TECHNICAL MAGZINE

Department of
Electronics & Communication Engineering

A.Y. 2019-20

VELAGAPUDI RAMAKRISHNA
SIDDHARTHA ENGINEERING COLLEGE
(AUTONOMOUS)
(Sponsored by Siddhartha Academy of General & Technical Education)
Estd.1977

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Department Vision

To produce globally competitive and socially sensitized engineering graduates and to bring out quality research in the frontier areas of Electronics and Communication Engineering.

Department Mission

To provide quality and contemporary education in the domain of Electronics and Communication Engineering through periodically updated curriculum, best of breed laboratory facilities, collaborative ventures with the industries and effective teaching-learning process.

To pursue research and new technologies in Electronics and Communication Engineering and related disciplines in order to serve the needs of the society, industry, government and scientific community.

PROGRAM OUTCOMES

Program outcomes examine what a program or process is to do, achieve, or accomplish for its own improvement and/or in support of institutional or divisional goals: generally numbers, needs, or satisfaction driven. They can address quality, quantity, fiscal sustainability, facilities and infrastructure, or growth.

After completion of the Electronics & Communication Engineering programme, the students will be able to have:

PO1: Engineering knowledge: An ability to apply knowledge of mathematics, science, fundamentals of engineering to solve electronics and communication engineering problems.

PO2: Problem analysis: An ability to identify, formulate and analyze electronics and communication systems reaching substantiated conclusions using the first principles of mathematics and engineering sciences

PO3: Design/development of solutions: An ability to design solutions to electronics and communication systems to meet the specified needs.

PO4: Conduct investigations of complex problems: An ability to design and perform experiments of complex electronic circuits and systems, analyze and interpret data to provide valid conclusions

PO5: Modern tool usage: An ability to learn, select and apply appropriate techniques, resources and modern engineering tools for modeling complex engineering systems.

PO6: The engineer and society: Knowledge of contemporary issues to assess the societal responsibilities relevant to the professional practice.

PO7: Environment and sustainability: An ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development

PO8: Ethics: An understanding of professional and ethical responsibilities and norms of engineering practice.

PO9: Individual and team work: An ability to function effectively as an individual, and as a member in diverse teams and in multidisciplinary settings.

PO10: Communication: An ability to communicate effectively with engineering community and with society at large.

PO11: Project management and finance: An ability to demonstrate knowledge and understanding of engineering and management principles and apply these to manage projects.

PO12: Life-Long Learning: An ability to recognize the need for, and engage in independent and life-long learning in the broadest context of technological change.

Technical Magazine 2019-20

DEPARTMENT OF ELECTRONICS & COMMUNICATIONS ENGINEERING

Department of Electronics & Communication Engineering

Editorial Board	ISSUE	Academic Year
Dr K. Sri Rama Krishna, Mr. K V Prasad	JUNE- APRIL	2019-20

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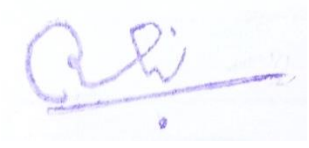
ABOUT THE DEPARTMENT

Established in the year 1977, the department of ECE offers B. Tech Programme in Electronics & Communication Engineering with an intake of 240 and two M. Tech Programmes in Communication Engineering & Signal Processing and VLSI Design & Embedded Systems . The department has been accredited by NBA of AICTE four times. More than 40% faculties are with Ph.D. qualification. Led by a team of highly qualified experienced faculty with specializations such as RF &Microwave, Antennas, Digital Signal Processing, Wireless Communications, and Digital Image Processing, VLSI and Embedded systems. The department provides excellent academic and research environment to the UG, PG and research students. A Centre of Excellence (TIFAC CORE- DST) in Telematics was established in the year 2009 with the state of the art facilities. Having successfully completed many research projects funded by UGC, AICTE, DST, NRSC-ISRO DLRL & ANURAG-DRDO etc., it is also recognized by JNTUK as "**Research Center.**" Faculty members extend guidance to research scholars, produce Ph.D.'s and publish their findings in peer reviewed national and international journals and conferences.

Message by HoD

As a part of nurturing the students with qualities like teamwork, ***technical*** skills and a glimpse of the competitive world of ***engineering*** and ***technology we are encouraging students to publish articles in the frontier areas of electronics and communication engineering.***

I am confident that all the faculty members and student community involved with this magazine have put their efforts in this in a way that the magazine both entertains and ignites the reader's mind. I would like to thank the editorial team members for bringing out this magazine regularly. I express my considerable appreciation to all the authors of the articles in this magazine. These contributions have required a generous amount of time and effort. It is this willingness to share knowledge, concerns and special insights with fellow beings that has made this magazine possible.



Dr K. Sri Rama Krishna

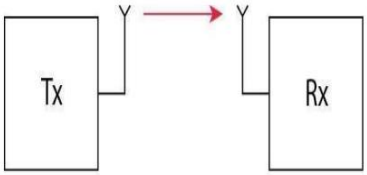
MIMO Antennas

Kalasani Naveen

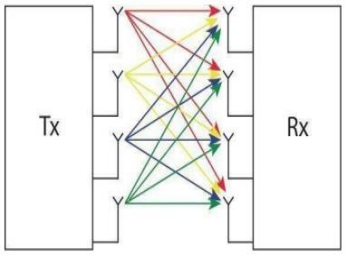
MIMO refers for Multiple-In-Multiple-Out transmission, which distributes the same information via numerous signals across different antennas at the same time whereas only using one radio network. Where it is in the way of antenna diversity which is a tool for enhancing the data strength and durability of a radio frequency link by using several antennas. There at the point of transmission, the dataset is partitioned into numerous data feeds, which are then rearranged upon that receiving station by some other MIMO radio with almost the same no of antennas.
The receiver is programmed to allow for minor temporal differences between signal pickups for extra noise or interruption, or even destroyed transmissions. MIMO antennas enable reliability in the transmission of data that traditional single antenna configurations Single In-Single Out (SISO) cannot provide when sending information on different channels. So,

MIMO device provides numerous benefits over traditional SISO designs, as a result of this:

1. Issues like blurring by damaged or skipped data frames can be addressed by using several communication channels, yielding enhanced audio or video quality.
2. Because MIMO antennas acquire and integrate numerous channels of same data that are obtained at widely differing time periods, that they can use reflected and rebounded Radio frequency (RF) broadcasts (called as multipath channels) to effectively boost strength of the signal even without clear distinction. This is especially effective in urban areas, because transmission loss among individual antenna terminals with no clear distinction is a big problem. MIMO communications have a lot of reflecting pathways between both the transmission and reception stations in urban situations.
3. Total performance can be increased, permitting for more videos and other information is being sent through the internet in higher quality and quantity.



SISO system example



MIMO system example

Certain MIMO wireless devices can also be used for ad-hoc networking, where single user endpoints can get in and out of the MIMO subnet at any time, and information from many other endpoint clients is instantaneously transmitted through the subnet, resulting in a auto-creation, auto-relieving ring topology that does not depend on a crucial layout to function, and expandable Mobile ad-hoc networks wireless devices will work in the same way. The capability to employ this sort of connectivity unlocks MIMO wireless system user who require dependable, flexible broadband service. Because MIMO wireless systems continue to dwindle in dimension and may be bundled into recognizable handheld wireless formats which

are more feasible than before. Without the inconvenience of permanent fix, ground stations and system transponders can be swiftly installed for short-term operations that require a greater network coverage.

Here are some instances of different users who benefit from MIMO systems:

1. Firstly, responders who regularly work in chaotic, shifting environments and cannot depend on mobile systems or any other solid equipment to be functional when they are required due to environmental catastrophes, electrical problems, overcrowded connections, or any other reasons.
2. Secondly, clients require their personal independent network communication nonspecific radio frequencies, such as enforcement agencies or the armed services. This covers small-group interpersonal and intercommunication as well as broader links that encompass aerial vehicles, unmanned aerial vehicle systems, and more.
3. Television broadcast creation, like as news programs or live sporting events, when the content is changed during transmission of video and telecasting the stations must relocate without notification, or where shooting may encompass numerous, concurrent focus of points. Another significant benefit for this area is there moral of extensive, costly cable connections.

Gooseneck omni antennas for broadcast video applications southwest antennas

Smart Watch

Padisala Keerthi

Nowadays, technologies became the most important thing in our life. For example, the normal wristwatch improved to something call “smart watch”. The smart watch is a wearable device, and it is the new version of the normal wristwatch. Because it has more functions than the normal watch has, and it can act like the smart phones in some features. Day after day smart watches become very important in many majors. The wristwatch is a device that we use it to know the time, and some of them can display the date. These normal wristwatches have been improved. In 1979, people thought that digital watch is an elegant idea. Through the history, people tried to gather different technologies in one device that they can wear it on their wrists

So the smart watches are one of these technologies that may be will have a bright future in several years depends on the additional functions that will include. For example, I think that the smart watches will develop to be used independent without the need to connect to the smart phones. So it will become as similar as any smart phone but the only different is that the smart watch you can wear it on your wrist, and it will be more easily to use than the smart phone. Moreover, I think that they will create a 3D smart watch, that will be more fun, and it will let the user share a video or a photo with others in a wide range of area. According to Trevor “Last Few months, the US space agency Nasa asked the public to develop a smart watch interface for its astronauts to use on the International Space Station” (Tan, 2015).I think this is will be a new function for the smart watches. However, I think that the smart watches will be a fad, or smart watches will not have a future. There are some disadvantages of the smart watches because of them people will not buy it. First, the smart watches have a small screen, so some people don’t like the small screen. Also, in future if the smart watches become exactly like the smart phone, some people will not buy it because they do not like to carry with them several devices that have the same

Home Automation

Bommareddy Anjini Reddy

Home Automation is a new-age solution to automate your home through furnishing automatic lights, automatic door locks, smart security cameras, automatic heating and cooling, etc. As this generation fascinated with modern technology, the demand has started to reach the skies. Making innovative ideas practical for the long term. Through Home Automation, you can record the total energy consumption of your home and customise your usage accordingly. Installation of this one-of-a-kind technology is not only beneficial for your pockets but also the environment will be grateful for switching to this mechanism. Home automation system combines hardware and software via a wireless network to control your home electronics and appliances through one device which could be a smart phone, tablet, or a specific central automation control hub system. These devices can be controlled remotely even when you're not at home.

What is Home Automation?

"Home automation" refers to the automatic and electronic control of household features, activity, and appliances. In simple terms, it means you can easily control the utilities and features of your home via the Internet to make life more convenient and secure, and even spend less on household bills. Read on to find answers to some of the most common questions about home automation technology, and get a few ideas for home automation solutions to incorporate in your home. Home automation is a network of hardware, communication, and electronic interfaces that work to integrate everyday devices with one another via the Internet. Each device has sensors and is connected through WiFi, so you can manage them from your smart phone or tablet whether you're at home, or miles away. This allows you to turn on the lights, lock the front door, or even turn down the heat, no matter where you are.

Design of Home Automation system:

This topic shows the overall design of Home Automation System (HAS) with low cost and wireless system. It specifically focuses on the development of an IOT based home automation system that is able to control various components via internet or be automatically programmed to operate from ambient conditions. In this project, we used Node MCU, a popular open source IOT platform, to execute the process of automation. Different components of the system will use different transmission mode that will be implemented to communicate the control of the devices by the user through Node MCU to the actual appliance. The main control system implements wireless technology to provide remote access from smart phone. We are using a cloud server-based communication that would add to the practicality of the project by enabling unrestricted access of the appliances to the user irrespective of the distance factor. The system intended to control electrical appliances and devices in house with relatively low cost design, user-friendly interface and ease of installation. The status of the appliance would be available, along with the control on an android platform. This system is designed to assist and provide support in order to 1fulfil the needs of elderly and disabled in home. Also, the smart home concept in the system improves the standard living at home.

Internet of Things (IOT) is a concept where each device is assign to an IP address and through that IP address anyone makes that device identifiable on internet. The mechanical and digital machines are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. Basically, it started as the "Internet of Computers." Research studies have forecast an explosive growth in the number of "things" or devices that will be connected to the Internet. The resulting network is called the "Internet of Things" (IoT). The recent developments in technology which permit the use of wireless controlling environments like, Bluetooth and Wi-Fi that have enabled different devices to have capabilities of connecting with each other. Using a WIFI shield to act as a Micro web server for the Arduino which eliminates the need for wired connections between the Arduino board and computer which reduces cost and enables it to work as a standalone device. The Wi-Fi shield needs connection to the internet from a wireless router or wireless hotspot and this would act as the gateway for the Arduino to communicate with the internet. With this in mind, an internet based home automation system for remote control and observing the status of home appliances is designed.

The concept of "Home Automation" has been in existence for several years. "Smart Home", "Intelligent Home" are terms that followed and is been used to introduce the concept of networking appliance within the house. Home Automation Systems (HASs) includes centralized control and distance status monitoring of lighting, security system, and other appliances and systems within a house. HASs enables energy efficiency, improves the security systems, and certainly the comfort and ease of users. In the present emerging market, HASs is gaining popularity and has attracted the interests of many users. HAS comes with its own challenges. Mainly being, in the present day, end users especially elderly and disabled, even though hugely benefited, aren't seen to accept the system due to the complexity and cost factors.

Design of an independent HAS:

To formulate the design of an interconnected network of home appliance to be integrated into the HAS. The objective to account for every appliance and its control to be automated and integrated into the network further formulated into the HAS.

Monitoring status of appliances:

Being able to view the status of home appliances on the application, in order have a better HAS.

Secure connection channels between application and Node MCU:

Use of secure protocols over Wi-Fi so that other devices are prevented to achieve control over the HAS. Secure connections are obtained by SSL over TCP, SSH.

Controlled by any device capable of Wi-Fi (Android, iOS, PC):

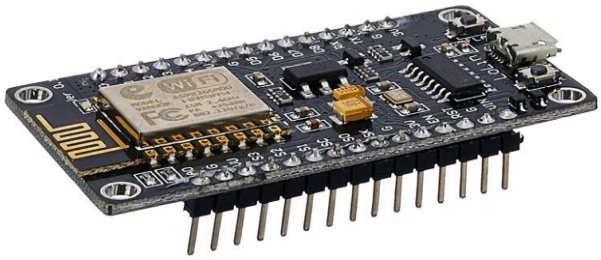
To achieve flexibility in control of the home appliances, and device capable of Wi-Fi connectivity will be able to obtain a secure control on the HAS.

Extensible platform for future enhancement:

With a strong existing possibility of adding and integrating more features and appliances to the system, the designed system needs to be highly extensible in nature.

The prototype of the proposed smart home is designed. The smart home has two rooms, one kitchen, one bathroom, one veranda. There is a ventilator in the kitchen. For the design and implementation of an IoT based home automation system, it uses an open source firmware Node-MCU through MQTT protocol along with diverse sensors, such as temperature and humidity sensor DHT11, PIR motion sensor HC-SR 505, gas sensor MQ2, rain sensor YL-83 for measuring the temperature, humidity, smoke, gas leakage, and rain. Several actuators control the activities of electronic devices of the home. The lights and fans are controlled by the dashboard. A graphical user interface (GUI) helps to interact with users and the system and ensures the comfort and safety of the users. The main entrance of the home has a door with a motor and motion sensor. This PIR motion sensor attached to the door detects the motion. This will let the door open and close automatically.

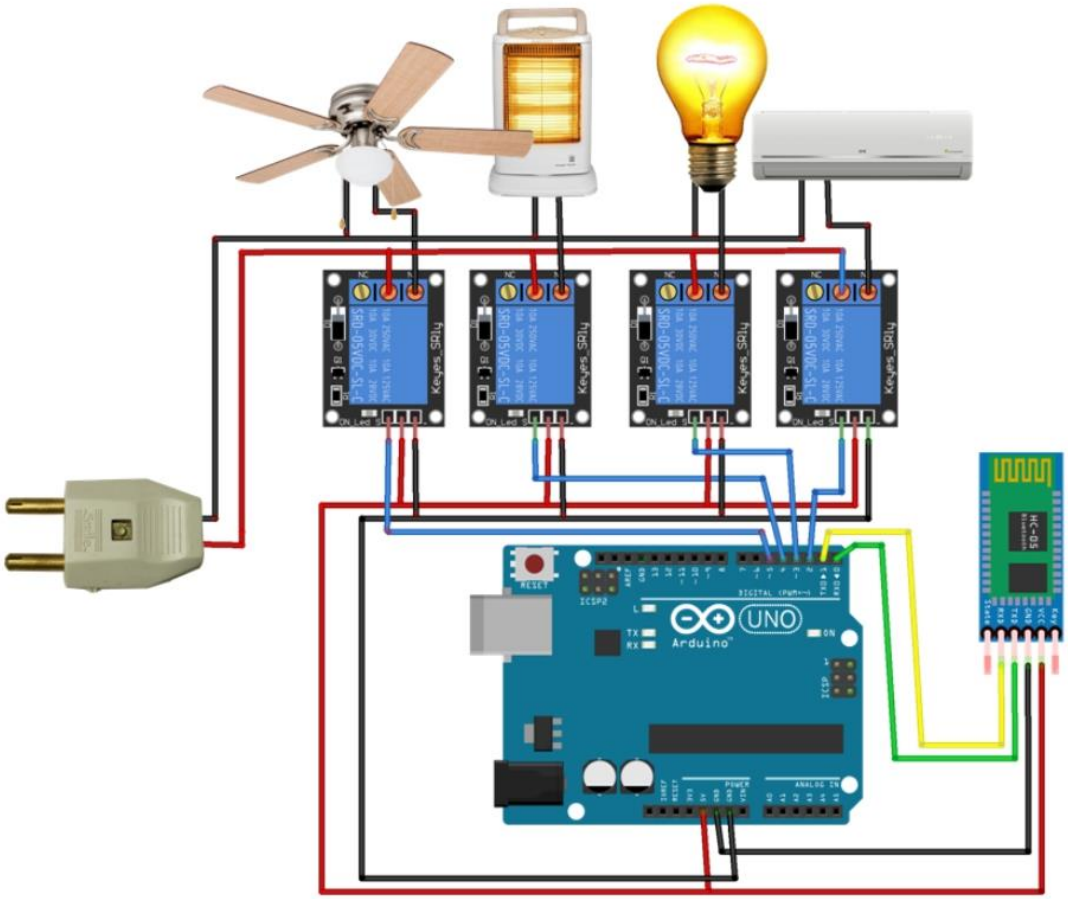
Our smart home automation system uses web services as an interoperable application layer. The system has a micro web server that is based on Arduino Ethernet. The proposed system allows authorized users to control and monitor connected appliances. A graphical user interface (GUI) for accessing and controlling the devices is provided by the web server. The ESP8266 is connected to the power switch. After that, it is connected to Wi-Fi and it gathers the data from different sensors. Then it sends the data to the MQTT dashboard. If the gas is detected from the gas sensor, the exhaust fan of the kitchen is ON. Otherwise, the exhaust fan is OFF. If the temperature value is greater than the threshold value, the room fan or AC is ON. Otherwise, the fan or AC is OFF. If it is raining, then the rain detector detects it and the window is shut down. Otherwise, it is open.



Node-MCU 1.0 (ESP-12E Module) is an IoT development board consisting of ESP8266, SoC integrating a 32-bit microcontroller [18] that uses Wireless 802.11 b/g/n standards and supports three operating modes STA/AP/STA+AP. In the study, we used the microcontroller (Node MCU/ESP8255) as the central unit of the prototype. We connected all the devices to the microcontroller board through jumper cable. The actuators such as light, fan and potentiometer through the 4 channel relay board. The power supply may be from the battery or other power source.

How does home automation work?

To develop an android application, we need to set up an Android IDE with some custom settings to access the PAHO library which is an MQTT client library. This library is written in Java. This is used especially for developing applications on Android. The Paho has been created to provide a reliable open-source platform. It implemented an open and standard messaging protocol. The intension was to give a new and emerging application for Machine-to-Machine (M2M) and the Internet of Things (IoT). Paho gives the following facilities: Reduces the physical and cost constraints of device connectivity. It provides effective levels of decoupling between devices and applications. It designs scalable web and enterprise



middleware and applications. Eclipse hosts a Nexus repository for those who want to use it. It manages application dependencies and sets up a build environment so that we can use the same repository to get the Paho Android Service. Adding the repository definition and the dependency code is shown in Appendix A. To complete the setup, we have to add few permissions to the android manifest such as—internet, network state, and phone state.

Here first activity allows the user to scan a QR code to get the server information since each user has a unique dashboard on the server. The second activity asks the user to connect to the MQTT broker and the third activity shows all the data provided by the broker. We can control the appliances from the MQTT dashboard. when light is on, motion detection gives NORMAL status and the rain detector gives DETECTED indicating that no one is waiting in front of the door and it is raining. The price of the sensors and actuators used in the implementation of the smart home does not differ very much for changing their brand. But the price of the microcontroller board (Node-MCU or ESP8266) is different. Due to this reason, the cost of the smart home implementation mainly depends on the price of the microcontroller board.

6G Communication

Shaik Zaiba

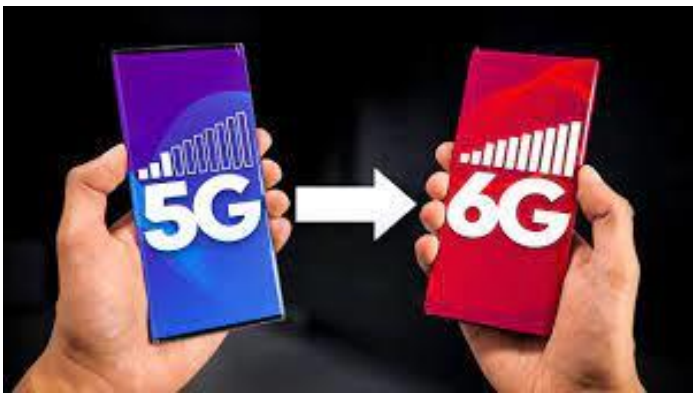
6G (sixth-generation wireless) is the successor to 5G cellular technology. 6G networks will be able to use higher frequencies than 5G networks and provide substantially higher capacity and much lower latency. One of the goals of the 6G internet is to support one microsecond latency communications. This is 1,000 times faster -- or 1/1000th the latency -- than one millisecond throughput.

The 6G technology market is expected to facilitate large improvements in the areas of imaging, presence technology and location awareness. Working in conjunction with artificial intelligence (AI), the 6G computational infrastructure will be able to identify the best place for computing to occur; this includes decisions about data storage, processing and sharing.

It is important to note that 6G is not yet a functioning technology. While some vendors are investing in the next-generation wireless standard, industry specifications for 6G-enabled network products remain years away.

What are the advantages of 6G vs. 5G?

6G networks will operate by using signals at the higher end of the radio spectrum. It is too early to approximate 6G data rates, but Dr.Mahyar Shirvani moghaddam, senior lecturer at the University of Sydney, suggested a theoretical peak data rate of 1 terabyte per second for wireless data may be possible. That estimate applies to data transmitted in short bursts across limited distances. LG, a South Korean company, unveiled this type of technology based on adaptive beamforming in 2021.



•The 6G technology market is expected to facilitate large improvements in imaging, presence technology and location awareness.

•6G's higher frequencies will enable much faster sampling rates, in addition to providing significantly better throughput and higher data rates.

Advancement in Wireless sensing technology:

•The combination of sub-mm waves (e.g., wavelengths smaller than one millimeter) and frequency selectivity to determine relative electromagnetic absorption rates could potentially lead to significant advances in wireless sensing technology.

Emergence of Digital Capabilities:

•It will see the emergence of simple, easy-to-wear-and- carry devices with a huge set of digital capabilities.

•This will help the paramedics, educators and agro- technicians to jumpstart the village ecosystems with little or limited need for on-site presence of doctors, professors and agro-experts. Optimising mass public transportation:

•For India, such an enabling set of technologies will bring manifold utilisation of scarce rail, air and road networks and make mass transportation far more efficient; Artificial Intelligence (AI) and massively parallel computing architectures will help solve transportation and scheduling operations research problems.

Challenges:

Maintaining Protection Mechanisms:

•The key technical challenges are energy efficiency, avoiding signal attenuation due to obstructions and water droplets in the air, and, of course, maintaining end-to-end trust through robust cyber security and data protection mechanisms.

Adoption of New Models:

•Need innovations in antenna design, miniaturisation, edge cloud and distributed AI models. In addition, we need to ensure end-to-end security and privacy by design, instead of as an afterthought.

Availability of Semiconductor:

•We don't have semiconducting materials that can use multi-THz frequencies. Getting any kind of range out of those frequencies may require enormous arrays of extremely tiny antennas.

Complex Design for Carrier Wave:

•Water vapor in the atmosphere blocks and reflects THz waves, so mathematicians will have to design models that allow data to take very complex routes to its destination.

OFDM Systems on Multi-Path Fading to Reduce ISI in Wireless Communication

Boppudi Bhavya Sai

In wireless communication, when a signal is sent to the receiver station, the signal has to go through several paths, different time delays and these arise to multi-path communication, which has distributed amplitudes and phases. As a result, it causes fluctuations in amplitude and phases at the received signal, this phenomenon is called fading. There are different types of fading namely large-scale fading, multipath fading, slow fading etc. some of the techniques for reducing these fading types are diversity reception and transmission, orthogonal frequency division multiplexing, Rake receivers, Space-time codes, Multiple Input Multiple Output (MIMO), equalization.

Multipath Fading occurs when a signal reaches the receiver from various path that is when multipath propagation takes place. Multipath fading can affect a large range of frequencies beginning from low frequency to microwave and beyond. It affects both amplitude and the phase of the signal causing phase distortions and ISI. Multipath fading can be mitigated by using some of the fading mitigation techniques such as receiver antenna diversity technique, equalization, rake receiver, OFDM etc.

OFDM is a multicarrier system in which the basic morality is to transform serial data stream into several parallel streams. These parallel streams are modulated on subcarriers. The input signal is broken into multiple smaller portions, which are transmitted independently in multicarrier systems. The advantage of multicarrier system is that if a portion of information is lost or damaged in transit, the receiver still gets the remaining information.

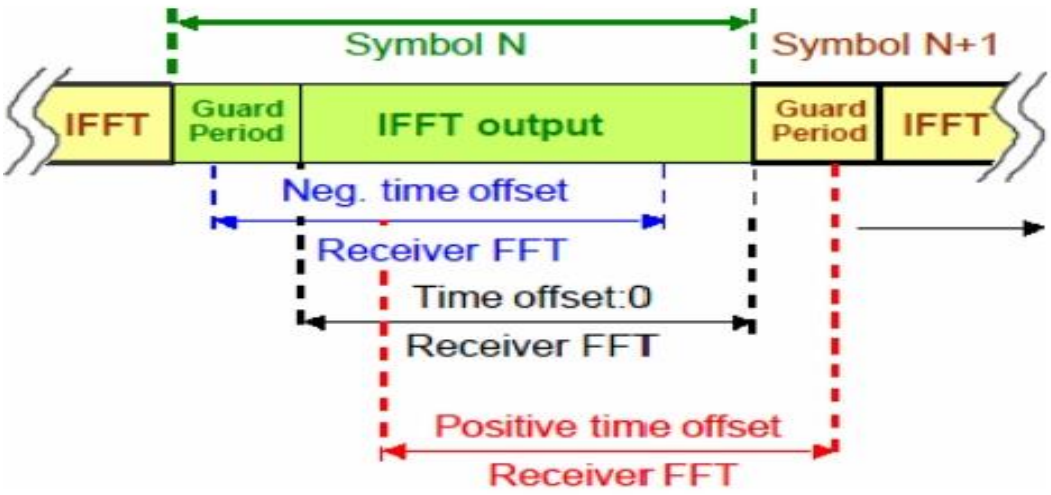
OFDM can transmit a high-rate data stream in parallel with a single subcarrier, which is modulated at low symbol rate within equivalent bandwidths using conservative digital modulation from multiple subcarriers within the same single channel. Digital modulation schemes are the way those are transmitted signal into frequency, phase, and amplitude. There are many digital modulation schemes for OFDM wireless communication such as: QAM, Quadrature Phase Shift Keying (QPSK), and BPSK.

APPLICATIONS:

- OFDM is used in cellular systems like 3GLTE and WiMAX
- Used in wireless local area networks (LAN’S)

- Under water communications and optical light communication
- Digital audio and video broadcasting
- High-definition television
- Broad band internet access
- 5G Communication
- Wireless metropolitan networks (WMAN)

CYCLIC PREFIX:



The cyclic prefix used in frequency division multiplexing schemes including OFDM to primarily act as a guard band between successive symbols to overcome inter symbol interference, ISI it act as a buffer region to protect the OFDM signal. The cyclic prefix repeats the end of the symbol so the linear convolution of the frequency selective multipath channel can be modelled as circular convolution, which intern may transform to the frequency domain via a discrete Fourier transform.

This approach accommodates simple frequency domain processing, such as channel estimation and equalization. To permanently Eliminate this ISI problems, the solution is to find the way where the lost part of the symbol could recover the one way to do this is by copying or duplicating an initial part of the symbol and inserting the end of it and it act as a cyclic prefix.

The addition of the cyclic prefix adds robustness to the OFDM signals. The data that is retransmitted can be used if required. As a cyclic prefix retransmits data that is already being transmitted, it takes up system capacity and reduced the overall data rate. The use of

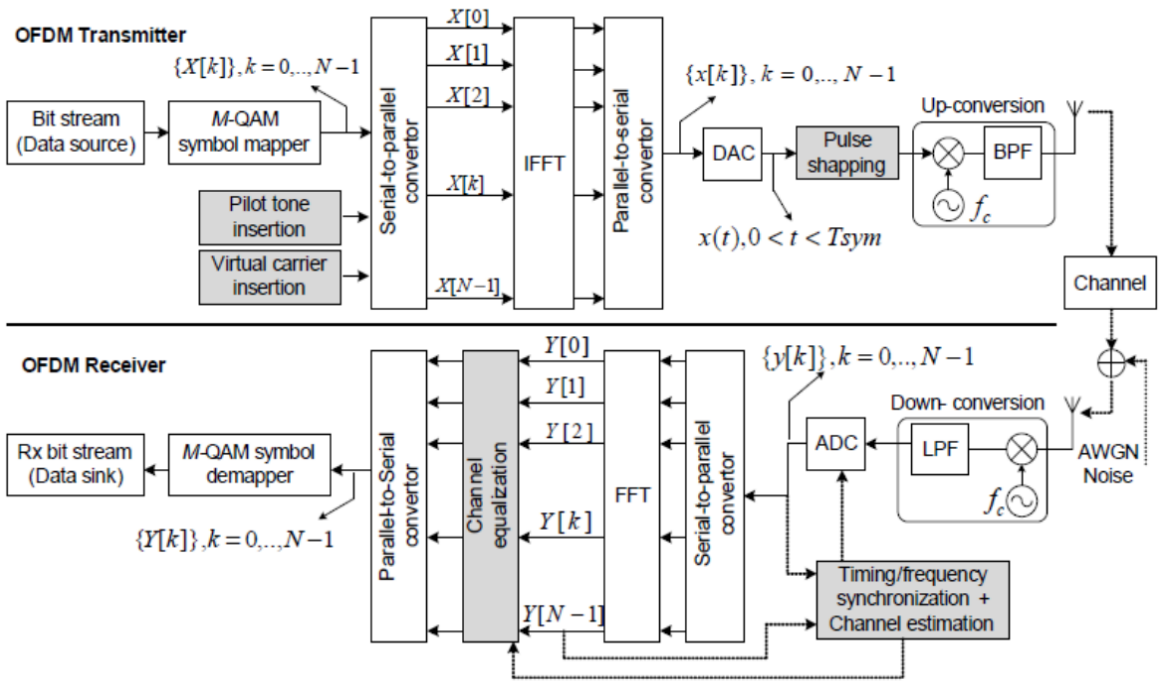
cyclic prefix is standard within OFDM and it enables the performance to be maintained even under conditions when levels of reflections and multipath propagation or high. The inter symbol interference can be minimized a lot the size of the symbol becomes larger that means the size of the delay spread becomes relatively minor.

OFDM SYSTEM:

At the transmitter, the incoming information bit stream (from the data source) is first converted into a stream of M-QAM information symbols at the M-QAM symbol mapper.

The parallel data is mapped from bits to symbols according to the selected modulation scheme (BPSK, QPSK,16 QAM, etc.)

{X[K]}, k=0, 1, …., N-1



In Serial- to- parallel converter, the input data are separated into subcarriers. The serial bit streams will be converted into many parallel subcarriers and then after that it will be transmitted into individual subcarriers. In Serial to parallel shifter the serial OFDM frame is rearranged into parallel block.

IFFT operation results in producing the {X [K]} symbol vector. We use IFFT for converting the data stream frequency domain to time domain for all subcarriers. Parallel-to-serial conversion is done in order to produce the discrete time domain OFDM symbol { x[k]}.

In parallel to serial shifter the parallel data is rearranged into a serial binary stream. In M-QAM de-mapper the frequency domain data is mapped from symbols in the IQ plane to bits. Then the continuous OFDM symbol x (t) ($0 < t \leq T$) is produced by the help of Digital-to-Analog convertor (DAC), where T is the OFDM symbol duration.

Finally, this pass band OFDM symbol is transmitted over the channel. This Additive white gaussian noise (AWGN) signal is transmitted to down converter which removes high frequency noise and interference from the signal path prior to the Analog to digital conversion to help avoid contaminated the signal with aliased noise. The digital signal obtained from Analog to digital converter (ADC) is passed to serial-to-parallel converter which is then separated into subcarriers. In parallel to serial shifter the parallel data is rearranged into a serial binary stream. We apply FFT to subcarriers which convert the data stream time domain to frequency domain for all subcarriers results in producing the (Y [K]) symbol vector. We evaluate the effect of fading channels on different digital modulation schemes like QPSK, BPSK and QAM etc.

Optical Communication

Bethina Sri Hasa

Optical communication systems date back to the 1790s, to the optical semaphore telegraph invented by French inventor Claude Chappe. In 1880, Alexander Graham Bell patented an optical telephone system, which he called the Photophone. During the 1920s, John Logie Baird in England and Clarence W. Hansell in the United States patented the idea of using arrays of hollow pipes or transparent rods to transmit images for television or facsimile systems. In 1954, Dutch scientist Abraham Van Heel and British scientist Harold H. Hopkins separately wrote papers on imaging bundles. Hopkins reported on imaging bundles of unclad fibres, whereas Van Heel reported on simple bundles of clad fibers. In 1961, Elias Snitzer of American Optical published a theoretical description of a fiber with a core so small it could carry light with only one waveguide mode. In the summer of 1970, one team of researchers began experimenting with fused silica, a material capable of extreme purity with a high melting point and a low refractive index By June of 1972, Robert Maurer, Donald Keck, and Peter Schultz invented multimode germanium-doped fiber with a loss of 4 dB per kilometer and much greater strength than titanium-doped fiber. By 1973, John MacChesney developed a modified chemical vapor-deposition process for fiber manufacture at Bell Labs. n April 1977, General Telephone and Electronics tested and deployed the world's first live telephone traffic through a fiber-optic system running at 6 Mbps, in Long Beach, California. Today more than 80 percent of the world's long-distance voice and data traffic is carried over optical-fiber cables.

What is optical communication?

Optical communication is any type of communication in which light is used to carry the signal to the remote end, instead of electrical current. Optical communication relies on optical fibers to carry signals to their destinations.

T**here are three main basic elements of a fiber optic communication system. They are**

Compact Light Source

Compact Light Source

Low loss Optical Fiber

Photo Detector

Types of optical fibres

Single-Mode Fibers: Single-mode fibers are used to transmit one signal per fiber; these fibers are used in telephone and television sets. Single-mode fibers have small cores.

Multi-Mode Fibers: Multimode fibers are used to transmit many signals per fiber; these signals are used in computer and local area networks that have larger cores.

A Fiber Optic Cable consists of four parts.

- Core
- Cladding
- Buffer
- Jacket

CHARECTERISTICS OF OPTICAL FIBRES

Bandwidth

The dispersion of single laser light is a good quantity of signal which can be transmitted for every second which results in high BW for long distances.

Smaller Diameter

•The Optical fiber cable diameter is approximately 300 micrometers.

•Less Weight

•The cable used in fiber optic communication is less weight as compared to the copper type cable.

•Signal Transmission for Long-distance

•As the laser light doesn't dissolve, then it is simply transmitted over lengthy distances.

•Less Attenuation

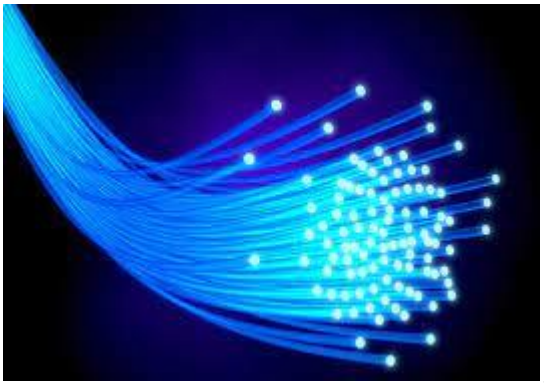
•The fiber optic cable is designed with glass & a laser light travels throughout it, then the signal loss while transmitting has simply 0.2 dB/km.

•Security of Transmission

•The data over optical fiber cable can be secured through optical encryption as well as no occurrence of the electromagnetic signal.

APPLICATIONS OF OPTICAL FIBRES

- Medical Industry
- Mechanical Inspections
- Communication
- Lighting and Decorations
- Defence
- Broadcasting

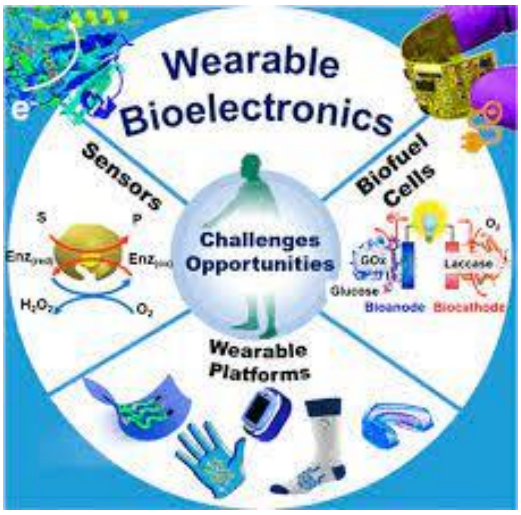


- Industries
- Defence/Government
- Data Storage
- Used for data transmission
- Telecommunications
- Networking
- Industrial/Commercial
- Broadcast/CATV

Bioelectronics

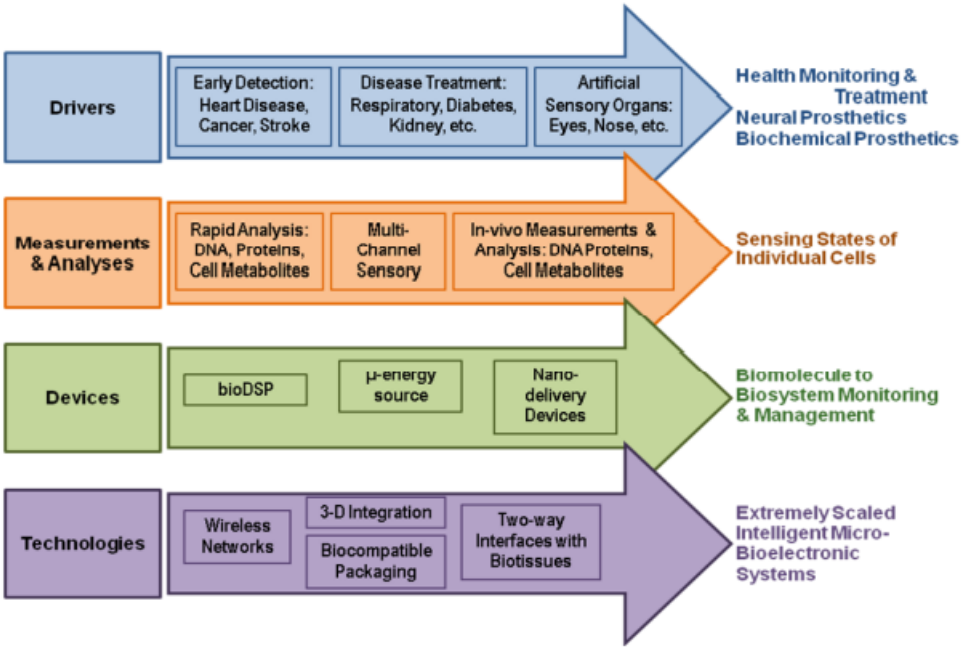
Molakalagiri Praneetha

Electronic devices have been revolutionizing biology and medicine over the past several generations. The development of the electrocardiograph (i.e., recording the electrical activity of the heart) approximately 100 years ago was one of the defining moments that helped establish the field of cardiology and is now an integral part of clinical practice. Today, defibrillators are implanted at a rate of 160,000 per year in the US alone to restore proper electrical activity to diseased hearts, once again changing the practice of medicine and creating a new market worth $5 billion per year. Electronic systems have also been critical to the development of the field of radiology, which has evolved from a single modality (X-ray) to include magnetic resonance imaging (MRI), computed tomography (CT), and positron emission tomography (PET), among others. MRI has made possible the imaging of soft tissue to help treat physical injuries. CT now allows 3D visualization of anatomical features, facilitating surgical planning. The medical imaging equipment market is expected to be worth $11.4 billion by 2012. In short, the application of electronics to medicine has transformed medical practice and will continue to do so. In this report, a number of emerging opportunities in bioelectronics are identified. Although, it is difficult to project the financial benefits at this early stage of research, the following figures for the costs of just a few diseases that could be impacted by bioelectronics provides a sense of the magnitude of potential markets and of the benefits to individuals and society in the healthcare sector alone. 1. In 2008, domestic health care spending reached $2.4 trillion, or 17 percent of the gross domestic product (GDP). This spending is projected to increase to $4.3 trillion in 2016.b 2.



In 2008, an estimated 1.4 million new cases of cancer were diagnosed and over 560,000 cancer deaths were reported in the United States. The National Institutes of Health (NIH) estimates these cases cost nearly $90 billion in direct medical expenses plus $130 billion more in lost productivity to the U.S. economy. 3. An estimated 22 million Americans suffer from heart disease and about 460,000 die from heart attacks each year (about 1 in 5 deaths). NIH estimates the direct cost of heart disease in the United States in 2008 to be $172.8 billion and the additional indirect cost due to lost productivity was $114.5 billion. 4. An estimated 7.2 million Americans are diagnosed with Type 2 diabetes and millions more are

undiagnosed. Diabetes leads to a range of debilitating complications, including blindness, nerve damage and amputation of toes or feet. The American Diabetes Association estimates that medical costs associated with diabetes were $116 billion in 2007, with an additional $58 billion in indirect costs. The study of biology also has been transformed by electronics. In the late 1940s and early 1950s, understanding the molecular basis of nerve and muscle function was achieved with the use of high impedance amplifiers. Those studies led to a new era of quantitative biology and practical clinical neuroscience. The patch clamp, which allowed researchers to measure the ionic current through single ion channels gave further insight into nerve action. These studies led directly to three Nobel Prizes and ultimately seven more. The electron microscope is also an example of applying electronics to biological problems. First demonstrated in the 1930s and developed over the next decade, the electron microscope allowed scientists to visualize the miniscule world of cells at an entirely new level of detail. Much of modern cell biology is built on information captured from these indispensible tools.

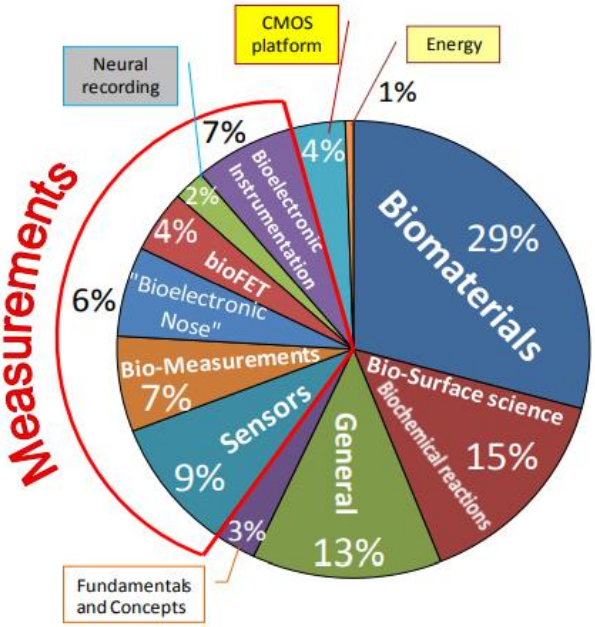


The figure above shows a framework for bioelectronics research, based on input from experts engaged for this study. This proposed framework is intended to catalyze further analyses and a comprehensive road-mapping exercise. The field of bioelectronics is poised for exponential growth. The Federal government's expertise in critical areas of science and technology, including sensors, nanoelectronics, and metrology should be harnessed and coordinated, along with expertise from academia and industry to firmly establish the United States as a leader in this high impact area of research and development.

A Taxonomy:

The first reference to bioelectronics, published in 1912, focused on measurement of electrical signals generated by the body, which is the basis of the electrocardiogram. In the 1960s two new trends in bioelectronics began to appear. One trend, enabled by the invention of the transistor, centered on the development of implantable electronic devices and systems to stimulate organs, e.g., the pacemaker. In the same time frame, fundamental studies were beginning to be reported on electron transfer in electrochemical reactions. Today, these three

areas of endeavour are converging to enable multi-signal recording and stimulation at the cell level, i.e., there is a kind of physical scaling law that is moving over time from the organ level toward cellular dimensions. At the same time, studies at the molecular level are leading to new understanding of cell performance. The analogy with nanoelectronics is striking; top-down scaling is being abetted by device design from the atomic level. Bioelectronics encompasses a range of topics at the interface of biology and electronics. One aspect of bioelectronics is the application of electronics to problems in biology, medicine, and security. This includes electronics for both detection and characterization of biological materials, such as on the cellular and subcellular level. Another aspect of bioelectronics is using biological systems in electronic applications (e.g., processing novel electronic components from DNA, nerves, or cells). Bioelectronics also focuses on physically interfacing electronic devices with biological systems (e.g., brain-machine, cell-electrode, or protein-electrode). Applications in this area include assistive technologies for individuals with brain-related disease or injury, such as paralysis, artificial retinas, and new technologies for protein structure-function measurements. The identified publications were organized into several topical areas, as shown in Figure 4. Examples of research papers in each of the topical areas are given below: Measurements (35%) – Works on sensors, monitoring systems and metrology. Several distinct categories were identified: Sensors (9%) - fabrication and properties of biosensors, biological, and chemical sensors Biochemical measurements (7%) - application of biosensors "Bio-electronic Nose" (6%) – Efforts focused on system integration for one targeted application Neural recording (2%) – Focus on microelectrode arrays and their interfaces with neurons BioFET (4%) – Field-Effect-Transistor-like devices for bio-sensing Bio-electronic Instrumentation (7%) – Practical (e.g. clinical) application of bio-electronic devices Biomaterials (29%) - Materials and fabrication techniques for bio-electronic devices, medical implants, 3D assembly, self-assembly, nano-particles, nano-tubes, nano-wires, etc.



Distribution of bioelectronics publications by topical area.

Bio-surface science/biochemical reactions (15%) - Research focused on the interaction between bio molecules and solid surfaces. Examples include bio-molecule immobilization, electron transfer in biochemical reactions and between bio-objects (bio-molecules or cells)

and the solid surface. The latter is often referred as “bio-electronic interface”. This definition is narrower than broader concept of bioelectronics interface as interaction between electronic devices and bio-objects. General (13%) -Articles including forewords, short abstracts, program descriptions, status reports, surveys, patent analyses, etc. CMOS/Semiconductor Platform (4%) – Electronic components of bio-electronic systems and integration issues. Topics include: Low-power implantable devices On-chip integration of sensors DSP for real-time processing of multi-parametric bio-electronic signals CMOS IC/microfluidics hybrid systems for cell manipulation and electrochemical analysis Micro-photodiodes arrays for retinal stimulation 3D chip integration and packaging Fundamentals and Concepts (3%) – Models, simulation, and new concepts related to bioelectronics. Energy Sources (1%) – Only three papers were identified and these focused on bio-fuel cells. The analysis of bioelectronics publications revealed a wide range of research programs spanning many related thrust areas. Although it is clear that micro- and nano-electronics is playing an important role in bioelectronics, via direct application of semiconductor industry products, an evident lack of semiconductor-related bio-electronic research is very visible. For example, only a small percentage of the surveyed work dealt with semiconductor platforms for biological applications. Moreover, the critical area of autonomous (e. g. implantable) energy sources doesn’t appear to have received much attention in the context of bioelectronics. There is an opportunity, therefore, for a concerted research effort directed toward the utilization of the semiconductor industry’s capabilities to provide bio-electronic specific tools and systems.

Different Indian Space Launch Vehicles

Bale Samuel Raj

Launch Vehicles are used to transport and put satellites or spacecrafts into space. In India, the launch vehicles development programme began in the early 1970s. The first experimental Satellite Launch Vehicle (SLV-3) was developed in 1980. An Augmented version of this, ASLV, was launched successfully in 1992. India has made tremendous strides in launch vehicle technology to achieve self-reliance in satellite launch vehicle programme with the operationalisation of Polar Satellite Launch Vehicle (PSLV) and Geosynchronous Satellite Launch Vehicle (GSLV).

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A. First Generation Launchers: These launchers are divided in two categories:

(i) Sounding rockets (ii) Operational sounding rockets

i. Sounding Rockets: Sounding rockets are usually one or two stage solid propellant rockets. They are primarily intended for probing the upper atmospheric regions using rocket-borne instrumentation. They also serve as platforms for testing prototypes of new components or subsystems intended for use in launch vehicles and satellites. The launch of the first sounding rocket US made 'Nike Apache' from Thumba near Thiruvananthapuram, Kerala on November 21, 1963, marked the beginning of the Indian Space Programme.

In 1965, ISRO started launching a series of our own sounding rockets named Rohini from TERLS. RH-75, with a diameter of 75mm was the first truly Indian sounding rocket, which was followed by RH-100 and RH-125 rockets. The sounding rocket programme was indeed the bedrock on which the edifice of launch vehicle technology was built. The experience gained was of immense value in the mastering of solid propellant technology and allied systems of the launch vehicles. Several scientific missions with national and international participation have been conducted using the Rohini sounding rockets.

ii. Operational Sounding Rockets:

(a) Satellite Launch Vehicle (SLV)

(b) Augmented Satellite Launch Vehicle (ASLV)

a. The Satellite Launch Vehicle (SLV): The Satellite Launch Vehicle (SLV) project was born out of the need for achieving indigenous satellite launch capability for communications, remote sensing and meteorology. SLV3, India's first experimental launch vehicle, was capable of placing 40 kg class payloads in Low Earth Orbit (LEO). It was an all solid, four stages, 22m tall vehicle, and weighing 17 ton.

The first experimental flight of SLV3, in August 1979, was only partially successful. The next launchon July 18, 1980 from Sriharikota Range (SHAR), successfully placed

Rohini satellite, RS-1, into the orbit, thereby making India the sixth member of an exclusive club of space-faring

The successful culmination of the SLV3 project paved the way to advanced launch vehicle projects such as the Augmented Satellite Launch Vehicle (ASLV), Polar Satellite Launch Vehicle (PSLV) and the Geosynchronous satellite Launch Vehicle (GSLV).

b. The Augmented Satellite Launch Vehicle (ASLV): Augmented Satellite Launch Vehicle (ASLV) was developed to act as a low cost intermediate vehicle to demonstrate and validate critical technologies. With a lift off weight of 40 tonnes, the 23.8 m tall ASLV was configured as a five stage, all-solid propellant vehicle, with a mission of orbiting 150 kg class satellites into 400 km circular orbits. The strap-on stage consisted of two identical 1m diameter solid propellant motors, Under the ASLV programme four developmental flights were conducted.

The first developmental flight took place on March 24, 1987 and the second on July 13, 1988. ASLV-D3 was successfully launched on May 20, 1992, when SROSS-C (106 kg) was put into an orbit of 255 x 430 km. ASLV-D4, launched on May 4, 1994, orbited SROSS-C2 weighing 106 kg. It had two payloads, Gamma Ray Burst (GRB) Experiment and Retarding Potentio Analyser (RPA) and functioned for seven years. ASLV provided valuable inputs for further development.

B. Operational Launchers:

Operational Launchers are further divided in two groups:

(i) Satellite Launch Vehicle (SLV)

(ii) Augmented Satellite Launch Vehicle (ASLV)

i. Polar Satellite Launch Vehicle: The Polar Satellite Launch Vehicle, usually known by its abbreviation PSLV is the first operational launch vehicle of ISRO. PSLV is capable of launching 1600 kg satellites in 620 km sun-synchronous polar orbit and 1050 kg satellite in geo-synchronous transfer orbit. In the standard configuration, it measures 44.4 m tall, with a lift off weight of 295 tonnes. PSLV has four stages using solid and liquid propulsion systems alternately. The first stage is one of the largest solid propellant boosters in the world and carries 139 tonnes of propellant. A cluster of six strap-ons attached to the first stage motor, four of which are ignited on the ground and two are air-lit.

The reliability rate of PSLV has been superb. With its variant configurations, PSLV has proved its multi-payload, multi-mission capability in a single launch and its geosynchronous launch capability. In the Chandrayaan-mission, another variant of PSLV with an extended version of strap-on motors, PSOM-XL, the payload haul was enhanced to 1750 kg in 620 km SSPO. PSLV has rightfully earned the status of workhorse launch vehicle of ISRO.

Vehicle Variants and Launch Capability PSLV-Generic

• No. of Solid Strap-ons : Six (9T)

• Payload capability to SSPO (600 km) : 1550 kg PSLV=Core Alone

• No. of Solid Strap-ons : NIL

• Payload capability to SSPO (600 km) : 1100 Kg PSLV XL

• No. of Solid Strap-ons : Six (12T)

• Payload capability o SSPO (600 Km) : 1700 kg

• Payload capability osub GTO (284 x 20650 km) 1425 Kg

Planned Launches

• PSLV-C29 / TeLEOS-1 mission in March 2016

• PSLV-C32 / IRNSS-1G mission in June 2016

• PSLV-C33 / CARTO-2C mission in September 2016

• PSLV-C35 / RESOURCESAT-2A mission in December 2016

ii. Geosynchronous Satellite Launch Vehicle (GSLV): Geosynchronous Satellite Launch Vehicle (GSLV) is capable of placing 2 ton class of satellites like the INSAT and GSAT series of communication satellites into Geosynchronous Transfer Orbit (GTO). GSLV is a 49 m tall, three stage vehicle with a lift-off mass of 416 ton. The first stage comprises of a S139 solid booster with four liquid strap-on motors, each weighing 40 ton. The second stage (GS2) is a liquid engine carrying 37.5 ton of liquid propellant. The third stage is the indigenously built Cryogenic Upper Stage (CUS) which uses typically 15 ton of cryogenic propellants (Liquid Hydrogen (LH2) as fuel and Liquid Oxygen (LOX) as Oxidiser).

C. Next Generation Launchers: The Geosynchronous Satellite Launch Vehicle Mark III (GSLV MkIII) also known as LVM3, is the next generation launcher being developed by ISRO for achieving self reliance in the launch of 4 ton class of communication satellites to

Geosynchronous Transfer Orbits (GTO). The launcher is designed to be a versatile launcher to launch payloads to other orbits as well and will have a payload capability in excess of 10 ton to Low Earth Orbits (LEO). Once GSLV-MkIII becomes operational, India would be able to dispense the procured launches for 4 ton class communication satellites.

Reconfigurable Antenna for Wireless Applications

Deekulla Myna

A reconfigurable antenna is an antenna capable of modifying its frequency and radiation properties dynamically, in a controlled and reversible manner. In order to provide a dynamic response, reconfigurable antennas integrate an inner mechanism (such as RF switches, varactors, mechanical actuators or tunable materials) that enable the intentional redistribution of the RF currents over the antenna surface and produce reversible modifications of its properties. Reconfigurable antennas differ from smart antennas because the reconfiguration mechanism lies inside the antenna, rather than in an external beam forming network. The reconfiguration capability of reconfigurable antennas is used to maximize the antenna performance in a changing scenario or to satisfy changing operating requirements.

Types of antenna reconfiguration

Reconfigurable antennas can be classified according to the antenna parameter that is dynamically adjusted, typically the frequency of operation, radiation pattern or polarization.

Frequency reconfiguration

Frequency reconfigurable antennas can adjust their frequency of operation dynamically. They are particularly useful in situations where several communications systems converge because the multiple antennas required can be replaced by a single reconfigurable antenna. Frequency reconfiguration is generally achieved by physical or electrical modifications to the antenna dimensions using RF-switches, impedance loading or tunable materials.

Radiation pattern reconfiguration

Radiation pattern reconfigurability is based on the intentional modification of the spherical distribution of the radiation pattern. Beam steering is the most extended application and consists of steering the direction of maximum radiation to maximize the antenna gain in a link with mobile devices. Pattern reconfigurable antennas are usually designed using movable/rotatable structures or switchable and reactively-loaded parasitic elements. In the last 10years, metamaterial-based reconfigurable antennas have gained attention due their small form factor, wide beam steering range and wireless applications. Plasma antennas have also been investigated as alternatives with tunable directivities.

Polarization reconfiguration

Polarization reconfigurable antennas are capable of switching between different polarization modes. The capability of switching between horizontal, vertical and circular polarizations can be used to reduce polarization mismatch losses in portable devices. Polarization reconfigurability can be provided by changing the balance between the different modes of a multimode structure.

Compound reconfiguration

Compound reconfiguration is the capability of simultaneously tuning several antenna parameters, for instance frequency and radiation pattern. The most common application of

compound reconfiguration is the combination of frequency agility and beam-scanning to provide improved spectral efficiencies. Compound reconfigurability is achieved by combining in the same structure
different single-parameter reconfiguration techniques or by reshaping dynamically a pixel surface

Recent Developments of Reconfigurable antennas for wireless communication systems

Reconfiguration techniques
There are different types of reconfiguration techniques for antennas. Mainly they are electrical (for example using RF-MEMS, PIN diodes, or varactors), optical, physical (mainly mechanical), and using materials. For the reconfiguration techniques using materials, the materials could be solid, liquid crystal, liquids (dielectric liquid or liquid metal).

Advantages

(i)low cost, low volume, simple integration, and good isolation between different wireless standards

(ii)low front-end processing that means no need for front-end filtering and good out-of-band rejection

(iii)best candidate for software-defined radios which can adapt to new surroundings

(iv)change functionality as per the mission changes, act as a single element or as an array, providing narrow band or wideband as per the requirements

Applications

1.Bio Medical Application

2.Satellite Application

3.Frequency Reconfigurable Antenna for a Cognitive Radio System

Plastic Solar Cell Technology

M. Leela Priyanka

Solar cells use freely available sunlight to make electricity. At the present time, solar electricity does not come cheap, because solar panels are rather expensive. Now imagine that we could reduce costs by printing solar panels like we print newspapers! We can do just that with plastic solar cells. There is a much friendlier source of energy: the sun! Best of all, it is free! The sun always shines and provides energy to the earth in the form of light, even on cloudy days. Solar panels convert this light into electricity, but solar panels are still pretty expensive. If solar panels were less expensive, we could use the sun to its full potential and have very cheap electricity!

NANO TECHNOLOGY & SCREEN-PRINTING TECHNIQUE:

The proposed novel plastic solar cell is manufactured basically from nano technology as mentioned above and then compacted using screen printing technique. The nano cells that are in the form of nano rods are procured first, after which they start to harness energy through their active layers. For efficient energy conversion, it is required that all individual solar cells are wired together. To achieve this all the solar cells are required to be on the same substrate, which can be achieved only through screen printing technique.

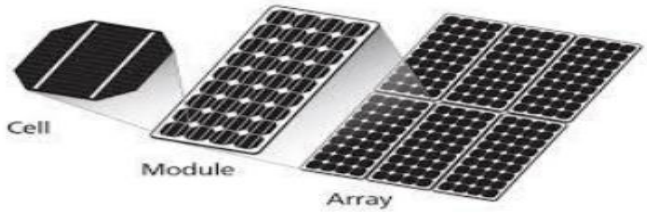


Fig 2. A Solar Cell, Solar Panel & Solar Array

Thus, screen printing here is employed to fabricate a polymer layer with <100mm, so that it effectively serves as a whole transport layer. This effectively increases the efficiency by around 4.3% in comparison to commercial silicon solar cells. The figure illustrated below show the production of nano rods involving nano technology for plastic solar cells. The stand-out feature of the utilizing polymer plastics is that it allows the involvement of the above said technologies to fabricate solar cells at room temperature itself. This comforts the manufacturer as no special environment is required to be set-up for plastic solar cells manufacture.

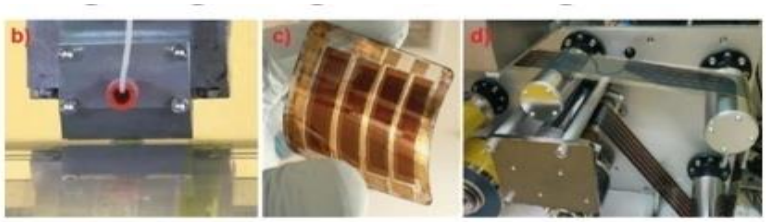


Fig 8. Screen Printing of Plastic Solar Cells

WORKING:

Plastic solar cells consist of a plastic layer on glass or a flexible foil. In the lab, we use glass plates with an obvious electric-powered contact [the positive (+) pole]. At the pinnacle of this contact, we positioned the ink for the energetic layer, which's the part of the sun molecular that converts daylight to electricity. This ink carries polymers, a protracted inexperienced one and a shorter pink one [5]. The polymers shape a combined layer, as shown in picture. On pinnacle of that layer, we positioned a steel layer, which capabilities because the negative (−) pole. We then flip the complete stack of layers the other way up such that daylight can shine via the glass into the energetic layer. Fig - Diagram of a plastic solar cell. The drawn shape of red and green polymers in Figure 1 is precisely what we want! There is a lot of interface, or area of contact, between the two polymers. This is necessary because sunlight creates electrical charges only at the areas where the two polymers are in contact. When the mild is absorbed (the yellow star), high-quality (+) and poor (−) electric costs are generated. Normally, the + and − entice every different and the power is lost. In plastic solar cells, the pink and inexperienced polymers make certain the costs may be separated.

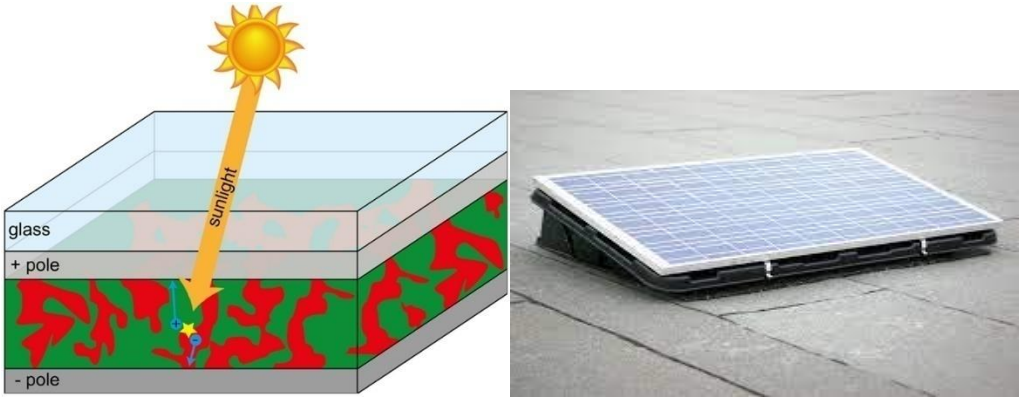


Diagram of a plastic solar cell.

ADVANTAGES:

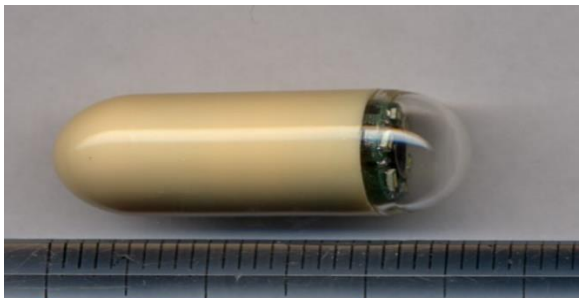
- This innovative and exciting advancement in solar technology opens the possibility of charging portable electronic gadgets (such as smartphones, laptops, and mp3 players).
- Manufacturers might accomplish this by using an organic solar cell that produces a current strong enough to rapidly charge a lithium battery without requiring the connection of several separate cells.
- Some elements of these high voltage cells perform better in various lighting conditions, even those in low levels of sunlight. The latter is the ideal setting for general electronic devices.
- Currently, this technology is only in the testing phase, but the success rates have been high, and the process looks very promising.
- The next step is making the technology available outside the lab and having cheap OPV chargers available for commercial purchase.

Pill Cam

Pasam Priyanka

Capsule endoscopy is a medical procedure used to record internal images of the gastrointestinal tract for use in disease diagnosis. Newer developments are also able to take biopsies and release medication at specific locations of the entire gastrointestinal tract. Unlike the more widely used endoscope, capsule endoscopy provides the ability to see the middle portion of the small intestine. It can be applied to the detection of various gastrointestinal cancers, digestive diseases, ulcers, unexplained bleedings, and general abdominal pains. After a patient swallows the capsule, it passes along the gastrointestinal tract, taking a number of images per second which are transmitted wirelessly to an array of receivers connected to a portable recording device carried by the patient. General advantages of capsule endoscopy over standard endoscopy include the minimally invasive procedure setup, ability to visualize more of the gastrointestinal tract, and lower cost of the procedure

Image of the colon acquired by capsule endoscopy



Pictures of a capsule

Technology:

Capsule endoscopy uses a small vitamin-sized wireless camera to capture images of a patient's digestive tract. The capsule is generally composed of a camera, antenna, and light array. Due to the small nature of the device, images cannot be stored within it. As a result, a sensor array with a storage unit is placed on the abdomen of the patient for the imaging period. This storage unit can then be connected to a computer at a later time so that a medical professional can analyze the images. Newer models of the capsule endoscope have looked to add camera systems on both ends of the pill or even store images within the pill itself to minimize the amount of medical equipment one must carry with them while using the device. For systems that store images directly within the pill, the pill must be collected after excretion for extraction of the images by a secondary device. The main shortcoming of capsule endoscopy is the field of view. Depending on the placement of the camera system within the device images may become obstructed by folds in the digestive tract. Due to the passive nature of image capture and lack of control in manoeuvring the device through the digestive tract novel solutions are being developed by various companies and research labs. For systems that utilize the setup with the camera system at the end of the capsule, the field of view ranges from 140 to 170 degrees. There are several advantages to choosing to use capsule endoscopy over standard endoscopy. Standard endoscopy can be more uncomfortable for a patient, can be more prone to puncturing the digestive tract walls, and is not able to

access the middle portion of the small intestine. Endoscopes must enter either through the mouth/nasal cavities or the rectum. Due to restrictions in length, extremely important regions for diagnosis in the small intestine are not able to be accessed. Currently, within the United States, capsule endoscopy cannot be used as a primary imaging method over standard endoscopy first. As a result, many patients must first undergo standard endoscopy to then be referred for capsule endoscopy. Further innovation will be required to make capsule endoscopy comparable to the current standard of care, but extensive work is being performed to achieve this.

Procedure:

Capsule endoscopy requires a number of different preparatory procedures to ensure clear images are taken of a patient's gastrointestinal tract for an accurate diagnosis of disease. There are various types of capsule endoscopes, but for a generalized description, one can assume the most common setup requires the capsule, sensor array, storage unit, and computer system being used. First, a patient will need to have the sensor array placed on their abdomen with a recording unit worn as a belt. The patient may be asked to stay at the hospital or return home depending on the start time. Next, the pill must be swallowed by the patient. After approximately 8 hours the sensor array can be removed and returned to a physician. The capsule will be excreted through regular bowel movements. During the procedure, there are a number of different policies to follow. A patient should only drink clear liquids for the first two hours after swallowing the pill and may eat after 4 hours. MRI studies, ham radios, metal detectors, and strenuous physical activity should all be avoided. Additionally, all external equipment must be kept dry.

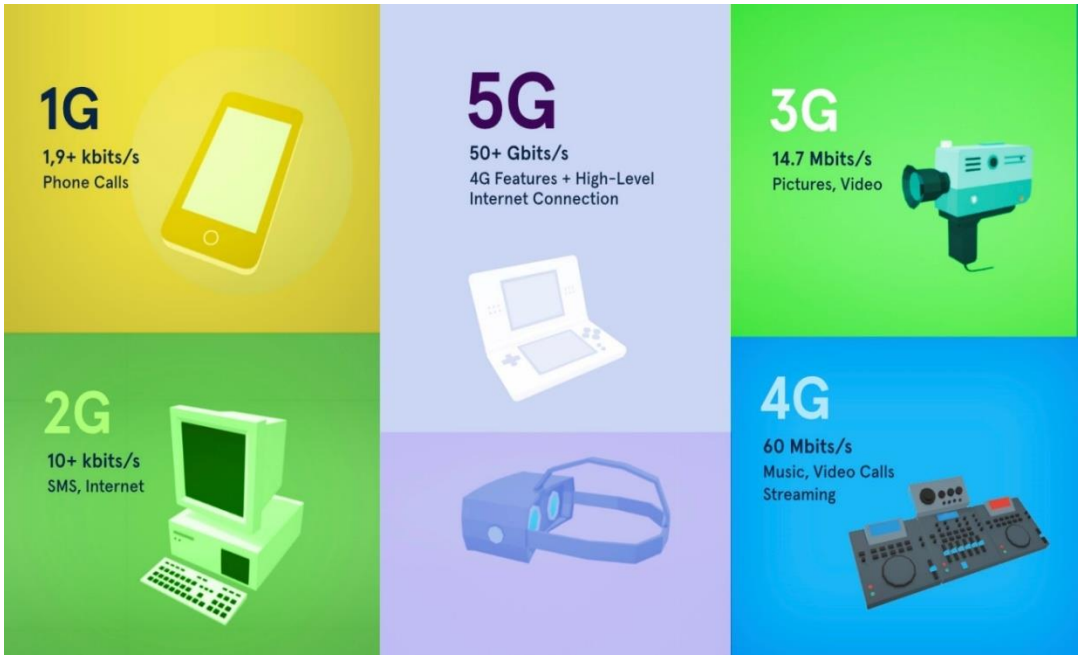
Medical Uses:

EGD, employs a camera attached to a long flexible tube to view the upper portion of the gastrointestinal tract, namely the esophagus, the stomach, and the beginning of the first part of the small intestine called the duodenum. A colonoscope, inserted through the rectum, can view the colon and the distal portion of the small intestine, the terminal ileum. These two types of endoscopy however cannot visualize the majority of the middle portion of the small intestine.Capsule endoscopy is therefore used to examine parts of the gastrointestinal tract that cannot be seen by standard endoscopy. It is useful when the disease is suspected in the small intestine, and can sometimes be used to find the site of gastrointestinal bleeding or the cause of unexplained abdominal pain, such as Crohn’s disease. However, unlike EGD or colonoscopy, it cannot be used to treat pathology that may be discovered. Common reasons for using capsule endoscopy include diagnosis of unexplained bleeding, iron deficiency, or abdominal pain, searching for polyps, ulcers, and tumours of the small intestine, and diagnosis of inflammatory bowl disease. The images collected by the miniature camera during a session are transferred wirelessly to an external receiver worn by the patient, using any one of a band of appropriate frequencies. The collected images are then transferred to a computer for display, review, and diagnosis. A transmitted radio-frequency signal emitted by some capsules can be used to accurately estimate the location of the capsule and to track it in real-time inside the body and gastrointestinal tract. Capsule endoscopy can still not yet replace standard endoscopy for various diseases, as is the case for those with cirrhosis. As of 2014, research was targeting additional sensing mechanisms and localization and motion control systems to enable new applications for the technology, for example, drug delivery.

5G Wireless Technologies

Vuyyala Sri Lakshmi

The introduction of 5G Wireless technology has been major breakthrough in communication. 5G technology has changed the means to use cell phones with very high bandwidth. Users never experienced ever before such a high-value technology.5G is a new global wireless standard after 1G, 2G, 3G, and 4G networks. It enables a new kind of network that is designed to connect virtually everyone and everything together including machines, objects, and devices. 5G can be considered as a turn of the 20th century proposed telecommunications and electrical power delivery system. From 1G to 5G the world of telecommunication is totally changed and now the aim of such industries is to furnish the best of the best services to the customers. The technical people worked very hard to furnish a smooth, undisturbed network and at last, they released 5G technology which aims for such wireless telecommunication network. This 5G network offers data bandwidth of greater than 1Gbps, furnishes CDMA multiplex and has the internet as the core network. Well, the 5G is not completely released but there are few countries that are using the 5G technology. The 5G core uses a cloud-aligned service-based architecture (SBA) to support authentication, security, session management and aggregation of traffic from connected devices, all of which requires the complex interconnection of network functions.



FEATURES OF 5G:

- High resolution for crazy cell phone users.
- Bi-directional large BW.
- Less traffic.
- 25 Mbps connectivity speed.
- Enhanced & available connectivity just about the world
- Uploading & Downloading speed of 5G touching the peak (up to 1 Gbps).
- Better & fast solution.

TYPES OF 5G NETWORK:

- Low Band 5G. Low band spectrum 5G is best understood as a blanket layer for nationwide coverage.
- Mid Band 5G. About six times faster than 4G LTE, mid band 5G is likely to be more available in major metropolitan areas of the United States.
- mmWave High Band 5G.

Virtual Reality

Virtual Reality (VR) is simulated experience that can be similar to or completely different from the real world. Currently standard VR systems use either VR headsets or multi projected environments to generate realistic Images, sounds and other sensations that simulate a user's physical presence in a virtual environment. Applications of VR can include entertainment and educational purpose. A person using VR equipment is able to look around the artificial world, move around in it, and interact with virtual features or items. Other, distinct types of VR style technology include augmented reality and mixed reality. The term "virtual" has been used in the computer sense of "not physically existing but made to appear by software".

Software used in VR:

Virtual Reality Modeling Language (VRML), first introduced in 1994, was introduced for the development of "Virtual World" without dependency on headsets. Web-VR is an experimental Java script Application Programming Interface (API) that provides support for various VR devices, such as the HTC Vive, Oculus Rift, Google Cardboard or OSVR, in a web browser.

Hardware used in VR:

Modern VR headset displays are based on technology developed for smart phones including: gyroscopes and motion sensors for tracking head, hand and body position; screens for stereoscopic displays and small, lightweight and fast computer processor.

Methods of VR:

- Simulation-based VR: Driving Simulator is an example for this type. It gives a driver onboard experience of actual driving of an actual driver by predicting vehicle motion caused by driver input and feeding back corresponding visual, motion and audio cues to the driver.·
- Projector-based VR: in projector-based VR, modelling of the real environment places a vital role in various VR applications, such as robot navigation, construction modelling and airplane simulation.

- Head-mounted display (HMD): A HMD more fully immerses the user in a virtual world. A VR headset ideally includes two small high resolution OLED or LCD monitors which provide separate images for each eye for stereoscopic graphics rendering a 3D virtual world, a binaural audio system, rational and positional real time head tracking for six degrees of movements.
- Avatar-image based VR (AIBVR): With AIBVR, people can join the virtual environment in the form of real video as well as an avatar. One can participate in 3D distributed virtual environment as form as either a conventional avatar or a real video.
- Desktop-base VR: Desktop-based VR involves displaying a 3D virtual world on a regular desktop display without use of any specialized positional tracking equipment.

Types of VR:

Augmented Reality (AR): AR is a type of VR technology that blends what the user sees in their real surrounding with digital contents generated by computer software. The additional software generated images with the virtual sense typically enhance how the real surrounding looks in some way. AR systems layer virtual information over a camera live feed into headsets or smart glasses or through a mobile device giving the user the ability to view 3D images. Mixed Reality (MR): MR is a merging of the real world and virtual world to produce new environments and visualisations where physical and digital objects co-exist and interact in real time.

Applications of VR:

VR is most commonly used in entertainment applications such as video games and 3D cinemas. Consumer VR headsets were first released by video game companies in the early-mid 1990. 3D cinemas have been used for sporting events, fine art, music videos and short films. In social science and psychology, virtual reality offers a cost effective tool to study and replicate interactions in controlled environment.

Autonomous Unmanned Aerial Vehicle for Emergency Blood Delivery

Increase in population has given rise to many problems, one such problem is lack of availability of blood in an emergency to the victim. It is a merely impossible to deliver blood on time due to heavy conjunction in traffic, lack of storage facilities and bad roads. There are only 2903 blood banks across India. The count of blood banks is less than 3 for 10,00,000 people. So there is a need for faster delivery methods of blood. The usage of autonomous drones for this purpose is very efficient. The term Autonomous flight is used when pilots command is not used to fly an aircraft. Usually this mode is helpful for long flights. Autonomous flights can be achieved by having a flight controller like Pixhawk, APM on board along with these listed components given below.

Hybrid VTOL UAV: Hybrid UAVs combine vertical take-off and landing capability with the forward propulsion of a fixed wing UAV. In many hybrid VTOL UAVs, motors are incorporated into the aircraft's wings, which then transition for forward flight. These UAVs can be easily operated in cities as they do not require any runway for take-off and landing.

Mission planner: Mission Planner is a ground control station and calibration software for Plane, Copter and Rover. Using mission planner we can give the way points to the aircraft and also monitor the status of aircraft using this ground station.

Pixhawk 2.1: The Pixhawk 2.1 is a flexible autopilot intended primarily for manufacturers of commercial systems. It has 32 bit ARM cortex M4 processor with 14 PWM / Servo outputs and UART, I2C, CAN interface.

GPS: The Global Positioning System (GPS) is a network of about 30 satellites orbiting the Earth at an altitude of 20,000 km. The GPS module connects to the nearby satellites. Precision of the GPS increases with the number of satellites connected. And a minimum of 5 satellites has to be connected for an autonomous flight.

Telemetry: Telemetry is a device that gives all the information about the orientation and any errors in the controller. It is a must for any autonomous flight. We can track the position of the aircraft by using a telemetry system. A telemetry module is connected to both the ground station and the aircraft and both the modules can act as transmitter and receiver at the same time.

Fabricating an UAV with these components can be used to comfortably deliver up to 1 litre of blood package and travel a distance of 50km in less than 30 minutes and can become a life saver for a person in emergency.

Autonomous unmanned aerial vehicles (UAVs) are proliferating in both commercial and military markets. Blood makes for an interesting UAV delivery case study because blood products (whole blood, red blood cells, and platelets) have a finite shelf life and unique constraints regarding how they must be transported and stored. The medical community's blood supply chain can potentially benefit from a pairing with a delivery platform that allows for on-demand capability and greater flexibility.

Graphene - The Future

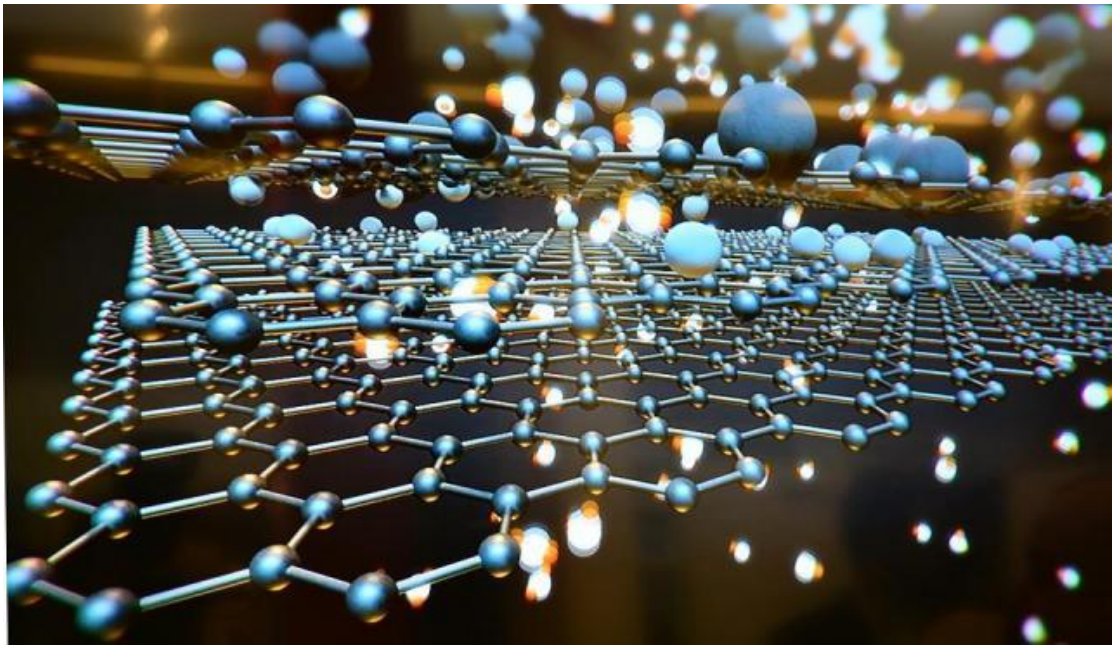
Uniqueness of Graphene

With the rapid advancement in the field of electronics, size, speed and flexibility have become the most important aspects. With the existing technology, we have to compromise with any one of these aspects. The only way to not compromise with these three aspects is by using graphene. Graphene is an allotrope of carbon in the form of a single layer of atom in 2-Dimensional Hexagonal lattice in which one atom forms each vertex. Graphene is so small that it is considered the world's first 2-D crystal. It was discovered by Russian born scientists Andre Geim and Kostya Novoselov in 2004 and they won the Nobel Prize for their discovery in 2010. Graphene has very high conduction capability because of its electron mobility. The mobility of electrons is 100 times faster than silicon and its heat conduction is also two times better than diamond. Graphene possesses electrical conductivity about 13 times better than copper. Graphene is harder than diamond and also more elastic than rubber. It is one of the strongest known materials if not the strongest material and also it is tougher than steel and yet lighter than aluminium.

Graphene Model

Graphene has the potential to create the electronics materials which are now considered as science fiction. Graphene might find its place in almost all engineering fields. Because of its conductivity it can be used as superconducting material, solar cells, transparent conducting electrode. In biomedical application graphene can be used for improved drug delivery and it can also be used in cancer treatment. It can be used in flexible displays, efficient solar panels, bulletproof vest as it can absorb twice as much impact as Kevlar which is normally used in

bullet proof vests. Coming to aerospace industry, graphene can be used in space propulsion due to its lightweight and strong interaction with light. One day it might find its place in supercomputer. The only problem with graphene is that, it is not easy to produce in large quantities at a decent quality and it costs about 100 dollars to 200 dollars per gram. All these things can be possible only if we can produce it in bulk or is it all just hype for the material.



Graphene has a unique molecular composition which could make it one of the smallest and most useful filters! **Researchers are hoping to develop a way of using graphene to filter sea water into drinking water**. This could potentially provide drinking water to millions around the world and even save lives.

Smart Pot

How Smart Pot Works?

Smart Pot is the one of the methods to grow a plant effectively. Each and every thing related to grow a plant that is temperature, moisture, sunlight everything is monitored by Smart Pot. So, it will inform the owner about his/her plant. And also, Smart Pot saves water by turning off the water supply when plant is having enough amount of water. Two main effective things in this project is, it is concerned to save water and plant, which are very precious things on the earth. This project is modern way of growing plant. Because it includes technology like IoT and electronics things to monitor plants status. So, this is best way of growing plant effectively. It is our duty to protect the plant. If we allow to destroy our natural resources like this then it will be dangerous for all human beings. Because without oxygen we can't even imagine our life. Trees and plants are the source of oxygen. So, we have to think about saving greenery on the earth. Our innovation should not be harmful towards natural resources.

Features:

- The smart pot which will nourishes the plant itself without human effort.
- The components which are used to make this smart pot are esp8266, Oled, DTH11 sensor, Soil moisture sensor, servo motor.
- Soil moisture sensor gives the amount of water content in the soil and displays the reading on OLED.
- If water supplied is less, then servo motor runs and supplies the water.
- DHT11 sensor senses the humidity & temperature around the plant & displays that on dashboard.
- LDR measures the amount of sunlight fallen on the plant and displays that on dashboard

The Smart Pot **aerates the soil**. That means there is airflow through the container walls and your potting mix. This results in cooler temperatures that don't damage your roots.

“Take care of the plants, they will take care of you”

High-K Dielectric Materials

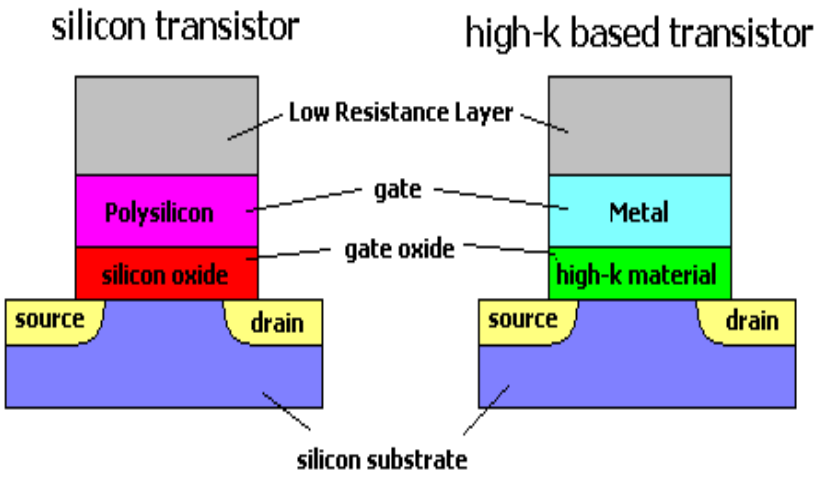
The microelectronics revolution of the past six decades has been intimately connected with advances in computer aided design, material science and fabrication technology. Over the years, complexity has increased from single transistor to integrated circuits, to large scale integration to very large scale integration where entire subsystems are placed on a single chip. Moore's law is the empirical observation that component density and performance of integrated circuits doubles every year, which was later revised to doubling every two years. Guided by the scaling rules set by Dennard in 1974, smart optimization, timely introduction of new processing techniques, device structures and materials, Moore's law has continued unabated for the last 40 years and is likely to continue in the future. The present MOSFET based VLSI technology is working on the principle of small dimensions with high integration".

Table of High-K Dielectric Materials

High-K Material	*K-value*	*Gap (eV)*
Si	3.9	1.1
SiO2	3.9	9
Si3N4	7	5.3
Al2O3	9	8.8
Ta2O5	22	4.4
TiO2	80	3.5
ZrO2	25	5.8
HfO2	25	5.8

In recent years, the ever increasing demand for higher speed, low power dissipation and more function on a chip, has led to relentless scaling of MOSFETs from sub microns to nanometre regime. For this historical trend to continue existing materials and technologies are approaching their physical limits and several technological challenges need to be overcome. In addition to the critical dimension control, oxide thickness, shallow junction formation, isolation and interconnect technologies need immediate attention. When the channel length is of the same order of magnitude as the depletion layer widths of the drain and the source, a MOSFET is said to be short. This reduction in channel length has resulted in different physical effects such as enhanced leakage current, drain induced barrier lowering (DIBL), short channel effects, sub threshold conduction and so on. The thickness of silicon dioxide (SiO2) gate dielectric is reduced as transistors are scaled down, in order to increase the drive current, reduce threshold voltage and increase device performance.

Comparison of Silicon Transistor and High-K Based Transistor



Due to thinning of the standard SiO2 gate dielectric, tunneling induced leakage current and dielectric breakdown will lead to unacceptable device performance resulting in increased power dissipation thus leading to its replacement. High-k dielectric materials could be a solution to overcome the scaling limit of SiO2.

The term high-κ dielectric refers to **a material with a high dielectric constant (κ, kappa), as compared to silicon dioxide**. High-κ dielectrics are used in semiconductor manufacturing processes where they are usually used to replace a silicon dioxide gate dielectric or another dielectric layer of a device.

Radar Systems and Its Applications

RADAR is an Acronym: Radio Detection and Ranging

Radar is an Electromagnetic system for the detection and location of reflecting objects such as Aircrafts, Ships, Space crafts, Vehicles, People, and the natural Environment. It operates by radiating energy into space and detecting the echo signal reflected from an object target. The reflected energy that is returned to the radar not only indicates the presence of a target, but by comparing the received echo signal with the signal that was transmitted, its location can be determined along with other target related information. Radar can perform its function at long or short distances and under conditions impervious to optical and infra red sensors. It can operate in darkness, haze, fog, rain and snow. Its ability to measure distance with high accuracy and in all weather is one of its most important attributes. Conventional radars generally operate in what is called the micro wave region: operational radars works in frequencies ranging from about 100 MHz to 36 GHz, which covers more than eight octaves.

Applications of Radar: Radar has been employed to detect targets on the ground, on the sea, in the air, in the space, and even below ground. The major areas of Radar application are briefly described below.

Military:- Radar is an important part of air-defense systems as well as the operation of offensive missiles and other weapons. In air defense it performs the functions of surveillance and weapon control. Surveillance includes target detection, target recognition, target tracking, and designation to a weapon system. Weapon-control radars track targets, direct the weapon to an intercept, and assess the effectiveness of the engagement. A missile system might employ radar methods for guidance and fusing of the weapon. High- resolution imaging radars, such as synthetic aperture radar, have been used for reconnaissance purposes and for detecting fixed and moving targets on the battlefield. Many of the civilian applications of radar are also used by the military. The military has been the major user of radar and the major means by which new radar technology has been developed.

Remote Sensing:- All radars are remote sensors; however, this term is used to imply the sensing of the environment. Four important examples of radar remote sensing are (1) Weather observation, which is a regular part of TV weather reporting as well as a major input to national weather prediction; (2) Planetary observation, such as the mapping of Venus beneath its visually opaque clouds; (3) short-range below ground probing; and (4) mapping of sea ice to route shipping in an efficient manner.

Air Traffic Control (ATC):- radars have been employed around the world to safety control air traffic in the vicinity of airports (Air Surveillance Radar, or ASR), and en route from one airport to another as well as ground vehicular traffic and taxiing aircraft on the ground. The ASR also maps regions of rain so that aircraft can be directed around them. There are also radars specifically dedicated to observing weather in the vicinity of airports, which are called Terminal Doppler Weather Radar, or TDWR.

Law Enforcement and Highway Safety:- The radar speed meter, familiar to many, is used by police for enforcing speed limits. It is also employed detection of intruders.

Air Safety and Navigation:- The Airborne weather avoidance radar outlines regions of precipitation and dangerous wind shear to allow the pilot to avoid hazardous conditions.

Low-flying military aircraft rely on terrain avoidance and terrain following radars to avoid colliding with obstructions or high terrain. Military aircraft employ ground mapping radars to image a scene. The radar altimeter is also radar used to indicate the height of an aircraft above the terrain and as part of self-constrained guidance system over land.

Ship Safety:-Radar is found on ships and boats for collision avoidance and to observe navigation buoys, especially when the visibility is poor. Similar shore-based radars are used for surveillance of harbors and river traffic.

Space:- Space vehicles have used radar for rendezvous and docking, and for landing on the moon. As mentioned, they have been employed planetary exploration, especially the planet earth. Large ground-based radars are used for the detection and tracking of satellites and other space objects. The field of radar astronomy using earth- based systems helped in understanding the nature of meteors, establishing an accurate measurement of the Astronomical Unit (the basic yard stick for measuring distances in the solar system), and observing the moon and nearby planets before adequate space vehicles were available to explore them at close distances. Other Applications:- radar has also found applications in industry for the noncontact measurement of speed and distance. It has been used for oil exploration. Entomologists and ornithologists have applied radar to study the movement of insects and birds, which cannot be easily achieved by other means. Some radar systems are small enough to be held in ones hand. Others are so large that they could occupy several football fields. They have been used at ranges close enough to almost touch the target and at ranges that reach to the planets.

Autonomous Cars

Autonomous cars use a variety of techniques to detect their surroundings, such as radar, laser light, GPS, and computer vision. Advanced control systems interpret sensory information to identify appropriate navigation paths, as well as obstacles and relevant signage. Autonomous cars have control systems that are capable of analysing sensory data to distinguish between different cars on the road, which is very useful in planning a path to the desired destination. Some demonstrative systems, precursory to autonomous cars, date back to the 1920s and 1930s. The first self-sufficient (and therefore, truly autonomous) cars appeared in the 1980s, with Carnegie Mellon University and ALV projects in 1984 and Mercedes Benz and Bundeswehr University Munich's Eureka Prometheus Project in 1987. A major milestone was achieved in 1995, with CMU's Nav Lab 5 completing the first autonomous coast-to-coast drive of the United States. Of the 2,849 miles between Pittsburgh, PA and San Diego, CA, 2,797 miles were autonomous (98.2%), completed with an average speed of 63.8 miles per hour (102.3 km/h). Since then, numerous major companies and research organizations have developed working prototype autonomous vehicles.

Working Model:

Among the potential benefits of autonomous cars is a significant reduction in traffic collisions the resulting injuries; and related costs, including a lower need for insurance. Autonomous cars are also predicted to offer major increases in traffic flow; enhanced mobility for children, the elderly' disabled and poor people; the relief of travellers from driving and navigation chores; lower fuel consumption; significantly reduced needs for parking space in cities; a reduction in crime and the facilitation of different business models for mobility as a service, especially those involved in the sharing economy.

Uniqueness of Autonomous Car

An autonomous car is a vehicle capable of sensing its environment and operating without human involvement. A human passenger is not required to take control of the vehicle at any time, nor is a human passenger required to be present in the vehicle at all. An autonomous car can go anywhere a traditional car goes and do everything that an experienced human driver does.

The Society of Automotive Engineers (SAE) currently defines 6 levels of driving automation ranging from Level 0 (fully manual) to Level 5 (fully autonomous). These levels have been adopted by the U.S. Department of Transportation.

The Hyper loop

Hyper loop is a proposed mode of passenger and freight transportation that would propel a pod-like vehicle through a reduced-pressure tube at more than airline speed. The alpha version of the proposal, published on the Space-X website, describes design claims of the system, as well as its function. The pods would accelerate to cruising speed gradually using a linear electric motor and glide above their track using passive magnetic levitation or air bearings. The tubes could also go above ground on columns or underground, eliminating the dangers of grade crossings. It is hoped that the system will be highly energy-efficient, quiet and autonomous.

The concept of high-speed travel in tubes has been around for decades, but there has been a resurgence in interest in pneumatic tube transportation systems since the concept was reintroduced, using updated technologies, by Elon Musk after 2012,incorporating reduced-pressure tubes in which pressurized capsules ride on an air cushion driven by linear induction motors and air compressors.

The Hyper loop concept has been explicitly open-sourced by Musk and Space-X, and others have been encouraged to take the ideas and further develop them.

To that end, a few companies have been formed, and several interdisciplinary student-led teams are working to advance the technology. Space-X is building an approximately 1-mile-long (1.6 km) subscale track for its pod design competition at its headquarters in Hawthorne, California.

Some experts are sceptical, saying that the proposals ignore the expenses and risks of developing the technology and that the idea is "completely impractical‖. Claims have also been made that the hyper loop is too susceptible to disruption from a power outage or being completely destroyed by a simple terror attack to be considered safe.

What makes Hyper loop different?

There are two big differences between Hyper loop and traditional rail. Firstly, the pods carrying passengers travel through tubes or tunnels from which most of the air has been removed to reduce friction. This should allow the pods to travel at up to 750 miles per hour. Secondly, rather than using wheels like a train or car, the pods are designed to float on air skis, using the same basic idea as an air hockey table, or use magnetic levitation to reduce friction.

What are the benefits of Hyperloop?

Supporters argue that Hyperloop could be cheaper and faster than train or car travel, and cheaper and less polluting than air travel. They claim that it's also quicker and cheaper to build than traditional high-speed rail. Hyperloop could therefore be used to take the pressure off gridlocked roads, making travel between cities easier, and potentially unlocking major economic benefits as a result.

When are the first Hyperloops going to be available?

A number of different companies are working to turn the idea into a functioning commercial system. Hyperloop technology is still in development even though the basic concept has been around for many years. At the moment, the earliest any Hyperloop is likely to be up and running is 2020 but most services are expected to be later, as trials of the technology are still in their early stages.

How much would a Hyperloop cost to build?

For the LA to San Francisco Hyperloop that Musk envisaged, he came up with a price tag of under $6bn. Musk envisioned an LA to San Francisco journey time of half an hour with pod departures every 30 seconds, each carrying 28 passengers.

Spreading the capital cost over 20 years and adding in operational costs, Musk came up with the figure of $20 plus operating costs for a one-way ticket on the passenger Hyperloop.

How does a Hyperloop tube work?

The basic idea of Hyperloop as envisioned by Musk is that the passenger pods or capsules travel through a tube, either above or below ground. To reduce friction, most -- but not all -- of the air is removed from the tubes by pumps.

Overcoming air resistance is one of the biggest uses of energy in high speed travel. Airliners climb to high altitudes to travel through less dense air; in order to create a similar effect at ground level, Hyperloop encloses the capsules in a reduced-pressure tube, effectively allowing the trains to travel at airplane speeds while still on the ground.

In Musk's model, the pressure of the air inside the Hyperloop tube is about one-sixth the pressure of the atmosphere on Mars (a notable comparison as Mars is another of Musk's interests). This means an operating pressure of 100 pascals, which reduces the drag force of the air by 1,000 times relative to sea level conditions, and would be equivalent to flying above 150,000 feet.

Wireless Charger

Emerging technologies are making our life simpler these days. With the introduction of mobile phones. Life has changed rapidly. But although there is much advancement in the technology, we still rely on the wired battery charges. The battery charges are required to carry everywhere to keep the battery backup. Now just think of a battery charger that charges your mobile automatically. When you sit for tea and place your mobile on the table, it simply charges your mobile. This is possible by use of microwaves. The microwave signals are transmitted from the transmitted. It eliminates the use of physical connectors, cable, etc. It is based on the principle of "Inductive coupling". The wireless battery charger uses two circuits. The first circuit is the transmitter circuit used to produce voltage wirelessly. In the second circuit that is receiver circuit consists of a receiver coil. Alternating current flows in the transmitter circuit creates magnetic field which links with the receiver coil. It generates current. This current is converted into DC by the receiver circuit, thus charging takes place. This is how your mobile get charging. It will work for very short distances only. Just place your phone on the charging pad and watch your device juice up.

Power Transfer

Wireless power transfer (WPT), wireless power transmission, wireless energy transmission (WET), or electromagnetic power transfer is the transmission of electrical energy without wires as a physical link. In a wireless power transmission system, a transmitter device, driven by electric power from a power source, generates a time-varying electromagnetic field, which transmits power across space to a receiver device, which extracts power from the field and supplies it to an electrical load. The technology of wireless power transmission can eliminate the use of the wires and batteries, thus increasing the mobility, convenience, and safety of an electronic device for all users. Wireless power transfer is useful to power electrical devices where interconnecting wires are inconvenient, hazardous, or are not possible.

Wireless power techniques mainly fall into two categories, near field and far-field. In near field or non-radiative techniques, power is transferred over short distances by magnetic fields using inductive coupling between coils of wire, or by electric fields using capacitive coupling between metal electrodes. Inductive coupling is the most widely used wireless technology; its applications include charging handheld devices like phones and electric toothbrushes, RFID tags, induction cooking, and wirelessly charging or continuous wireless

power transfer in implantable medical devices like artificial cardiac pacemakers, or electric vehicles.

In far-field or radiative techniques, also called power beaming, power is transferred by beams of electromagnetic radiation, like microwaves or laser beams. These techniques can transport energy longer distances but must be aimed at the receiver. Proposed applications for this type include solar power satellites and wireless powered drone aircraft.

An important issue associated with all wireless power systems is limiting the exposure of people and other living beings to potentially injurious electromagnetic fields.

How do wireless chargers work?

Wireless chargers work by creating a magnetic field that your phone, watch, or other device absorbs to gain energy. When you place a device on a wireless charging pad, a small coil in the device receives and harvests energy from the magnetic field, and uses it to power the battery.

Advantages of Using a Wireless Charger

A wireless mobile charger frees you from the constraints of lightning cables, micro-USB cables, and USB power converters: instead, you simply lay your phone on the wireless charger when you need to recharge the phone.

Right now, only newer model phones support wireless charging, but this is expected to change in the future. Phone manufacturers as a whole are moving towards only using wireless charging. Combined with Bluetooth technology for earbuds and speakers, this move would eventually remove all ports from phones. That day isn't here yet, but in the meantime, more and more phones that support wireless charging are entering the market.

Advantages of Using a Wireless Charger

Wireless mobile chargers make your life easier, which in today's hectic world is never a bad thing. The benefits of wireless chargers include:

One-stop charging: a wireless mobile charger can power all Qi-compatible devices, including phones, tablets, headsets, and wireless earbuds.

Less clutter: No need to keep track of multiple cords and cables, which often get lost or broken. A single mobile wireless charger replaces them all, making wireless charging a popular choice for travel tech.

Extending battery life: Lay your phone on the charger whenever you have a few minutes to give its battery life a quick boost.

Safe connections: As all charging takes place inside the phone, there's no risk of corroded USB ports, reducing the risk of charging errors or electrical faults. You also never need to worry about electrical problems caused by third-party charging cables, which can be less than reliable.

No Wear and Tear: Plugging phones into power cable regularly increases the risk of damaging phone ports, which can lead to costly repairs.

No Risk of Overheating: Once a Qi-compatible phone is fully charged, it turns off the wireless charger, saving energy and preventing the battery from overheating.

Organic Light Emitting Diode

Organic Light Emitting Diode (OLEDs) operates on the principle of converting electrical energy into light, a phenomenon known as electro-luminousness. They consist of emissive electroluminescent layer comprised of a film of organic compounds (carbon, hydrogen & oxygen). In its simplest form, an OLED consists of a layer of luminescent materials sandwiched between two electrodes. When an electric current is passed between the electrodes, through the organic layer, the light is emitted with a color hat depends on the particular material used.

The battery or power supply of the device containing the OLED. An electric current flows from the cathode to the anode through the organic layers. The cathode gives electrons to the emissive layer of organic molecules. The anode removes electr0n from the conductive layer of organic molecules. At the boundary between the emissive & the conductive layers, electron finds electron holes. When an electron finds an electron hole, the electron fills the hole. When it happens the electron gives up energy in the form of a photon of light. The OLED emits light. The color of light depends on the type of organic molecules in the emissive layer. Manufacture place several types of organic films on the name OLED to make color displays. The intensity or brightness of the light depends on the amount of electrical current applied the more current, the brighter the light.

Working

composed of a layer of organic materials situated between two electrodes, the anode and cathode, all deposited on a substrate. The organic molecules are electrically conductive as a result of delocalization of pi electrons caused by conjugation over part or all of the molecule. These materials have conductivity levels ranging from insulators to conductors, and are therefore considered organic semiconductors. The highest occupied and lowest unoccupied molecular orbitals (HOMO and LUMO) of organic semiconductors are analogous to the valence and conduction bands of inorganic semiconductors

Polymer light-emitting diodes

Polymer light-emitting diodes (PLED, P-OLED), also light-emitting polymers (LEP), involve an electroluminescent conductive polymer that emits light when connected to an external voltage. They are used as a thin film for full-spectrum colour displays. Polymer OLEDs are quite efficient and require a relatively small amount of power for the amount of light produced.

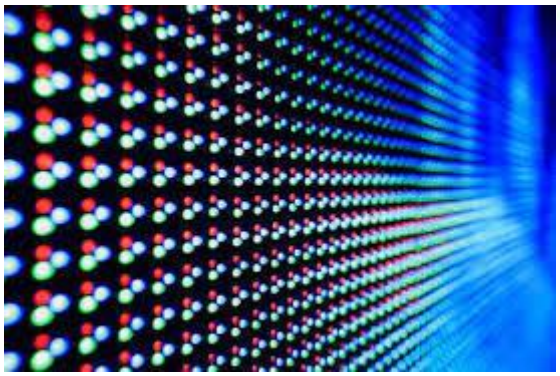
Vacuum deposition is not a suitable method for forming thin films of polymers. However, polymers can be processed in solution, and spin coating is a common method of depositing thin polymer films. This method is more suited to forming large-area films than thermal evaporation. No vacuum is required, and the emissive materials can also be applied on the substrate by a technique derived from commercial inkjet printing. However, as the application of subsequent layers tends to dissolve those already present, formation of multilayer structures is difficult with these methods. The metal cathode may still need to be deposited by thermal evaporation in vacuum. An alternative method to vacuum deposition is to deposit a Langmuir-Blodgett film.

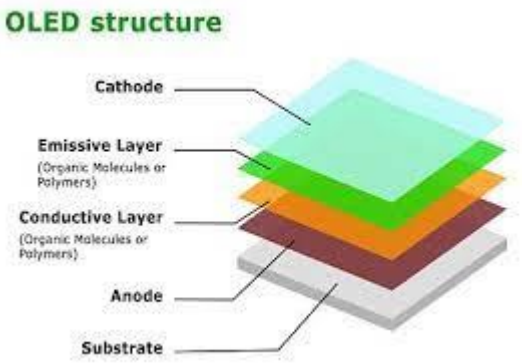
Phosphorescent materials

Phosphorescent organic light-emitting diodes use the principle of electrophosphorescence to convert electrical energy in an OLED into light in a highly efficient manner, with the internal quantum efficiencies of such devices approaching 100%.

Typically, a polymer such as poly(N-vinylcarbazole) is used as a host material to which an organometallic complex is added as a dopant. Iridium complexes[71] such as Ir(mppy) as of 2004 were a focus of research, although complexes based on other heavy metals such as platinum have also been used.

The heavy metal atom at the centre of these complexes exhibits strong spin-orbit coupling, facilitating intersystem crossing between singlet and triplet states. By using these phosphorescent materials, both singlet and triplet excitons will be able to decay radiatively, hence improving the internal quantum efficiency of the device compared to a standard OLED where only the singlet states will contribute to emission of light.





Applications

OLEDs are used to create digital displays in devices such as television screens, computer monitors, and portable systems such as smartphones and handheld game consoles. A major area of research is the development of white OLED devices for use in solid-state lighting applications.

- Televisions and Monitors. OLED devices for televisions and computer monitors were commercially released in 2013, and in just five years they have cornered the premium display market. ...
- Smartphones and Tablets. ...
- Wearables. ...
- Light Panels. ...
- OLED Materials from Avantama.
-

Charging of mobile phones using Water droplet's

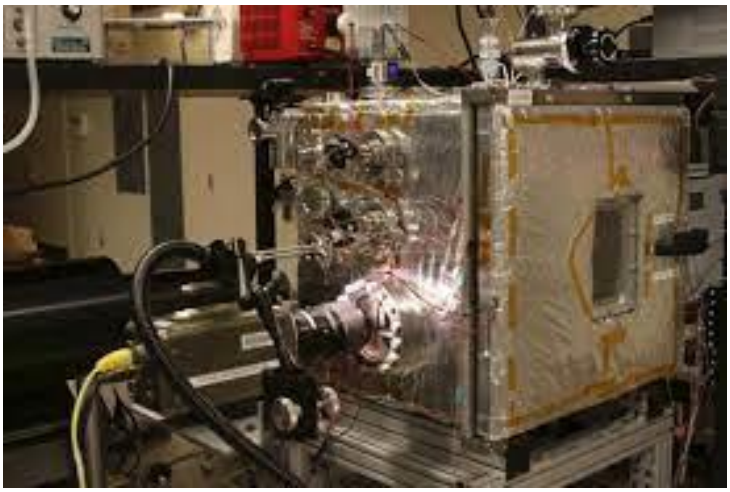
MIT researchers are developing a way to harvest energy from, off all things, water droplets. They discovered that when water droplets spontaneously ―jump‖ away from a super hydro phobic-surface, they generate a tiny electric charge.

Condensation is the real mechanism for the movement of the water, and the team figured out that by using interleaved metal plates--particularly when adjacent plates have opposite charges--they could gather that energy and send it through an external circuit, thus powering small electronic devices.

What's really cool about the whole thing is that it's a passive process, meaning a device rigged up with these plates would generate power with zero external power or intervention. Of course, it's also not a very efficient means of harvesting energy just yet. The team hopes to tune their system to generate a microwatt (that's a millionth of a watt) per square centimeter of plate.

That said, using the above as a metric, the team figured that a system in a cube form factor measuring 50cm and each side could produce enough juice to charge up a mobile phone in half a day. Thought of another day, that would be a fairly effective generator if you're trying to power a few light bulbs out in the middle of nowhere.

In any case, kudos to the two lead researchers on the project, MIT postdoc Nenad Miljkovic and associate professor of mechanical engineering Evelyn Wang, on some strong innovation, and here's hoping they continue to make it more efficient.



How it works?

The device will have a series of interleaved flat metal plates that can be made of cheaper aluminium. "As water droplets jump, they carry charge from one plate to the other; if the two plates are connected through an external circuit, that charge difference can be harnessed to provide power," said post-doctoral fellow NenadMiljkovic and Evelyn Wang, an associate professor of mechanical engineering, at MIT. The system is based on earlier findings by Miljkovic and Wang that droplets on a superhydrophobic surface convert surface energy to kinetic energy as they merge to form larger droplets.

This sometimes causes the droplets to spontaneously jump away, enhancing heat transfer by 30 percent relative to other techniques. They later found that in that process, the jumping droplets gain a small electric charge. In a practical device, two arrays of metal plates – like fins on a radiator – would be interleaved so that they are very close but not touching. “The atmosphere is a huge source of power and all you need is a temperature difference between the air and the device,” Miljkovic added.

This will allow the device to produce condensation, just as water condenses from warm, humid air on the outside of a cold glass, he said in a paper published in the journal Applied Physics Letters

3D Intra-operative holographic Technology

Surgeons working on the heart in a minimally invasive fashion have to do quite a bit of interpolating and imagining of where their instruments are in relation to the anatomy and how that anatomy is different from that of other patients. Typical intra-operative imaging systems provide a 2D view from X-ray fluoroscopes and 3D ultrasound aids in giving a volumetric reproduction. Often these are presented separately and can be unwieldy to browse in a unified way.

Imagine having a 3D holographic reproduction of the patient‘s actual heart during surgery to slice, rotate, and manipulate in free space with one‘s own hands. This is actually something that exists now and has been successfully used in surgeries at Schneider Children‘s Medical Center in PetachTikva, Israel. Using Philips clinical imaging equipment and holographic technology from Real View Imaging (Yokneam, Israel), a team of surgeons was able to analyze the hearts of eight patients during minimally invasive interventional procedures.

The technology does not require any special glasses and interaction with the virtual heart can be done with one‘s hands or a ―scalpel‖ to take slices and look inside the organ.

Holography is a unique method of photography whereby 3D objects are recorded using a laser and then restored as precisely as possible to match the originally recorded object. When illuminated via a laser, holograms are able to form an exact 3D clone of the object and duplicate its features

A holographic image can be seen looking into an illuminated holographic print by shining a laser through a hologram and projecting a image on the screen. The paper reviews the basic concepts of holography, discussing in depth of the principle of interference on which it is based, and outlines the broad applications of holography

Holography is a diffraction-based coherent imaging technique in which a complex three-dimensional object can be reproduced from a flat, two-dimensional screen with a

complex transparency representing amplitude and phase values. It is commonly agreed that real-time holography is the ne plus ultra art and science of visualizing fast temporally changing 3-D scenes. The integration of the real-time or electro-holographic principle into display technology is one of the most promising but also challenging developments for the future consumer display and TV market. Only holography allows the reconstruction of natural-looking 3-D scenes, and therefore provides observers with a completely comfortable viewing experience. But to date several challenges have prevented the technology from becoming commercialized. But those obstacles are now starting to be overcome. Recently, we have developed a novel approach to real-time display holography by combining an overlapping sub-hologram technique with a tracked viewing-window technology

Principle of Projection

When the two laser beams reach the recording medium, their light waves, intersect and interfere with each other. It is this interference pattern that is imprinted on the recording medium. The pattern itself is seemingly random, as it represents the way in which the scene's light interfered with the original light source but not the original light source itself. The interference pattern can be considered an encoded version of the scene, requiring a particular key the original light source in order to view its contents. This missing key is provided later by shining a laser, identical to the one used to record the hologram, onto the developed film. When this beam illuminates the hologram, it is diffracted by the hologram's surface pattern. This produces a light field identical to the one originally produced by the scene and scattered onto the hologram. The image this effect produces in a person's retina is known as a virtual image

Li- Fi Technology Transmission of data through light

Transfer of data from one place to another is one of the most important day-to-day activities. The current wireless networks that connect us to the internet are very slow when multiple devices are connected. As the number of devices that access the internet increases, the fixed bandwidth available makes it more and more difficult to enjoy high data transfer rates and connect to a secure network. But, radio waves are just a small part of the spectrum available for data transfer. A solution to this problem is by the use of Li-Fi. Li-Fi stands for Light-Fidelity. LiFi is transmission of data through illumination by taking the fiber out of fiber optics by sending data through an LED light bulb. It is the term some have used to label the fast and cheap wireless communication system, which is the optical version of Wi-Fi. Li-Fi uses visible light instead of Gigahertz radio waves for data transfer. It is based on LEDs or other light source for the transfer of data. The transfer of the data can be with the help of all kinds of light, no matter the part of the spectrum that they belong. That is, the light can belong to the invisible, ultraviolet or the visible part of the spectrum. Also, the speed of the communication is more than sufficient for downloading movies, games, music and all in very less time.

Li-Fi can be the technology for the future where data for laptops, smart phones, and tablets will be transmitted through the light in a room. Security would not be an issue because if you can't see the light, you can't access the data. As a result, it can be used in high security military areas. It is the upcoming and on growing technology acting as competent for various other developing and already invented technologies. Hence the future applications of the Li-Fi can be predicted and extended to different platforms and various walks of human life. Possibilities for future utilization are abundant. Every light bulb can be converted into li-fi signal receptor to transfer data and we could proceed toward the cleaner, safer, greener and brighter future. As we know that the airways are getting clogged day by day Li-fi can offer a genuine and very efficient alternative. Li-Fi is enabled by advanced digital transmission technologies. Optical cell networks based on Li-Fi are the link between future energy efficient illumination and cellular communications. They can also harness unregulated, unused and vast amount of electromagnetic spectrum and can even enable ever smaller cells without the need for new infrastructure. The issues of shortage of radio frequency can be

tackled easily with only limitation being that it works in direct line of sight of light. There are no dead ends to technology and science. Now both light and radio waves can be used simultaneously to transfer data and signals

How does LiFi work?

LiFi is a Visible Light Communications system transmitting wireless internet communications at very high speeds. The technology makes a LED light bulb emit pulses of light that are undetectable to the human eye and within those emitted pulses, data can travel to and from receivers. Then, the receivers collect information and interpret the transmitted data. This is conceptually similar to decoding Morse code but at a much faster rate – millions of times a second. LiFi transmission speeds can go over 100 Gbps, 14 times faster than WiGig, also known as the world's fastest WiFi.

Advantages of LiFi

There are many different advantages offered by using LiFi. One of its biggest benefits come with its efficiency. Since LiFi makes use of VLC technology, which in turn makes use of highly-efficient LED bulbs, users are able to enjoy lower costs in terms of energy consumption. Additionally, they only require working LED lights, which are already available within most households and other establishments, allowing for additional savings in terms of installation costs.

Another big advantage of LiFi is that the usage of light allows LiFi connections to occur almost instantaneously because light travels at extremely fast speeds. This results in faster transmission of data and faster internet connections – about 100 times faster than speeds achievable by WiFi.

Prodigious Technology

Waste Management

The waste management play a vital role in today's environment . To acquire a pollution free atmosphere and to make our globe to reach the future generation, managing the waste is very much important. Taking this situation into account China‘s capital Beijing has come up with an ingenious idea to encourage people to recycle more. Recycling becomes fun when there are rewards involved. The subway ride in Beijing is paid by recycling a plastic bottle. It has installed 34 ―reverse‖ vending machines in subway stations throughout the city. When a passerby inserts an empty plastic bottle, the machine‘s sensor scans it to assess the value of the plastic – anywhere from 5 to 15 cents – and spits out a public transportation credit or extra mobile phone minutes. The reward is commensurate with the quality and number of bottles being fed into the machine, although there is also the option for people such as tourists, who don‘t need the rewards, to insert bottles anyways. Most of the recycling machines, according to Recycling Today, are placed in high-traffic or touristy areas, such as the Temple of Heaven in Beiging, which sees as many as 60,000 people pass by daily. When you consider that most people have a plastic bottle of something in their hands, whether it‘s water or soda, that‘s a whole lot of plastic that city officials don‘t want to see littered on the ground. This system, with its free rewards, makes.

Recycling Process

Recycling more appealing, and is a good step forward for a city that‘s already notorious for its environmental degradation. The idea is catching on. Also in Sydney, where ―beverage containers now outstrip cigarette butts as the most littered item,‖ the city officials placed Envirobank reverse vending machines throughout the city, The rewards are nice – food truck vouchers, tickets to the city‘s famous New Year‘s Eve party, movie tickets and bus passes. Unlike traditional recycling bins, where people would throw regular garbage and contaminate

the recycling, making it hard or impossible to process, this machine only fits plastic bottles and soda cans. Because it immediately crushes them, each Envirobank can hold up to 3,000 items. While I think these initiatives are great, they don‘t really solve the bigger issue of disposable plastic. Recycling, as useful and good as it can be, is not an ideal solution. Plastic can never be fully recycled, but is always _down-cycled‘into a lesser form of itself until it cannot be reworked and eventually gets landfilled. The most important task is to educate people about the importance of reusability, and get people off their addictions to bottled water and soda and onto using reusable bottles and cups. If this technology is implemented in developing nations such as India , ample amount of waste can be reduced.

Raspberry Pi Technology

Computer is not only a luxury but also a necessity for every person in today‘s world. Raspberry pi is a credit-card sized computer aimed at providing a computer to every person in the world. Raspberry Pi is intended to provide a base on which kids can learn programming while enthusiasts can do different types of commercial programming. It serves as an efficient base due to its low cost and the number of interfaces available. The Raspberry Pi can be used instead of a personal computer, but with some limitations due to its limited processing power.

Design of Raspberry pi Board

The main purpose of designing the raspberry pi board is to encourage learning, experimentation and innovation for school level students. The raspberry pi board is a portable and low cost. Maximum of the raspberry pi computers is used in mobile phones. It enables people of all ages to explore computing, learn programming languages like Python and can be used for many tasks that a computer does, like games, browsing internet, word processing, spreadsheets and also playing video. It is used in programming concepts and hardware interfacing. It‘s used for making digital photo frames, tablets etc. It is used in robotics for controlling motions, sensors, etc. It can be used in creating and handling of small servers. It can be used in voice activated coffee machine. It‘s used in automated system to detect leakage from microwave oven.

Advantages of Raspberry Pi Technology

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python.

Due to its size, it can be hidden anywhere, behind television sets, within walls. It provides basic computer functions like word processing, web browsing .It has many disadvantages (i.e..,) though it can be used as a computer but it is closer to a mobile device. Since it is not covered with any case, it is exposed and can be touched easily which can cause damage. It is time consuming to download and install software and is unable to do complex multitasking.

Raspberry pi helps to increase hardware knowledge and software applications related to it. Raspberry pi is an amazing piece of hardware because of the combination of the features of a traditional computer and an embedded device.

Versions of Raspberry Pi

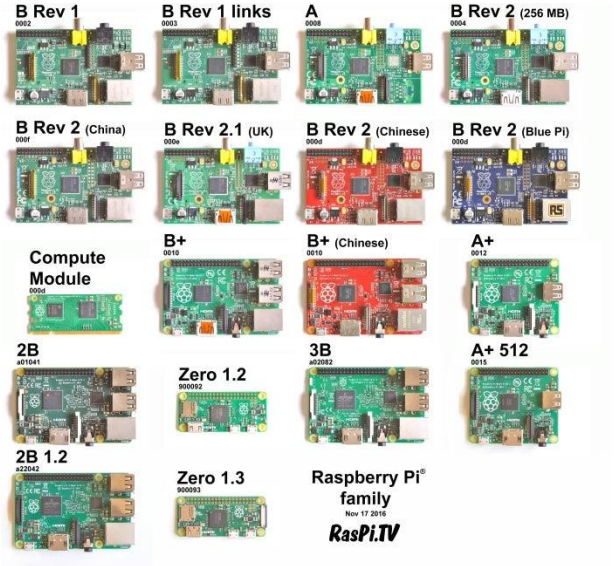
There are lots of different versions of the Raspberry Pi, and each has different features.

All of the versions use a Broadcom 'system on a chip' (SoC) which contains an ARM-compatible central processing unit (CPU), random-access memory (RAM) and a graphics processing unit (GPU).

All versions use an SD card or MicroSD card for the operating system and file storage. They also have a 40-pin General-Purpose Input/Output (GPIO) connector, which can be used for controlling other electronics.

Some versions of the Raspberry Pi have an ethernet connector for connecting to the internet. Some versions can also use Wi-Fi to connect to the internet.

The Raspberry Pi comes in three different sizes. The 'standard' size is used for all Model B versions, and is 85.6 mm x 56.5 mm (3.370 in × 2.224 in). The 'compact' size is used for all Model A versions, and is 65 mm × 56.5 mm (2.56 in × 2.22 in). The 'zero' size is used for all Raspberry Pi Zero versions, and is 65 mm × 30 mm (2.56 in × 1.18 in)

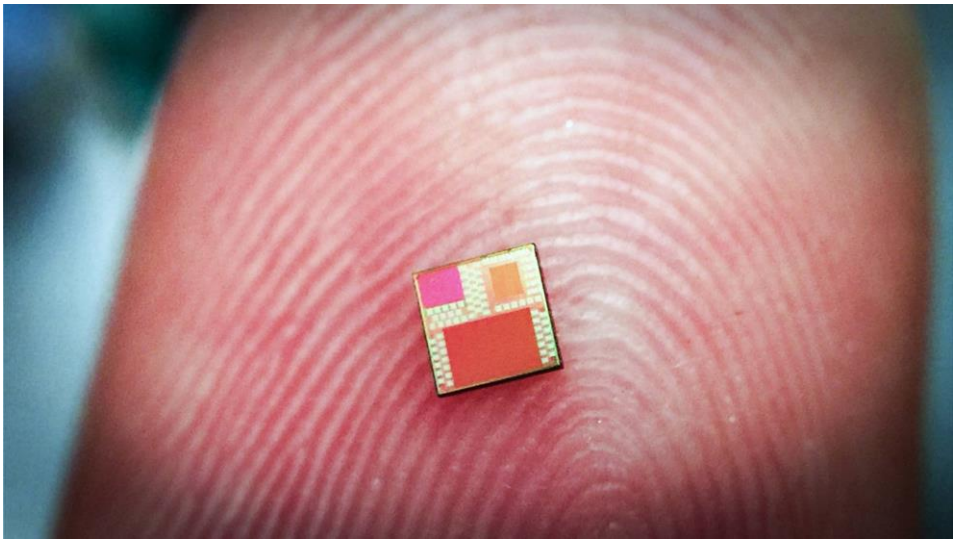


Medical Microchipping

Brief about Microchipping

A cohort of scientists from universities world over has developed a new type of implantable microchip capable of performing various pre-programmed functions inside the body for a certain period of time, and later dissolving into oblivion.

A new study on the technology explains how "transient electronics" are the exact opposite of traditional electronics, which are designed with stability and long-term durability in mind. Dissolvable electronics, on the other hand, are specifically designed to melt away once they have accomplished their respective tasks.



A remarkable feature of modern silicon electronics is its ability to remain physically invariant, almost indefinitely for practical purposes. Although this characteristic is a hallmark of applications of integrated circuits that exist today, there might be opportunities for systems that offer the opposite behavior, such as implantable devices that function for medically useful time frames but then completely disappear via re-absorption.

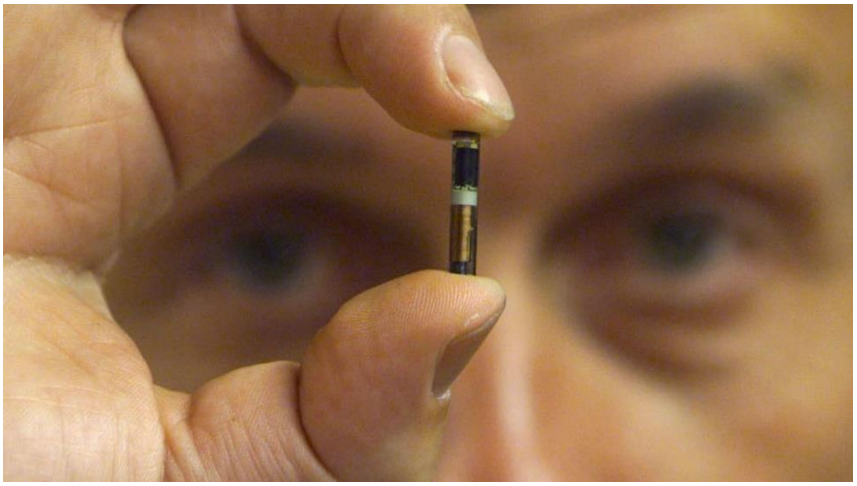
Medical Records

Researchers have examined microchip implants in humans in the medical field and they indicate that there are potential benefits and risks to incorporating the device in the medical field. For example, it could be beneficial for noncompliant patients but still poses great risks for potential misuse of the device. Destron Fearing, a subsidiary of Digital Angel, initially developed the technology for the VeriChip.

In 2004, the VeriChip implanted device and reader were classified as Class II: General controls with special controls by the FDA; that year the FDA also published a draft guidance describing the special controls required to market such devices.

Advantages of micro chipping

One example of this might be implantable chips designed to target open wounds with heat in order to prevent infection, particularly during patients' time at hospitals. Another use might perhaps be to trigger an immune response that targets a potentially deadly infection, seeing as how conventional medicine has largely rejected the much more effective holistic and nutrition-based approaches to preventing and treating disease.



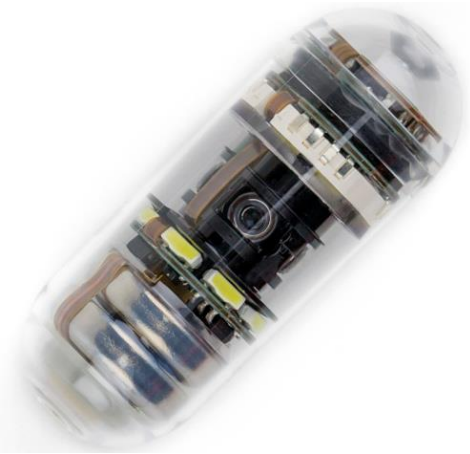
According to reports, test chips have already been created that are composed of a combination of silicon and magnesium oxide, and coated in a protective layer of silk produced by extracting silk from silkworms, dissolving it, and reforming it into a crystallized coating. Depending on the intended lifespan of a particular chip, the thickness of the silk might be extremely thin to last for just a few hours, or slightly thicker to last for days or even weeks.

“People say "Bless you" when you sneeze because when you sneeze, your heart stops for a mili-second”

Electronic Pills - Collecting Data inside the Body

After years of investment and development, wireless devices contained in swallowable capsules are now reaching the market. Companies such as Smart Pill based in Buffalo, New York and Israelbased Given Imaging (PillCam) market capsules the size of vitamin tablets.

These pills contain sensors or tiny cameras that collect information as they travel through the gastrointestinal tract before being excreted from the body a day or two later.



How do electronic pill collect data inside the body?

These new electronic inventions transmit information such as acidity, pressure and temperature levels or images of the oesophagus and intestine to your doctor's computer for analysis.

Doctors often use invasive methods such as catheters, endoscopic instruments or radioisotopes for collecting information about the digestive tract. So device companies have been developing easier, less intrusive ways, to gather information.

Digestive diseases and disorders can include symptoms such as acid reflux, bloating, heartburn, abdominal pain, constipation, difficulty swallowing or loss of appetite.

"One of the main challenges is determining just what is happening in the stomach and intestines." says Dr. Anish A. Sheth, Director of the Gastrointestinal Motility Program at Yale-New Haven Hospital.

Doctors can inspect the colon and peer into the stomach using endoscopic instruments. But some areas cannot be easily viewed, and finding out how muscles are working can be difficult.

Electronic pills are being used to measure muscle contraction, ease of passage and other factors to reveal information unavailable in the past.

After years of investment and development, wireless devices contained in swallowable capsules are now reaching the market. At some situations, doctors can't easily detect diseases and hence it becomes too late to cure it. Use of electronic pill helps us to easily detect the diseases and can take suddenaction against it. In 1972, Professor John Cooper and Dr. Eric Johannessen from Glasgow University, U.K has led to the development of electronic pill. Companies such as SmartPill based in Buffalo, New York and Israel-based Given Imaging (PillCam) market capsules the size of vitamin tablets.These pills contain sensors or tiny cameras that collect information as they travel through the gastrointestinal tract before being excreted from the body a day or two later.

It is a medical monitoring system. Measurement parameters of electronic pills include temperature analysis, pH measurements, conductivity and dissolved oxygen. And they can also capture images and sent it into Doctor's system. Doctors often use invasive methods such as catheters, endoscopic instruments or radioisotopes for collecting information about the digestive tract. So device companies have been developing easier, lessintruisive ways to gather information.Digestive diseases and disorders can include symptoms such as acid reflux, bloating, heartburn, abdominal pain, constipation, difficulty swallowing or loss of appetite."One of the main challenges is determining just what is happening in the stomach and intestines." says Dr. Anish A. Sheth, Director of the Gastrointestinal Motility Program at Yale-New Haven Hospital. Doctors can inspect the colon and peer into the stomach using endoscopic instruments. But some areas cannot be easily viewed, and finding out how muscles are working can be difficult. Electronic pills are being used to measure muscle contraction, ease of passage and other factors to reveal information unavailable in the past.

Vertical Farming

What is Vertical Farming?

Vertical farming is an eco-friendly architectural concept for cultivating food within skyscrapers.

It uses green inventions and green technologies related to hydroponics, aeroponics and aqua-farming to economically produce food for personal and communal consumption.

It is estimated that over the next four decades, our population will increase by 3 billion people and that 80% of us will be living in cities.

Many scientists are concerned that the amount of land required to feed us in the future will not be available nor will it be economically or environmentally sustainable.

How Vertical Farming is going on?

Currently, the amount of land required to produce food for 6.8 billion people on earth is equivalent to the continent of South America. In four decades, we will require an additional 2 billion acres for cultivating food. But that much arable land doesn't exist.

Global warming and geological events will continue to create extreme weather conditions causing frost, floods, droughts, hailstorms, wildfires and torrential rainfalls that will severely effect the economics and sustainability of our food supply.

India has the world's second largest population and is experiencing extreme changes in temperatures and rainfall patterns.

Advantages of Vertical Farming

It is predicted that within this century, India will lose 30% of it's agricultural production. So as the population increases, scientists are wondering - "Where are we going to get food?"

Dickson Despommier, a microbiologist, is credited with popularizing the concept of vertical farming.

The idea originated from an assignment given to his students to determine how 2 million inhabitants of Manhattan could be fed from crops produced on 13 acres of rooftop gardens. It

was discovered that only 2% of the population could be fed from these gardens so vertical farming became an alternative solution.

Vertical farming stacks and grows plants "vertically" in skyscrapers and uses mineral enriched water instead of soil. It also uses the recycling concept of aquaponics where fish are cultivated in tanks and their waste provides nutrients for edible plants.

Waste Management

What is waste Management?

Dust plays a dominant role in cement industry. It mostly affects the worker health such as silicosis (lung cancer) and heart attack. Hence it leads to decrease the efficiency of the machine. Our aim is to sense the dust in the Grinding sector and settle it by spraying the chemicals (Ion carboxylic foam) in the atmosphere. During cement production 1.4% of total production has been wasted in the form of dust. It affects the worker health and efficiency of the machine. In Cement manufacturing during grinding process more dust are produced by the machines, it leads to tremendous health issues(Silicosis, Heart attack) and decreasing the efficiency of the product as well as machine. We came to know that 46,000 peoples were died by silicosis due to the inhale of tiny particles of silica. By the emission of dust, it leads to damage the expensive machines that results in decrease its efficiency and also workers health are at risk.

The intensity of dust is also measured by Dust Sensor. Based on sensed value, the chemical quantity is decided by the controller. Then chemical is sprayed in atmosphere using sprayer.

Types of Wastes

Waste management (or waste disposal) include the activities and actions required to manage waste from its inception to its final disposal. This includes the collection, transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process.

Waste can be solid, liquid, or gas and each type has different methods of disposal and management. Waste management deals with all types of waste, including industrial, biological and household. In some cases, waste can pose a threat to human health. Waste is produced by human activity, for example, the extraction and processing of raw materials. Waste management is intended to reduce adverse effects of waste on human health, the environment or aesthetics.

Waste management practices are not uniform among countries (developed and developing nations); regions (urban and rural areas), and residential and industrial sectors can all take different approaches.

Advantages of Waste Management

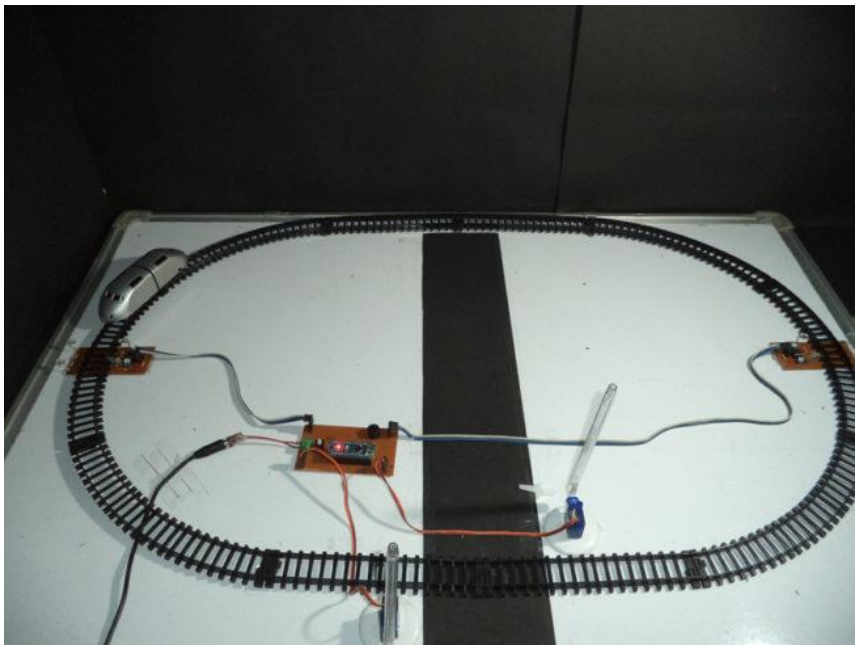
A large portion of waste management practices deal with municipal solid waste (MSW) which is the bulk of the waste that is created by household, industrial, and commercial activity.The waste hierarchy refers to the "3 Rs" Reduce, Reuse and Recycle, which classifies waste management strategies according to their desirability in terms of waste minimisation. The waste hierarchy is the cornerstone of most waste minimisation strategies. The aim of the waste hierarchy is to extract the maximum practical benefits from products and to generate the minimum amount of end waste.

Automatic Railway Gate Controller with High Sped Alert System

This automatically controls the operation of railway gates by detecting the arrival and departure of trains at the gate. Detectors are placed at the faraway distance on the railway track and they are connected to micro controller, which activates the motors to perform the mechanical action of opening and closing the railway gates.

The Working Process:

The IR LEDs and photodiodes are placed on either side of the track initially IR LED is the transmitter, that continuously transmits IR light to the receiver. When train arrives, it blocks falling and we can consider that the train is moving from left to right. Now, the first sensor pair act as counter and gets activated when the train blocks it, and second sensor pair slops working.



The counter values generated are used to calculate the velocity of train. If speed of train is increased an alarm/buzzer is activated. About a million people have died over the past 5 years in unmanned railway crossings all over the world. At least 1/3rd of the railway crossings are unmanned due to their remote placement and less traffic. The Automatic Railway Gate Control System using IR Sensor & Arduino focuses on systematic traffic control of railway gates that are both manned and unmanned. This project will not only make the system more reliable & precise, but also save the authorities from hiring man power to do the job. You may take it as a onetime investment.

Working of prototype

The Automatic Railway Gate Control System Project makes use of an Arduino Nano to control the whole circuit. Two Servo motors are used to open and close the railway gates. Four IR sensors are used for sensing the arrival or departure of train. The main objective is to close the railway gates when the train approaches it, so as to block vehicles from going across the track. As soon as the train moves further away from the railway crossing, the gates must

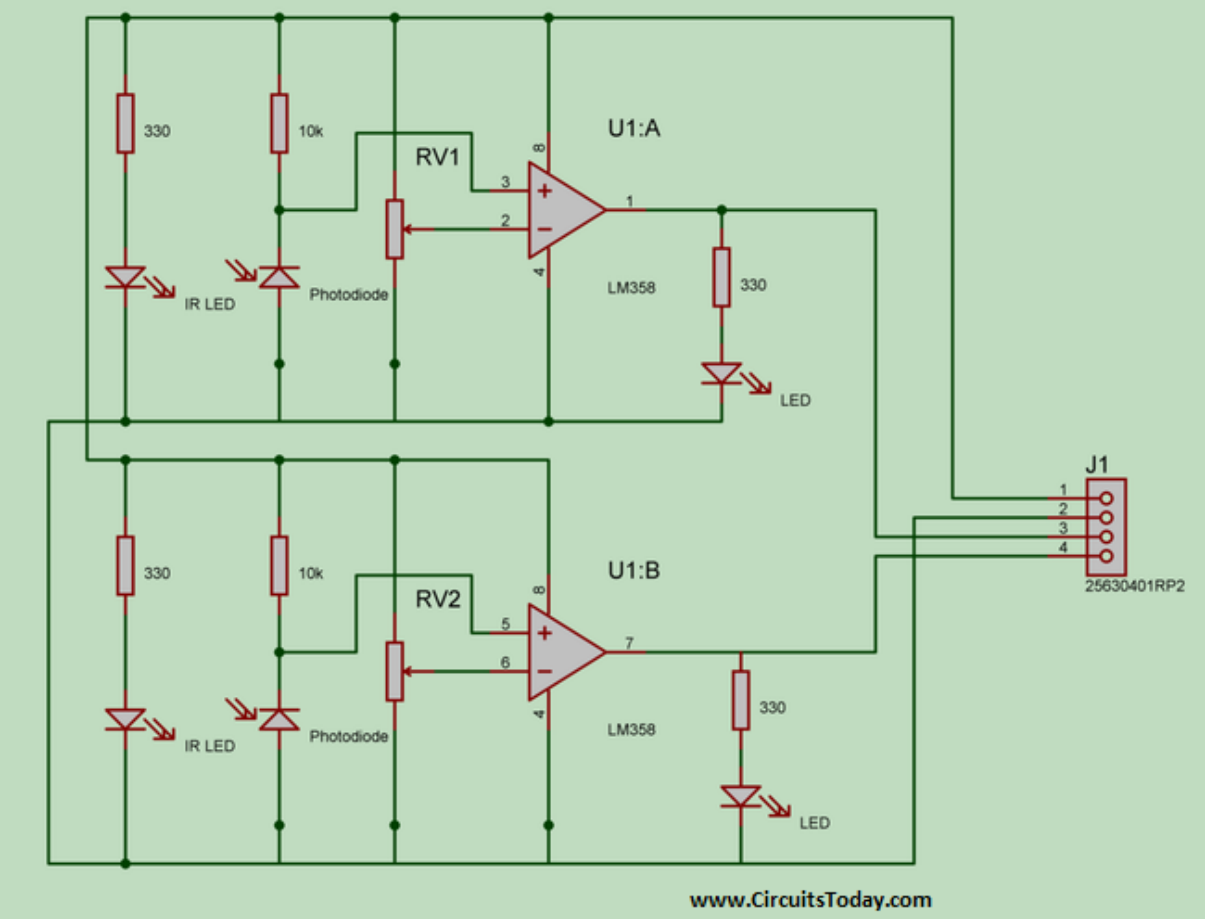
automatically open to allow vehicles to cross by. Components Used The automatic railway gate control makes use of 3 PCB's. One is for the Arduino Nano, which works as controller of the whole project. The other two PCB's are needed for the IR pairs. I designed all the three PCBs on EAGLE CAD software. If you want to make etched PCB, refer both the figures given below. Output of all the sensors are connected to A0, A1, A2 and A3 pins of Arduino.

The pins D9 and D10 of the Arduino are PWM pins. These pins are connected to the Servo motor. Servos are controlled by sending an electrical pulse of variable width, or pulse width modulation (PWM), through the control wire.IR pair is made with dual Op-amp IC LM358. Only one IC is required for a pair. A preset is used for calibration.

IR Sensors

Two IR pairs are used in the project. If you are familiar with PCB etching you can etch the PCB, but it is not necessary to use the etched PCB, you can use two IR sensors instead of one pair that is easily available in market.

The Circuit Diagram:



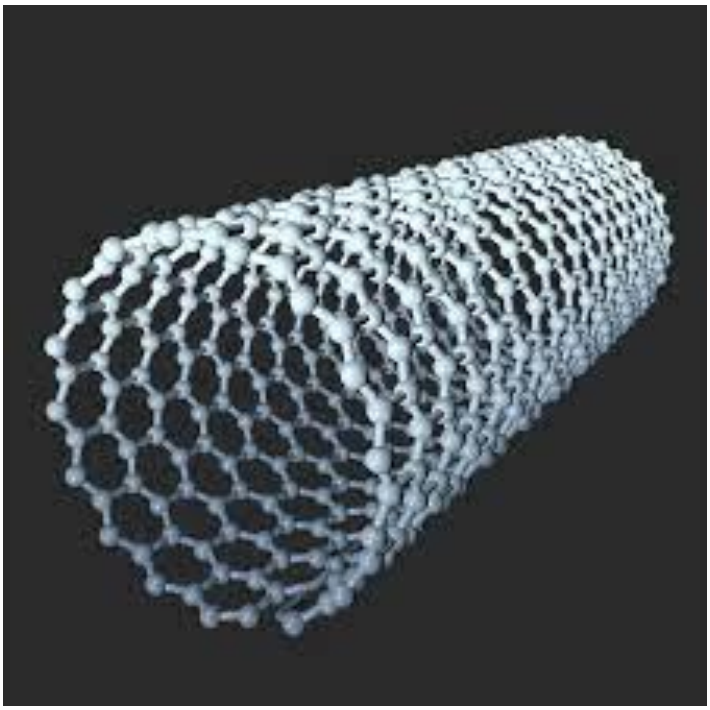
Carbon Nano Tubes

“It has become appallingly obvious that our technology has exceeded our humanity”. –Albert Einstein.

This technology could give future portable devices much longer battery life between Charges . It is to extend battery life for mobile devices. By using a nano scale contacts, we are Able to achieve much smaller power consumption. This research is based on an existing technology known as phase change memory. Instead of using metal wires as resistors, the research team used carbon nanotubes that are 10,000 times thinner than a human hair. For this we have to place a small amount of Phase Change Materials (PCM) in a Nano scale gap formed in the middle of the carbon nanotube. The nanotube PCM memory Could increase the phone’s energy efficiency so it could run for a longer life time in a smaller battery. This is important that anything has to operate on a battery such as satellites, telecommunication Equipment in remote locations or any number of scientific and military Applications .

Carbon nanotubes – what they are, how they are made, what they are used for

What are carbon nanotubes?



Carbon nanotubes (CNTs) are cylindrical molecules that consist of rolled-up sheets of single-layer carbon atoms (graphene). They can be single-walled (SWCNT) with a diameter of less than 1 nanometer (nm) or multi-walled (MWCNT), consisting of several concentrically interlinked nanotubes, with diameters reaching more than 100 nm. Their length can reach several micrometers or even millimeters.

carbon nanotubes and human hair

The purple structure is a human hair fragment, with a diameter of about 80 to 100 thousand nanometers and in the background is a network of single-walled carbon nanotubes. (Image: Jirka Cech)

Like their building block graphene (Why not read our extensive tutorial on graphene – which includes a fantastic infographic), CNTs are chemically bonded with sp2 bonds, an extremely strong form of molecular interaction.

This feature combined with carbon nanotubes' natural inclination to rope together via van der Waals forces, provide the opportunity to develop ultra-high strength, low-weight materials that possess highly conductive electrical and thermal properties. This makes them highly attractive for numerous applications.

Carbon allotropes

Carbon is the fourth-most-abundant element in the universe and, depending on the arrangements of carbon atoms, takes on a wide variety of forms, called allotropes. Carbon allotropes exhibit unique properties of strength and electrical conductivity.

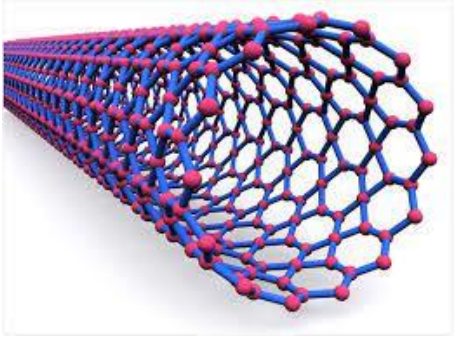
Solid carbon at room temperature has two classical structures: diamond and graphite. In 1985 the discovery of the existence of a third and new carbon allotrope containing sixty perfectly symmetrically arranged carbon atoms (also known as C60, fullerene, or buckyballs) meant a major breakthrough and opened a novel field of carbon nanochemistry. Then, in 1991, carbon nanotubes were discovered and graphene in 2004.

Electrical properties of carbon nanotubes

The rolling-up direction (rolling-up or chiral vector) of the graphene layers determines the electrical properties of the nanotubes. Chirality describes the angle of the nanotube's hexagonal carbon-atom lattice.

Armchair nanotubes – so called because of the armchair-like shape of their edges – have identical chiral indices and are highly desired for their perfect conductivity. They are unlike zigzag nanotubes, which may be semiconductors. Turning a graphene sheet a mere 30 degrees will change the nanotube it forms from armchair to zigzag or vice versa.

While MWCNTs are always conducting and achieve at least the same level of conductivity as metals, SWCNTs' conductivity depends on their chiral vector: they can behave like a metal and be electrically conducting; display the properties of a semi-conductor; or be non-conducting. For example, a slight change in the pitch of the helicity can transform the tube from a metal into a large-gap semiconductor



Ultrasonic Finger Print Sensor

Fingerprint sensor technology currently used in smart phones like iphone6 produces a 2D image of a finger's surface, which can be spoofed easily with a printed image of the fingerprint. But this new developed ultrasonic sensor eliminates such risk by imaging the ridges and valleys of the fingerprint's surface and tissue beneath in 3D.

This enhances biometrics and information security for smartphones and other devices that makes it difficult to spoof. Using password for smartphones was a big security problem, and so the biometric solution was ahead.

The origin of the new technology began to come together in 2007, when the teams at the Berkeley Sensor and Actuator Center collaborated to initiate research into piezoelectric micro machined ultrasonic transducers (PMUT). Arrays of PMUT were developed along with a custom application-specific integrated circuit and supporting electronics. As medical ultrasound is conducted so as the ultrasonic imageries are collected.

Transducers on the chip's surface emit a pulse of ultrasound and they receive echoes from the ridges and valleys of the fingerprint's surface. The chip is fabricated from two wafers-a MEMS wafer that contains ultrasound transducers and a CMOS wafer that contains signal processing circuitry. And they both are bonded together and MEMS is thinned to expose transducers. Since it involves low cost and high volume manufacturing process, ultrasound chips can be manufactured at an extremely low cost. It is powered by 1.8V power supply using powerefficient charger pump. Transducer are highly sensitive. Beyond biometrics and information security purposes, the new technology's expected to find many applications, inducing low cost ultrasound as a medical diagnostic tool or for personal health monitoring.

Providing our most cutting-edge, sleekest security solution.

Combining a smartphone's display and fingerprint reader for a seamless and sleek look, 3D Sonic uses technological advances and acoustics (sonic waves) to scan the pores of a user's finger for a deeply accurate 3D image. An ultra-thin (0.2 mm) sensor enables cutting-edge form factors such as full glass edge-to-edge displays, and can be widely used with flexible OLED displays.

Delivering security-rich, built-in anti-spoofing security.

Safeguard a user's identity with the most advanced fingerprint security system available. 3D Sonic uses acoustic-based technology that reflects the unique features of a user's individual fingerprint vs. optical solutions, which leaves users exposed to spoofing. With anti-spoofing built in, neither a photograph nor fake mold of your finger can access your phone.

Offering high-performance protection, even in extreme conditions.

3D Sonic delivers high-performance protection across a wide range of conditions—dry, wet, and even contaminant exposure—and it's faster compared to legacy solutions when fingers are wet.

Haptic Technology

“A Sense of Touch”

The Haptic is the science of applying touch (tactile) sensation and control to interact with computer applications.

Haptic technology

Haptics isthe tactile feedbacks that take advantage of user sense of touch by applying forces, vibration and motion to the user. This technology promises to have wide reaching applications as it already has in some fields like in control virtual objects,spaceshipmanures,surgical training , gaming and so on...

Haptic interfaces are divided two categories.

Force feedback interface are used to explore, modify and remove virtual objects in 3D applications. Tackle feedback interface deals with surface properties such asroughness, smoothness and temperature.

Haptic science consists of human parts and machine parts.

Haptic devices acts as input/output devices that track a user's physical manipulation and to provide realistic touch sensations coordinated with one screen events. Haptic technology is widely used in many applications such as in gaming, surgicalsimulation, medical training, and mechanical training in virtual environment, robotics, mobile devices, and entertainment. Implementations of haptic technology is expensive.

Advantages of Haptic Science

Haptic technology, also known as kinaesthetic communication or 3D touch, refers to any technology that can create an experience of touch by applying forces, vibrations, or motions to the user.These technologies can be used to create virtual objects in a computer simulation, to control virtual objects, and to enhance remote control of machines and devices (telerobotics). Haptic devices may incorporate tactile sensors that measure forces exerted by the user on the interface. The word haptic, from the Greek: ἁπτικός (haptikos), means "tactile, pertaining to the sense of touch". Simple haptic devices are common in the form of game controllers, joysticks, and steering wheels.

Haptic technology facilitates investigation of how the human sense of touch works by allowing the creation of controlled haptic virtual objects. Most researchers distinguish three sensory systems related to sense of touch in humans: cutaneous, kinaesthetic and haptic. All perceptions mediated by cutaneous and kinaesthetic sensibility are referred to as tactual perception. The sense of touch may be classified as passive and active,and the term "haptic" is often associated with active touch to communicate or recognize objects.

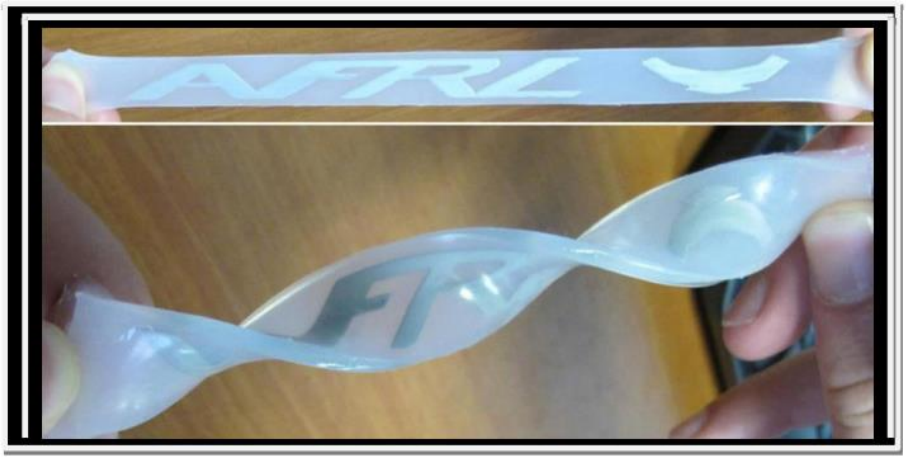
As technology evolves and computer power grows, haptic devices and effects evolves and gets more realistic. This technology has proved that virtual objects can also be touched, felt and controlled. This technology must be made affordable cost and the haptic devices must be made simple and easier to use.

Health Monitoring Ribbon

Researchers will provide an update on the latest technologies, as well as future research plans, at the 250th National Meeting & Exposition of the American Chemical Society (ACS).

About Health Monitoring Ribbon

"Basically, we are using a hybrid technology that mixes traditional electronics with flexible, high-performance electronics and new 3-D printing technologies," says Benjamin J. Leever, Ph.D., who is at the Air Force Research Laboratory at Wright-Patterson Air Force Base. "In some cases, we incorporate 'inks,' which are based on metals, polymers and organic materials, to tie the system together electronically. With our technology, we can take a razor-thin silicon integrated circuit, a few hundred nanometres thick, and place it on a flexible, bendable or even foldable, plastic-like substrate material," he says.



To allow electronics to be bendable or stretchable or even change their configuration after fabrication, the Wright-Patterson team has turned to liquid gallium alloys as an electrical interconnect material, Leever says. "While these liquid alloys typically oxidize within minutes and become essentially useless," he says, "the team has been able to dramatically reduce the effects of the oxidation through the use of ionic species confined to the walls of microvascular channels within the flexible substrates."

The result is thin, foldable material that allows the circuitry to fit into extremely tight spaces and even to be integrated into complex curved surfaces, such as an airplane's wing, or even a person's skin.

Applications of Health Monitoring Ribbon

In aircraft applications, Leever explains, the hybrid flexible system can be used to monitor stresses and strains and report this information through miniature embedded antennas to ground crews or a pilot. The researchers also are developing the same approach to monitor pilots' health. This involves a biosensor system that can measure heartbeat, hydration levels, sweat, temperature and other vital signs through miniature circuitry. The system would be embedded on a flexible, wearable patch and would include an antenna to transmit these biometric signals to the pilot or a ground team. The patch will "breathe," bend and stretch,

and will provide real-time measurements of metrics that indicate fatigue or potential cognitive problems, Leever notes.

Another military application the Air Force is pursuing is use of a flexible hybrid system in "bunker buster" bombs, which detonate after penetrating deep in the earth. Because of the system's toughness, Leever says, initial testing suggests that the flexible circuitry would remain viable and could detonate the weapon after surviving the initial impact of ground contact after being dropped from aircraft.

Advantages

In the civilian world, Leever foresees use of flexible systems to monitor the conditions of bridges and other types of infrastructure in real time. He also points to medical applications, such as physical feedback for athletes as they exercise and real-time hospital monitoring for caregivers concerned about changes in a patient's vital signs. This type of monitoring dispenses with the need for the bulky electrodes and wiring that normally are associated with close medical surveillance. "Overall, the military has the advantage of being able to move ahead with potentially higher risk research," he explains. "Commercial investors want a clear demonstration before making an investment. The military can pursue possibly transformational applications at earlier stages if we see a promising approach to realize and advance a technology's revolutionary potential. When we are successful, the commercial sector directly benefits."

Farming with Robots

About Agriculture Robots

Agricultural robots are the fastest growing technology developed to perform various complex tasks that are difficult for humans to achieve. Recent news claims that the Japanese government has taken an initiative to use robotic operators in lands swamped by March 2011 tsunami. This—Dreamproject‖ was planned to involve unmanned tractors working in the farm on the disaster site. The robotic farmers are capable of cultivating vegetables, fruits, soybeans, wheat and rice,which are then packed in boxes and shipped across the country by this robotic technology. This process is accompanied by recycling of carbon dioxide using machinery in an attempt to reduce the use of fertilizers.,

Robot Technology

Fruit picking robots, driverless tractor / sprayers, and sheep shearing robots are designed to replace human labor. In most cases, a lot of factors have to be considered (e.g., the size and color of the fruit to be picked) before the commencement of a task. Robots can be used for other horticultural tasks such as pruning, weeding, spraying and monitoring. Robots can also be used in livestock applications (livestock robotics) such as automatic milking, washing and castrating. Robots like these have many benefits for the agricultural industry, including a higher quality of fresh produce, lower production costs, and a decreased need for manual labor. They can also be used to automate manual tasks, such as weed or bracken spraying, where the use of tractors and other human-operated vehicles is too dangerous for the operators.

An end effector in an agricultural robot is the device found at the end of the robotic arm, used for various agricultural operations. Several different kinds of end effectors have been developed. In an agricultural operation involving grapes in Japan, end effectors are used for harvesting, berry-thinning, spraying, and bagging. Each was designed according to the nature of the task and the shape and size of the target fruit. For instance, the end effectors used for harvesting were designed to grasp, cut, and push the bunches of grapes.

Advantages of Robotic Technology

Berry thinning is another operation performed on the grapes, and is used to enhance the market value of the grapes, increase the grapes' size, and facilitate the bunching process. For

berry thinning, an end effector consists of an upper, middle, and lower part. The upper part has two plates and a rubber that can open and close. The two plates compress the grapes to cut off the rachis branches and extract the bunch of grapes. The middle part contains a plate of needles, a compression spring, and another plate which has holes spread across its surface. When the two plates compress, the needles punch holes through the grapes. Next, the lower part has a cutting device which can cut the bunch to standardize its length.

For spraying, the end effector consists of a spray nozzle that is attached to a manipulator. In practice, producers want to ensure that the chemical liquid is evenly distributed across the bunch. Thus, the design allows for an even distribution of the chemical by making the nozzle to move at a constant speed while keeping distance from the target.

Snapdragon 805

Agricultural robots are the fastest growing technology developed to perform various complex tasks that are difficult for humans to achieve. Recent news claims that the Japanese government has taken an initiative to use robotic operators in lands swamped by March 2011 tsunami. This ―Dream project‖ was planned to involve unmanned tractors working in the farm on the disaster site. The robotic farmers are capable of cultivating vegetables, fruits, soybeans, wheat and rice, which are then packed in boxes and shipped across the country by this robotic technology. This process is accompanied by recycling of carbon dioxide using machinery in an attempt to reduce the use of fertilizers.

Specifications

The Qualcomm Snapdragon 805 (APQ8084) is an ARM-based SoC largely for Android tablets and smartphones. Announced in November 2013, the S805 is the successor to the Snapdragon 801, making it the new top model among the ARM SoCs from Qualcomm. In addition to the slightly improved quad-core CPU (2.7 GHz vs. 2.5 GHz S801), the SoC integrates a brand-new GPU. The Adreno 420 offers new features like DirectX 11 and outperforms its predecessor by up to 40 percent. Furthermore, the chip integrates a 128-bit memory controller (LPDDR3-1600, 25.6 GB/s) and supports both Wi-Fi (802.11a/b/g/n/ac) and Bluetooth 4.1. UMTS and LTE(+) can be added by an additional radio (e.g. Gobi MDM 9x35).

CPU

The CPU cores have been modified just slightly and are now based on the Krait 450 architecture (performance per clock between Cortex-A7/A9 and Cortex-A15 or Apple Cyclone). This also means that the cores are still based on the ARMv7 ISA, which is a 32-bit design. Competitors like Apple are already selling 64-bit-capable ARMv8 chips, e.g. the Apple A8 and A8X as found on the iPhone 6 and iPad Air 2. Thanks to its quad-core design and very high clock rates of up to 2.7 GHz, the Snapdragon 805 offers a performance similar to the Samsung Exynos 5433 and is therefore one of the fastest ARM-based SoCs of 2014.

GPU

The new Adreno 420 graphics unit not only supports DirectX 11.1 (and therefore new features such as tessellation), but will also provide an up to 40 percent 3D performance boost compared to the previous Adreno 330. Overall, the Adreno 420 (usually clocked at 600 MHz) is somewhat faster than the Mali-T628 MP6 (Samsung Exynos 5420/5430) and PowerVR

G6430 (Apple A7). Only Nvidia's Tegra K1 and the PowerVR GX6650 (Apple A8X) are offering an even higher performance.

Features

As the Snapdragon 805 does not have a cellular modem, an additional module must be installed for use in smartphones. Qualcomm provides either the Gobi MDM9x25 or MDM9x35 series, both of which include support for UMTS, LTE(+) Cat. 4 and carrier aggregation.The Snapdragon 805 is one of the first SoCs available to be able to decode 4k videos with the H.265 codec and stream the content to a compatible TV. A large number of older video codecs are also supported.The revised camera ISP is now even more powerful than before and can handle a throughput in the GPixel/s range. This allows advanced post-processing capabilities as well as cameras with higher resolutions.

3-D Printing–Modern Manufacturing& Rapid Prototyping

3D printing is a computer aided, additive manufacturing process in which a solid part is created from its CAD (Computer Aided Design The CAD model produced by 3D modelling software applications such as CATIA, Solid works, Pro-Engineer, UG, etc. is first sliced into layers by various other software applications. The 3D printer then produces the cross section of t part and stacks it layer by lay to produce the finished real world replica of the intended CAD model.

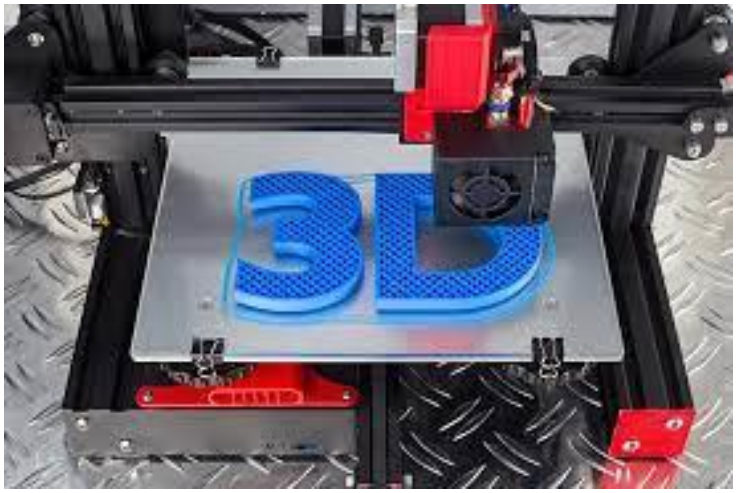
HOW IT WORKS?

This is one of the earliest technologies to be used as a prototyping technique and was patented by scientist and engineer Chuck Hull in 1986. It consists of a vat of photopolymer resin on a movable platform which moves in the Z-direction (up and down). The UV laser cures the 2D layer producing the cross section. After one layer is completed, the platform moves down by the Z-thickness value to fabricate the next layer. Therefore the X-Y coordinates actuate the UV laser whereas the Z coordinate is controlled by the platform. The UV light causes the photopolymer to harden exactly at the point where the light contacts the surface. The photopolymers can be epoxies, vinyl ethers or acrylates. The finished part is rinsed and support parts removed either manually resoluticuracy finished v e r close t t h e C A D model a engine g u a r a n t e ei n g companies to supply their best product in the least time possible.

Industrial applications include the sectors of aerospace, automotive, armaments, consumer electronics, medical and surgical equipment, toys and many other large scale production sectors. The SLA process although it being a success in mass production and large scale industries, are very expensive or the small scale and personal home based applications. A more commercialized method of the liquid based 3D printing process is the Inject based liquid process (ObjetPolyjet by Objet Geometries ltd.) w c A with material jet printing. A thin layer of photopolymer resin is sprayed onto a tray which is simultaneously exposed to a UV laser curing source. Sometimes instead of a heating source, a cooling source can cause the solidification (water cooled to ice), which is the case of the Rapid Freeze Prototyping Process.

Advantages of 3D models

3D printing is a computer aided additive manufacturing process in which a solid part is created from its CAD (Computer Aided Design) model. Sometimes this process is referred to as a 'freedom manufacturing' process thanks to its dynamic and flexible classes of applications. The CAD model produced by 3D modelling software applications such as CATIA, Solid works, Pro-Engineer, UG, etc. is first sliced into layers by various other software applications. The 3D printer then produces the cross section of the part and stacks it layer by layer to produce the finished real world replica of the intended CAD model. 3D printing has been known to maintain a cycle time reduction between 30%-90% depending on the technology used and the complexity of the part.



Zigbee Technology

The zigbee communication is a communication technology to connect local wireless nodes and provides high stability and transfer rate due to data communication with low power.

How it Works?

This technology suggests the grouping method that makes it possible to perform wide range data transferring depending on the node signal strength in zigbee node and analyse the suggested algorithm through simulation. Based on IEEE 802.15.4 Low Rate Wireless Personal Area Network (LRWPAN) standard, the Zigbee standard has been proposed to interconnect simple, low rate and battery powered wireless devices.

ZigBee is a low-cost, low-power, wireless mesh networking standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications, the low power-usage allows longer life with smaller batteries, and the mesh networking which promises high reliability and larger range. ZigBee has-been developed to meet the growing demand for capable wireless networking between numerous low power devices. Zigbee technology will be formed within next two to three years a minimum of 100-150 Zigbee chips would be present in it. It would cost only a 5$ for single chip. ZigBee is designed for remote controls and sensors, which are very many in number, but need only small data packets and, extremely low power consumption for longer life. The ZigBee Alliance targets applications across consumer, commercial, industrial and government markets worldwide. It is likely that ZigBee will increasingly play a vital role in the future of computer and communication technology.

Zigbee specifications

Zigbee is based on the Institute of Electrical and Electronics Engineers (IEEE) Standards Association's 802.15 specification. Zigbee is built for control and sensor networks on the IEEE 802.15.4 wireless standard for wireless personal area networks (WPANs). The Zigbee WPANs operate on 2.4 Ghz, 900 MHz and 868 MHz frequencies.

The Zigbee specifications, which are maintained and updated by the Zigbee Alliance, boost the IEEE 802.15.4 standard by adding network and security layers in addition to an application framework.

The standards created by the alliance can be used to create multivendor interoperable offerings. Manufacturers that are developing custom applications that don't need to operate with the applications of other manufacturers can create their own specific variations and extensions.

As of this writing, there are three Zigbee specifications: Zigbee PRO, Zigbee RF4CE and Zigbee IP.

Zigbee PRO aims to provide the foundation for IoT with features to support low-cost, highly reliable networks for device-to-device communication. Zigbee PRO also offers Green Power, a new feature that supports energy harvesting or self-powered devices that don't require batteries or AC power supply.

Zigbee RF4CE is designed for simple, two-way device-to-device control applications that don't need the full-featured mesh networking functionalities offered by the Zigbee specification.

Zigbee IP optimizes the standard for IPv6-based full wireless mesh networks, offering internet connections to control low-power, low-cost devices.

Gi-Fi Technology

For many years, cables ruled the world. Optical fibers played a dominant role because of its higher bit rates and faster transmission. But the installation of cables caused a greater difficulty and thus led to wireless access. The foremost of this is Bluetooth, which can cover 9- 10metres. Wi-Fi followed it having coverage area of 91metres. However, the standard's original limitations for data exchange rate and range, number of channels, high cost of the infrastructure have not yet made it possible for Wi-Fi to become a total threat to cellular networks.

Gi-Fi will help to push wireless communications to faster drive. Gi-Fi (Gigabit Fidelity) or Gigabit Wireless is the world's first transceiver integrated on a single chip that operates at 60GHz on the CMOS process. It will allow wireless transfer of audio and video data up to 5 Gigabits per second, ten times the current maximum wireless transfer rate at one-tenth of the cost, usually within a range of 10 meters. It utilizes a 5mm square chip and a 1mm wide antenna burning less than 2 mw of power to transmit data wirelessly over short distances, much like Bluetooth.

Gi-Fi or gigabit wireless refers to a wireless communication at a data rate of more than one billion bits (gigabit) per second.

By 2004 some trade press used the term "Gi-Fi" to refer to faster versions of the IEEE 802.11 standards marketed under the trademark Wi-Fi.

In 2008 researchers at the University of Melbourne demonstrated a transceiver integrated on a single integrated circuit (chip) that operated at 60 GHz on the CMOS process.It will allow wireless transfer of audio and video data at up to 5 gigabits per second, ten times the current maximum wireless transfer rate, at one-tenth the cost. Researchers chose the 57–64 GHz unlicensed frequency band since the millimetre-wave range of the spectrum allowed high component on-chip integration as well as the integration of very small high gain arrays. The

available 7 GHz of spectrum results in very high data rates, up to 5 gigabits per second to users within an indoor environment, usually within a range of 10 metres. Some press reports called this "GiFi".It was developed by Melbourne University-based laboratories of NICTA (National ICT Australia Limited), Australia's Information and Communications Technology Research Centre of Excellence.

In 2009, the Wireless Gigabit Alliance was formed to promote the technology. It used the term "WiGig" which avoided trademark confusion.

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