space probes the mass, power, and volume of onboard equipment is severely restricted and hence the antenna diameter and the transmit power are quite limited. Therefore, a large receive antenna and high power transmitter are usually installed in the ground station, which can compensate for the restrictions on the onboard resources. If a large-aperture optical platform became available in a space station or a data relay satellite system, a small user terminal could be utilized in space probes. Such a platform would constitute an effective backbone communication station, unaffected by visibility conditions of the ground stations.

Communication within Satellite Clusters

Functions usually performed by a single large satellite can be divided among a number of co-located and interlinked smaller satellites. Each small satellite may have a different limited function; however,

as a whole the cluster acts as a single large satellite. Cooperative control and synchronization of maneuvers are required in order to maintain safety margins inside the co-location slots. An optical intersatellite link offers the best compromise between ease of interfacing with the switching matrix and the ability to support high-speed links among the small satellites, and there is also no interference of the optical signals. A Gbit/s data link is required in the modem/switch satellite and server satellite. Small terminals with antennas of a diameter of a few centimeters can establish Gbit/s communication links between small satellites, and the broadened beam divergence allowed by the short distance can strongly reduce tracking requirements.

Broadband Internet Service to Aircraft and Space Planes

In many aircraft, real-time high-speed Internet access is available in flight. Aircraft equipped with Ku-band communication terminals (11.2~12.8 GHz for downlink, 14.0~14.4 GHz for uplink) offer either an Ethernet local area network (LAN) connection or a wireless 802.11b network connection, or both. The maximum data rates are presently 20 Mbps from the satellite to aircraft and 1 Mbps from the aircraft to satellite. Aircraft that fly above the cloud layer can be accessed from satellites without any attenuation by clouds and with little atmospheric turbulence. Like aircraft, high altitude platform systems and unattended aerial vehicles (UAV) are promising candidates for the application of optical communications systems. Multiple access techniques employing optical phased arrays will be needed in such applications.



4G Wireless Technology

Fourth generation (4G) technology will offer many advancement to the wireless market, including downlink data rates well over 100 Mbps, low latency, very efficient spectrum use and low-cost implementations. With impressive network capabilities, 4G enhancement promise to bring the wireless experience to an entirely new level with impressive user applications, such as sophisticated graphical user interfaces, high-end gaming, high-definition video and high-performance imaging. Consumer expectations for mobile handsets and similar products are becoming more and more sophisticated. Consumers are demanding a better user experience along with more advanced and useful applications on a more ergonomic device.

The current 3G devices are good, but they will have to improve in areas like imaging and processing power to support future 4G applications like three dimensional (3D) and holographic gaming, 16 megapixel (MPixel) smart cameras and high-definition (HD) camcorders. Applications like these will demand more processing power than the current 3G handsets offer, requiring more efficient applications processors.

The move to 4G networks will allow service providers to offer the impressive applications that will drive users to upgrade to the new phones. Current downlink data rates are less than 10 megabits per second (Mbps); 4G systems will offer downlink data rates well over 100 Mbps, an improvement of 10 times over 3G. 4G systems will also have low latency, improving the consumer

experience. With flexible network connections, efficient use of spectrum and impressive user applications, 4G will offer what consumers want.

What is LTE?

Long Term Evolution (LTE) technology is sometimes called 3.9G or Super 3G and has been developed by the Third Generation Partnership Project (3GPP) as an improvement to the current Universal Mobile Telecommunications System (UMTS). By using Orthogonal Frequency Division Multiple Access (OFDMA), LTE will be able to provide download rates of 150 Mbps for multi-antenna (2x2) multiple-input multiple output (MIMO) for the highest category terminals. For these terminals upload rates in the 50 Mbps range will allow an efficient transfer of data.

LTE makes very efficient use of the available spectrum with channel bandwidths from 1.25 Megahertz (MHz) to 20 MHz. The flexible “slice” will allow LTE to be more easily implemented in countries where 5 MHz is a commonly allocated amount of spectrum. LTE will also co-exist with legacy systems already rolled out around the world.

Latency and Efficiency

Latency in a wireless network describes the time it takes between when an action is initiated or requested and when it actually begins. In 3.5G networks, when a phone is in dormant mode and wants to initiate a connection, a several hundred milliseconds (ms) delay is



common. For transmission of data packets, 50 ms one-way latency is the norm.

Consumers want a connection experience like they get at their homes using a wired broadband connection. LTE will decrease latency to just 50 ms from dormant to connection and a 5 ms one-way latency after that, delivering connection latencies similar to a wired connection. A new class of mobile devices is emerging that is a convergence of the Smartphone market with the PC market. These new MIDs, Mobile Internet Devices, are low-power, high-performance wireless devices, able to deliver a desktop experience on a small footprint, portable device. MIDs deliver an intuitive user interface with touch screens, as well as full featured browser support, high resolution displays, broadband and personal connectivity, a camera, camcorder, navigation, media player, gaming and office productivity applications in a small footprint that can operate all day on a single charge.

Next Generation Applications Processors

The amount of processing performance needed to deliver these new 4G applications will be large. Integrated, multi-core architectures that deliver microprocessors and DSPs on a single chip will be critical to 4G's success. Products such as TI's OMAP applications processors enable more sophisticated and intuitive user's interfaces and provide a web browsing experience similar to traditional PCs.

Integration and Power Management

To be able to deliver the performance needed for 4G technologies, process technologies must continue towards higher integration. The current 45 nanometer (nm) process in use today allows up to two times the density compared to the previous 65nm process. In addition to cost savings, the 45nm process achieves a 25% performance increase over the 65nm process. Continued integration will increase performance while decreasing costs over time. But all this integration comes at a price, namely the need for sophisticated power management technologies. Shrinking the process technology down to 45nm has an exponential effect on leakage power until it becomes a significant part of a device's total power.



Figure 1

The big challenge in bringing 4G to the market will be using the right applications processors as well as modem and power management technologies to deliver the performance, size and battery life that consumers demand. The path is clear to bring 4G to reality and deliver compelling application and performance that will pave the way for the future of wireless.



The Advantages of 3G Technology

3G (Third Generation) is the latest wireless technology. It is also known as UMTS (Universal Mobile Telecommunications System), an improvement over 2G (Second Generation) providing wireless access to the data and information to the users from anywhere and anytime. It is the latest mobile technology and in fact it is described by Cellular (2004) as being a generic name for the host of mobile technologies.

3G cellular phones were first launched in Japan in October 2001. This 3G phone was designed so users would be able to surf the Internet, view pictures of the people they are talking to, watch movies and listen to music on their handsets .

What are the benefits of 3G? You can perform all those functions that you perform at present with your mobile devices but at much higher speed than before. It provides you with faster connectivity, faster internet access, and music entertainment with improved quality. The benefits are immense. You can avail the benefits of video calling. You can call your friend and have a video call facility. The clarity is better and the facility can be enjoyed as long as both of you are using the 3G technology.

With 3G technology it is possible to access any site on the Internet by using your phone as a modem for your computer or laptop and mail the important documents. Downloading games and songs is much faster with this technology. You

can download your favorite games into your mobile and start playing. You can also download the music videos or simply the songs. The technology enables for much faster download. Hence it will take only few minutes to download movie clips or albums.

You can use your favorite search engines to find information on news headlines, get information about the evening weather so that you can plan your party. You can find out the latest baseball score and any latest news about your favorite sport. The 3G phones with their advanced feature will also enable you to watch exciting highlights of your favorite sport. With the increased speed and improved quality of the services provided in the 3G phones, you can view the multimedia data applications like movie clips and the music videos with more clear picture than with the 2.5G technology mobiles.

The 3G technology provides you with the data transmission speed of up to 2Mbps when you are using the phone on stationary mode. It also provides significantly faster data transfer rates of connectivity and increased networking and most importantly the resistance to noise.

The technology has in fact increased the bit rate thus enabling the service providers to provide high speed internet facilities, increased call volumes and host of the multimedia applications to their customers.

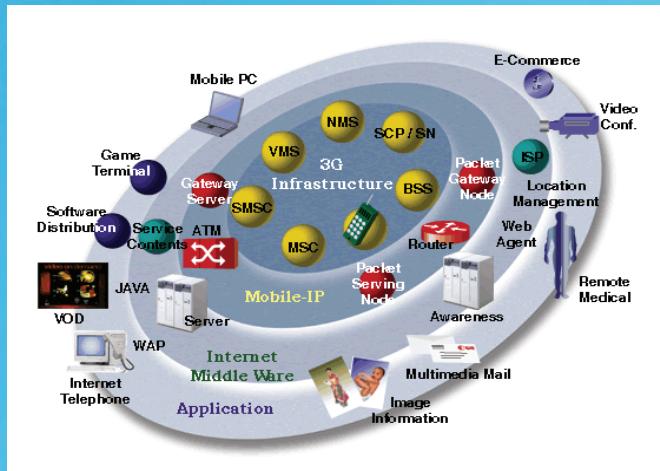


Figure 1

All these services can be provided to the customers on the basis of the amount of data they transmit and not on the time for which they use the service thus making the services cheaper for us.

A great deal of potential exists for new applications in the future as 3G packet based networks will allow users to be on line all the time. The capabilities of wireless networks in terms of bandwidth must still, however, be improved upon (3GNewsroom.com, n.d.).

3G is an exciting new technology that is being incorporated into mobile devices across the globe. Users are now able to make person-to-person calls, download data and do a variety of other tasks they never imagined possible all via their 3G cell phones.

**-Karan Parikh
S.E. EXTC-A**



Current Affairs in Electronics & Telecommunications in India

In this age of technology, Electronics and Telecommunication has surely played an important part in the development of the human race. The devices like mobile phones & laptops which have become an integral part of our daily lives came into existence only because of the developments made in the field of Electronics. Telecommunication, on the other hand has brought the world much closer to us; this is because of the fact that we can talk to people who are miles away just by the click of a button, all thanks to Telecommunication.

With the advent of 4G networks, Bharti Airtel officially became the first company in INDIA to provide 4G services across 296 towns in the country. Leading Telecomm operators in INDIA including Vodafone, Airtel, Reliance and many others slashed roaming calls rates by 40% and that of SMS by 75%, this sudden slashing of call and SMS rates were brought about because of the decision taken up by TRAI (Telecomm Regulatory Authority of INDIA). The reports of Union Government suggest that out of the 27 operational satellites almost 11 communicational satellites are operational; this is actually great news because as compared to the year of 2014, more number of communicational satellites are in working condition. TRAI has put forward a proposal so as to compensate people, who experienced issues related to call drops during the last few days by 15th October, 2015. The Government of INDIA will notify spectrum sharing

guidelines in a few days, while the spectrum trading rules will be issued by the end of October 2015. Spectrum sharing and trading guidelines will allow mobile operators to better utilize the available airwaves & will help in putting a check to the current issues related to call drops. As per the recent studies done by TIMESJOBS, there has been an increase of about 6% in the number of people getting jobs in the telecommunication industries. Jio, which is likely to launch commercial services in coming few months, is aiming to expand the addressable 4G market in the country by promoting Mi-Fi hotspots that allow users to stream data via 4G networks. Mi-fis can connect up to 10 devices at a time and cost around Rs 3,000. Reliance Jio is likely to reduce prices by about 50% to incentivize users to shift to its network. Mobile data will log a compound annual growth rate of 18 percent between now and 2020, increasing its revenue share from the current 18 percent to 31 percent, says a City Research report.

The electronics market of India is one of the largest in the world and is anticipated to reach US\$ 400 billion in 2022 from US\$ 69.6 billion in 2012. The market is projected to grow at a compound annual growth rate (CAGR) of 24.4 per cent during 2012-2020. Consumer Electronics has the highest share (29.7 per cent) in the total production of electronic goods in India. The Electronic Components had witnessed a growth of about 23.74 per cent from the previous year which was supported by the rapid growth in domestic manufacturing of electronic components. Not surprisingly,



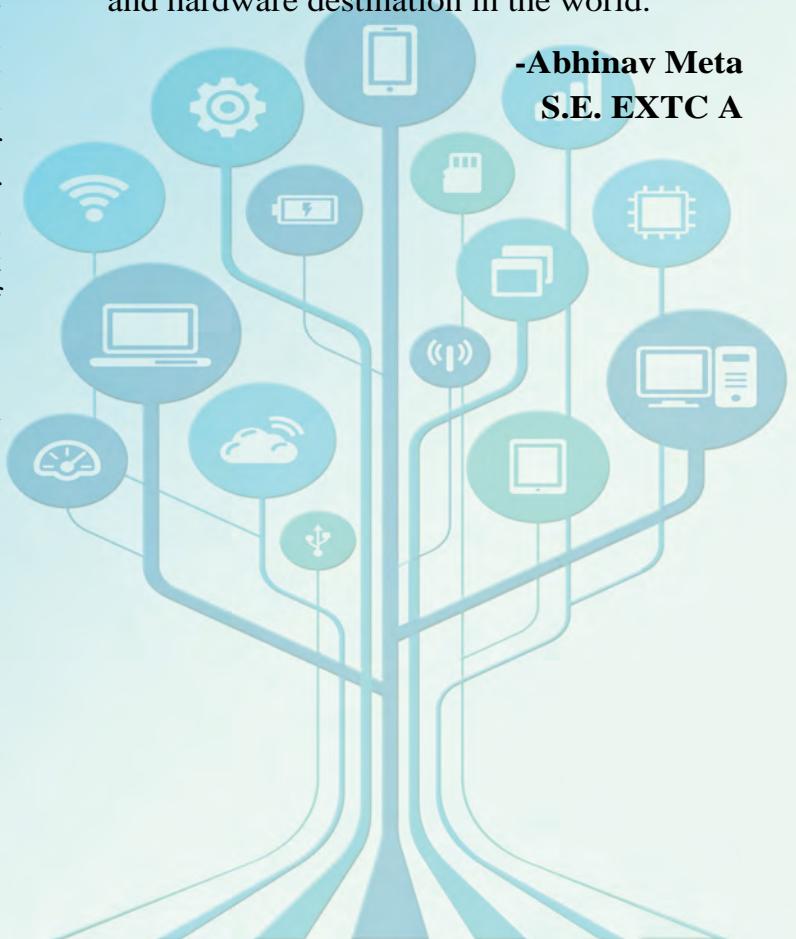
computers are a key component of total electronics output in India (9.9 per cent in 2015); the segment's share is likely to go up over this decade, given greater policy focus on encouraging computer hardware manufacturing. Samsung Electronics has invested Rs 517 crore (US\$ 77.82 million) towards the expansion of its manufacturing plant in Noida, Uttar Pradesh (UP). Taiwan-based HTC has decided to manufacture products in India. HTC is believed to have partnered GDN Enterprises, which has an assembly set up in Noida. As of 2015, to attract foreign investment in Electronics sector, the Government of INDIA has adopted Chinese style Special Economic Zones with the aim to provide islands of excellence where the infrastructure is world standard. Fifteen-year tax breaks given to foreign investors for the purpose of trade operations, duties and tariffs. The growth in demand for telecom products has been high, with India adding two million mobile phone users every month as of September 2015, which serves as one of the main reasons for the growth in production of electronic goods. This growth is expected to continue over the next decade, too. Multinational corporations are providing growing electronics market in India at lower costs by manufacturing semiconductors in India as of August 2015. The chip design and other complex components electronic device can be acquired from the Indian companies at low cost. India is growing up to be one of the biggest markets for electronic instrumentations. The main factor pertaining to the success of the Indian Electronics and Hardware Industry is the growth in the market demand. The growth in the manufacturing of semiconductor serves as the key driver in the emergence of India as one of the leaders. The advantages pertaining to the taxes and duties, the access to technical and engineering expertise,

proper manufacturing facilities, lucrative investment offers, etc.

From the points mentioned above, it is clear that the Government of INDIA is actually working really hard so as to ensure that the "ELECTRONICS AND TELECOMMUNICATION" sectors in INDIA flourish. Besides this, Government of INDIA is also promoting the "Make in INDIA"

Initiative so as to promote INDIAN goods on perhaps a larger scale. As of today, EXTC sector in INDIA has suffered but there have been various laws which were implemented and as a result the flaws in the sector were overcome. India stands number two behind China as far as TELECOMMUNICATIONS Sector is concerned. The Indian Electronic industry constitutes less than 1% of the global market. However, demands for these products are growing rapidly and investments are flowing in to augment manufacturing capacity. India has the potential to come up as the next electronics and hardware destination in the world.

**-Abhinav Meta
S.E. EXTC A**





Advancement of Technology

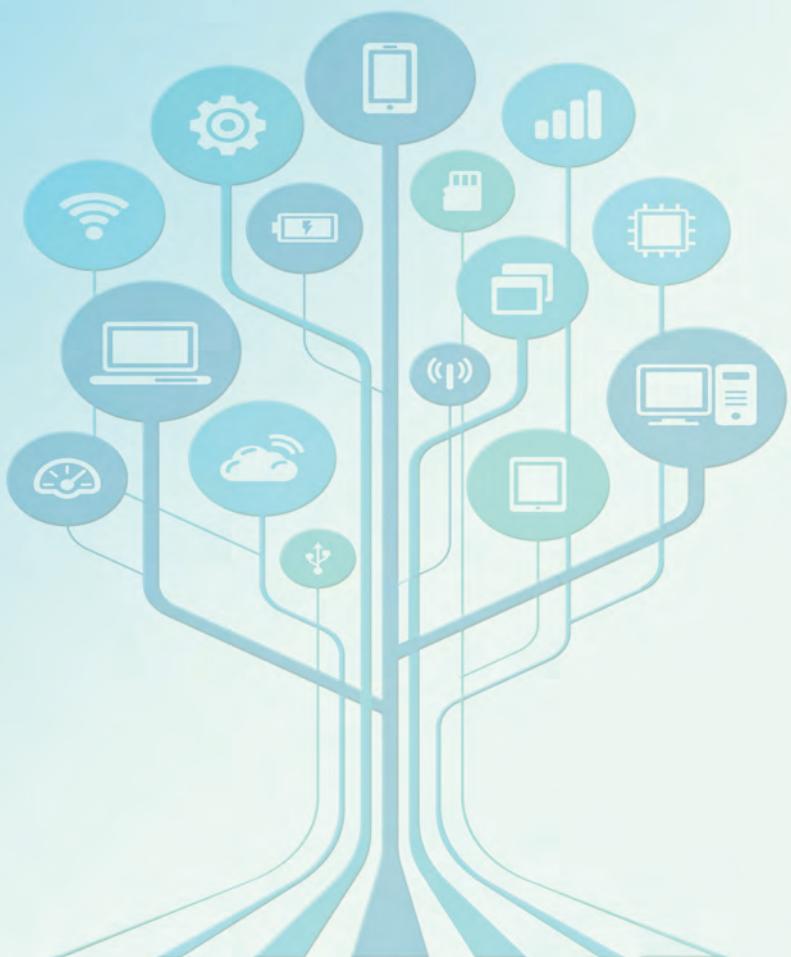
Technology creates more problems than it solves, and may threaten or damage the quality of life. As an individual living in the era of rapid development of technology, I believe that technology facilitates people's life and creates more comfort in people's life.

The advancement of technology has remarkably improved the quality of life. In contemporary history, every appearance of a new technology has improved the social advancement, enhancing the quality of life. The invention of the car and the plane made it possible for people to travel far away from their home for vacation and business. The updated technology to cars and planes makes people's travel more comfortable and safe. People can take advantage of the big ship for a cruise and the ship provides people with the products of all over the world. The appearance of the electricity brought people to a completely new world. The domestic appliances help people economize time on homework so that people have more time for relaxation. The TV and Internet provide people the entertainment as well as the information. The people benefited a lot from the development in medicine. A lot of incurable diseases become no more deadly. The average of people's life now increases a lot than before. The technology is also stimulant to the economic prosperity. Economic prosperity contributes to create more employment opportunity in job market. The increase in employment opportunity can help resolve the social problems, such as violence, drug, poverty, etc. These social problems

are main factors undermining the quality of people's life. The violence makes people worried about their safety. The poverty can only give people misery, never mind the quality of life. Only can a rich and developed society guarantee the quality of peoples' life. It is impossible for us to expect a high quality of life in a poor society with low productivity and undeveloped technology.

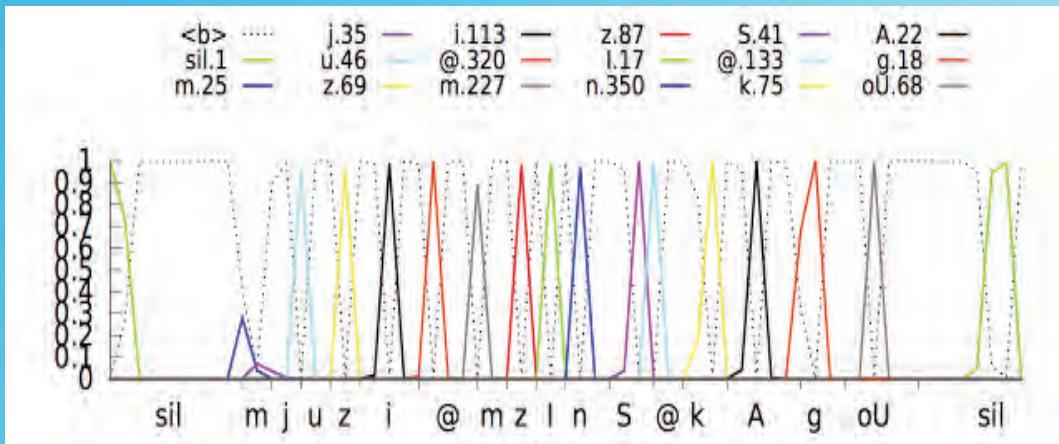
Although the technology creates some problems threatening the quality of people's life, these problems will not be a threat any longer if we use the technology well. Meanwhile, I believe the threat or the damage will be overcome following the further technological development.

-Sumit Khushwaha
S.E. EXTC-A



Google Voice Search: Faster and More Accurate Way of Life

Posted: Thursday, September 24, 2015



Posted by Haşim Sak, Andrew Senior, Kanishka Rao, Françoise Beaufays and Johan Schalkwyk – Google Speech Team

Back in 2012, we announced that Google voice search had taken a new turn by adopting Deep Neural Networks (DNNs) as the core technology used to model the sounds of a language. These replaced the 30-year old standard in the industry: the Gaussian Mixture Model (GMM). DNNs were better able to assess which sound a user is producing at every instant in time, and with this they delivered greatly increased speech recognition accuracy.

Today, we're happy to announce we built even better neural network acoustic models using Connectionist Temporal Classification (CTC) and sequence discriminative training techniques. These models are a special extension of recurrent neural networks (RNNs) that are more accurate, especially in noisy environments,

and they are blazingly fast!

Our improved acoustic models rely on Recurrent Neural Networks (RNN). RNNs have feedback loops in their topology, allowing them to model temporal dependencies: when the user speaks /u/ in the previous example, their articulatory apparatus is coming from a /j/ sound and from an /m/ sound before. Try saying it out loud - “museum” - it flows very naturally in one breath, and RNNs can capture that. The type of RNN used here is a Long Short-Term Memory (LSTM) RNN which, through memory cells and a sophisticated gating mechanism, memorizes information better than other RNNs. Adopting such models already improved the quality of our recognizer significantly.

The next step was to train the models to recognize phonemes in an utterance without requiring them to make a prediction for each time instant. With Connectionist Temporal Classification, the



models are trained to output a sequence of “spikes” that reveals the sequence of sounds in the waveform. They can do this in any way as long as the sequence is correct.

The tricky part though was how to make this happen in real-time. After much iterations, we managed to train streaming, unidirectional, models that consume the incoming audio in larger chunks than conventional models, but do actual computations less often. With this, we drastically reduced computations and made the recognizer much faster. We also added artificial noise and reverberation to the training data, making the recognizer more robust to ambient noise. You can watch a model learning a sentence here.

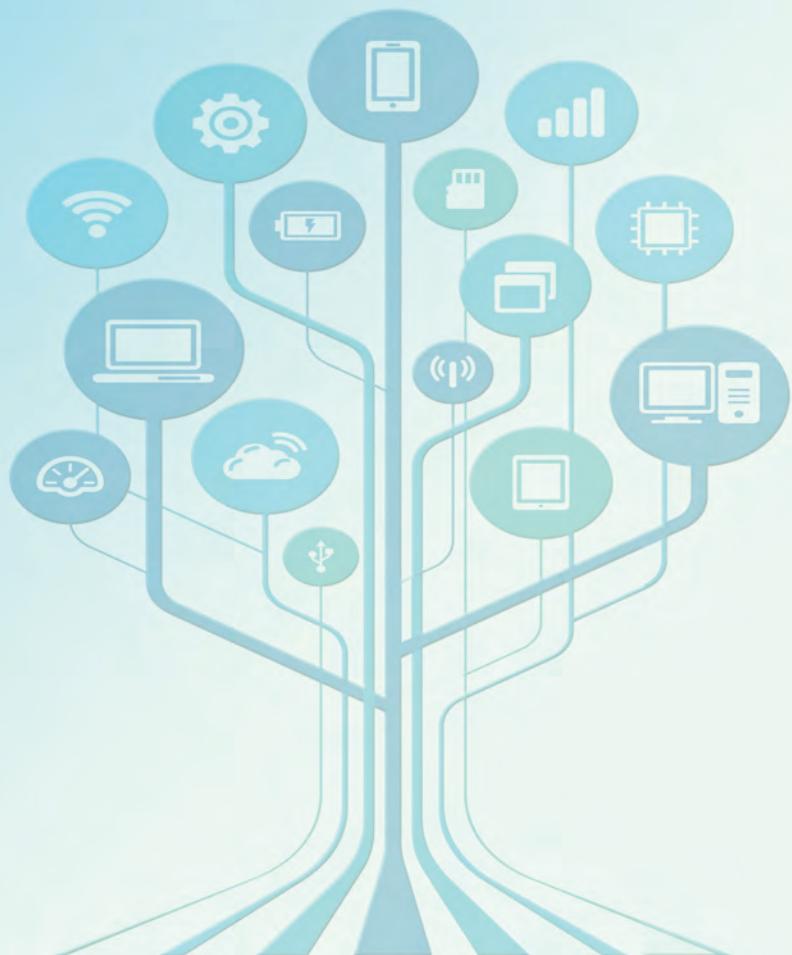
We now had a faster and more accurate acoustic model and were excited to launch

it on real voice traffic. However, we had to solve another problem - the model was delaying its phoneme predictions by about 300 milliseconds: it had just learned it could make better predictions by listening further ahead in the speech signal! This was smart, but it would mean extra latency for our users, which was not acceptable. We solved this problem by training the model to output phoneme predictions much closer to the ground-truth timing of the speech.

Reference:

[1]<http://googleresearch.blogspot.in/2015/09/google-voice-search-faster-and-more.html>

-Pratik Jain
S.E. EXTC-A





Quantum Teleportation- Our Future!!!

Disappearing from one place and reappearing at some other place, isn't it really amazing!? There would be no need to wait in tedious lines, sitting in traffic and rushing through crowds. It'd be so much convenient to simply step up onto platform, see some pretty sparkling lights and rematerialize exactly at your destination.



Figure 1

The same happens in an episode of "Star Trek", known as Teleportation. Wishing the same, scientists started their work on teleportation and they successfully did it. Physicists researched on Quantum Teleportation of an atom. They teleported the quantum state of photon to a crystal, in which information transmitted from light to matter, over a record distance of 25kms across optical fibers.

This record was set using advanced single photon detectors. They are made up of superconducting wires of Molybdenum Silicide that were about 150nm wide and

cooled to about -457°F. About 1% of photons travel 100km of fiber for Normal detectors whereas by Advanced Single-photon detectors more than 80% of arriving photons are recorded.

Further development in Quantum Teleportation enables Quantum Internet. It gives secure communication compared to which is used nowadays. Building block for Quantum Internet will be Quantum Routers that can receive quantum information from location and route it to another without destroying it. This technology has the potential to revolutionalize communications.

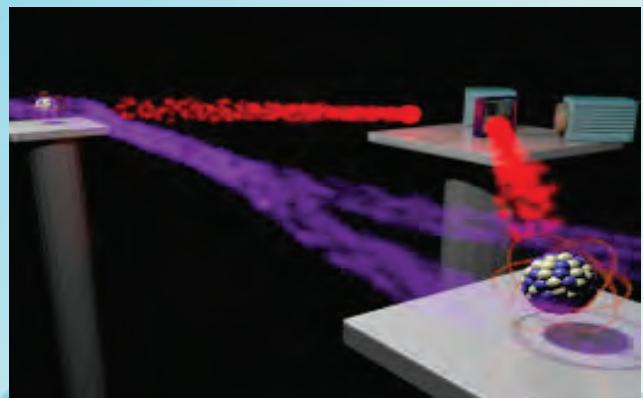


Figure 2

Future step may be teleportation between Cities, Countries and even between Earth and Orbiting Satellites finally.

**-Nikita Khatiya
S.E. EXTC-A**

EVENTS

Seminar on Internet of Things by IEEE-TCET

IEEE-TCET Student Chapter provided all of its student members a glimpse into the fast growing world of technology with a seminar on ‘Internet of Things’ which was conducted on 5th September, 2015.

The speaker for this seminar was Mr. Naman Singh who is a representative of DuckDuckGo, Mumbai. Having attended various international seminars and conferences, he could connect well with the students to give them a fair idea of what IoT, or as some call it, Internet of Everything and Big Data means to a common man and why should all engineers watch out for this next big thing.



In the current unprecedented era of connectedness, IoT will bring about a rise in a number of household objects connected to the internet; from mobiles, tablets, wearable clothing, cars and kettles, the IoT will have a significant impact on how we go about our daily lives. Mr. Singh also explained the



students how the IoT promises to be the most disruptive technological revolution since the advent of the Internet. It is also likely to be the biggest system ever built with projections that indicate more than 50 billion humans and objects will be connected to the Internet by 2020.

He also brought to light the negative aspects or the societal concerns surrounding trust and privacy for safeguarding personal information.

The seminar was attended by second and third year students from various departments. It proved to be a success with all students demanding to learn more about the technical aspects of sensors and connectivity in the future after a question and answer round with the speaker.

-Deepti Bhardwaj

Secretary, IEEE-TCET

Zephyr 2015-16

Zephyr, the annual technical festival of Thakur College Of Engineering & Technology was organized during the period of three days starting from 24th Sept to 26th Sept 2015. And as always, it was a huge success.

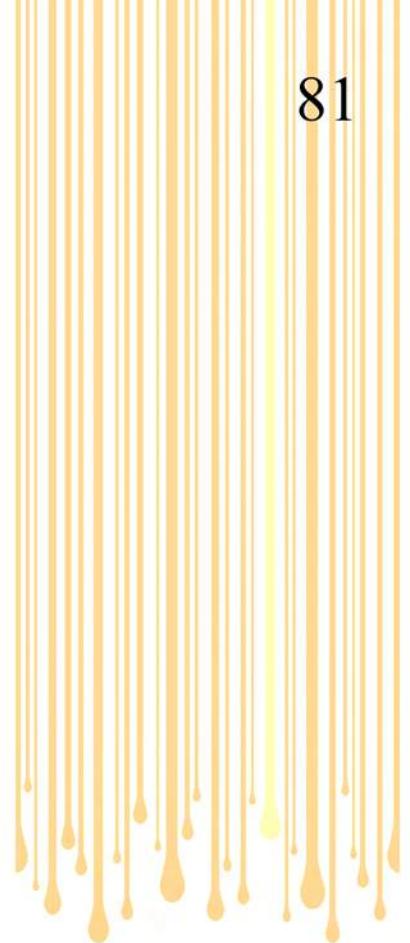


The festival inauguration ceremony consisted of an event named 'Contraption'. It comprised of a series of actions, with the previous one leading to the next action and ultimately, the words "Ignite Your Mind" being lifted up with help of balloons. Apart from this, the festival consisted of a total of around 50 different events. The events consisted of both, the regular annual events like Laser Tag, Robowars, Laser Trap, etc as well as some new events like Defuse the Bomb, etc. Laser Tag registered a lot of entries from various teams. It consisted of 2 teams, at a time, of 4 members each, trying to combat in a dark room with just a few glowing walls and pillars to help them find their way. Robowars included the participants' robots battling in the arena to win the event. In Laser trap, the participants had to reach the other end without hitting a laser beam.

The new event of Defuse the Bomb was as well received as the regular events, by the participants. In this, the participants in teams of 2 had to go through a series of four rounds within a time period of 5 minutes with the difficulty level increasing with every round. The first round had 'Blind Typing' wherein one team member had to type a given paragraph without looking at the monitor, with max three errors allowed. The 2nd & the 3rd stages consisted of clues solving which would lead to the next clue. In the 4th stage, the final clue led the team to the bomb which had to be defused.



Other than these technical events, the festival also included numerous LAN connected games such as Counter Strike, Dota-2, FIFA-14 and PSP games. These events also had a large number of registrations. These events witnessed some of the finest gamers competing against each other. All the events took place on all the three days of the festival.



One of the most popular events of Zephyr was Footloose, which involved B-Boying. It was filled with a lot of enthusiasm and fun from the participants. A huge crowd had gathered to see the event take place. This event took place towards the end of the last day of Zephyr and hence was the finale of the festival.

**-Tarush Shenoy
SE EXTC-B**

Texas Analog Design Contest

Texas Instruments is the third largest manufacturer of semiconductors, after Intel and Samsung. The company has a portfolio of nearly 45,000 analog products and customer design tools, making it the world's largest maker of analog technology components.

It conducted a competition of Embedded Systems for the Electronics and Telecommunication students (From Second year students to Fourth year students) of TCET in the odd semester of the year 2015.



- Competition details: The competition is held in three rounds. The first round was a MCQ test on 7th September, 2015. The second round was actual implementing of the circuit which was held on 30th September, 2015. Third round was also a MCQ test between the teams that won in the second round.
- Registration: Interested students were asked to register on the Texas Instruments' site.
- Participation cost: Free of cost.
- Teacher-in-charge: Dr. Sangeeta Mishra

- Participants: 236 students from all the three years had participated.
- Performance: After the first round, 40 teams i.e. 80 students were qualified for the second round. After the second round, three teams qualified for the third round. The winners of the competition were Ashish Rawat & Arshdeep Sood (TE EXTC B) and Shivani Seksaria and Pratik Jain (SE EXTC A).
- How were the competitions conducted?
 1. There was a seminar initially that explained how the competition will be held and what was it exactly about.
 2. The first round which was held in the seminar hall 3 was a MCQ test. The link from which the students were supposed to study was given beforehand.
 3. The second round was held in the labs of the first floor where actual implementation of the circuit was required. The op-amps that were required were ordered from the Texas site itself free of cost.
 4. The third round was a MCQ test that was held between the three teams that won in the second round.



It was the first time for them to learn things from the link provided and implement it for the competition, so the students faced a little difficulty which was later rectified by the teacher-in-charge.



- Basic analysis:
 1. Strength:
It is a great opportunity for students since there are a number of seminars and workshops held in our department but only a few competitions. With this much participation and the efforts put in by the teachers-in-charge the competition was successful. Since it was something new and useful, all the students appreciated it. It was also an opportunity for the students to learn about the contemporary ICs used by the industry and it deepened their knowledge about analog ICs. It also inspired them to participate in more such co-curricular activities.
 2. Weakness: Since this was something new, it was a little difficult for students to understand the rules and what actually has to be done.

- Conclusion: The Texas Analog Design contest is held annually throughout the world on a national level. This was the first time TCET students got the opportunity to participate in such a competition. It was a great learning experience for the students which will inspire them to participate more on such platforms.

**-Aanchal Agrawal
T.E. EXTC-A**

RESULTS

Toppers of even semester:

Sr. No.	Name	Pointers	Class
1.	Anjali Padiya	9.32	BE A
2.	Khushbu Thakur	9.32	BE B
3.	Shyam Sunder Cranganoor	9.43	TE A
4.	Snehal Ransing	9.57	TE B
5.	Sumit Kushwaha	9.93	SE A
6.	Tarush Shenoy	9.25	SE B

Code of ethics

- Engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties and disclose promptly factors that might endanger the public or the environment.
- Engineers shall perform services only in the areas of their competence.
- Engineers shall issue public statements only in an objective and truthful manner.
- Engineers shall treat all persons fairly and not engage in acts of discrimination based on race, religion, gender, disability, age, national origin, sexual orientation, gender identity or gender expression.
- Engineers shall strive to improve the understanding of technology, its appropriate application and potential consequences.
- Being honest and impartial, and servicing with fidelity the public, their employers and clients
- Striving to increase the competence and prestige of the engineering profession

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