



**BHARATI VIDYAPEETH INSTITUTE OF TECHNOLOGY,  
NAVI MUMBAI**

**TECHNOPULSE**

**TECHNICAL MAGAZINE**

**2020-21**

**ELECTRONICS AND TELECOMMUNICATION  
DEPARTMENT**

## About Department:

Since its establishment in 1983, the Department of Electronics and Telecommunication Engineering is constantly engaged in the pursuit of providing quality education to aspiring engineers. With a sanctioned intake of 60 students, this department has always been the favourite choice among the students seeking admission to diploma course. Fully equipped and well maintained labs are instrumental in acquainting the students with various practical aspects of the technologies. A range of instruments available in Labs give students the opportunity to hone their practical skills. The instruments available in these labs encompass Colour TV trainer kit, Satellite receivers, Mobile communication Kits, DTH, Microprocessor & Microcontroller trainer kits. The Computers Lab. has sufficient number of PCs having internet facility on every single of them with a ratio of two students per PC Besides the programming languages, the PCs are loaded with educational software like PCB making software, Microprocessor & Microcontroller simulators, brain teasers etc. Well qualified and highly devoted staff is committed for imparting the best knowledge to the students. Proper guidance of staff along with sincere efforts of students' produces simulators, brain teasers etc. Well qualified and highly devoted staff is committed for imparting the best knowledge to the students. Proper guidance of staff along with sincere efforts of students' produces excellent results every year. Here we equip our students with essential knowledge and skills which help them to excel in this highly competitive & demanding world.

## Department Vision:

To impart quality education through exploration and experimentation and generate socially conscious engineers with embedded ethics and values

## Department Mission:

- **M1.** To produce competent Electronics and Telecommunication engineers through quality education by imparting knowledge, skill and project based learning.
- **M2.** To educate students with practical approach to dovetail them to various industries' needs.
- **M3.** To train students to be hard core professionals and entrepreneurs and also virtuous, ethical patriotic human beings concerned about society and the nation.

## Program Educational Objectives (PEOs)

- **PEO 1.** Provide socially responsible, environment friendly solutions to Electronics and Telecommunication engineering related broad-based problems adapting professional ethics.
- **PEO 2.** Adapt state-of-the-art Electronics and Telecommunication engineering broad-based technologies to work in multi-disciplinary work environments.

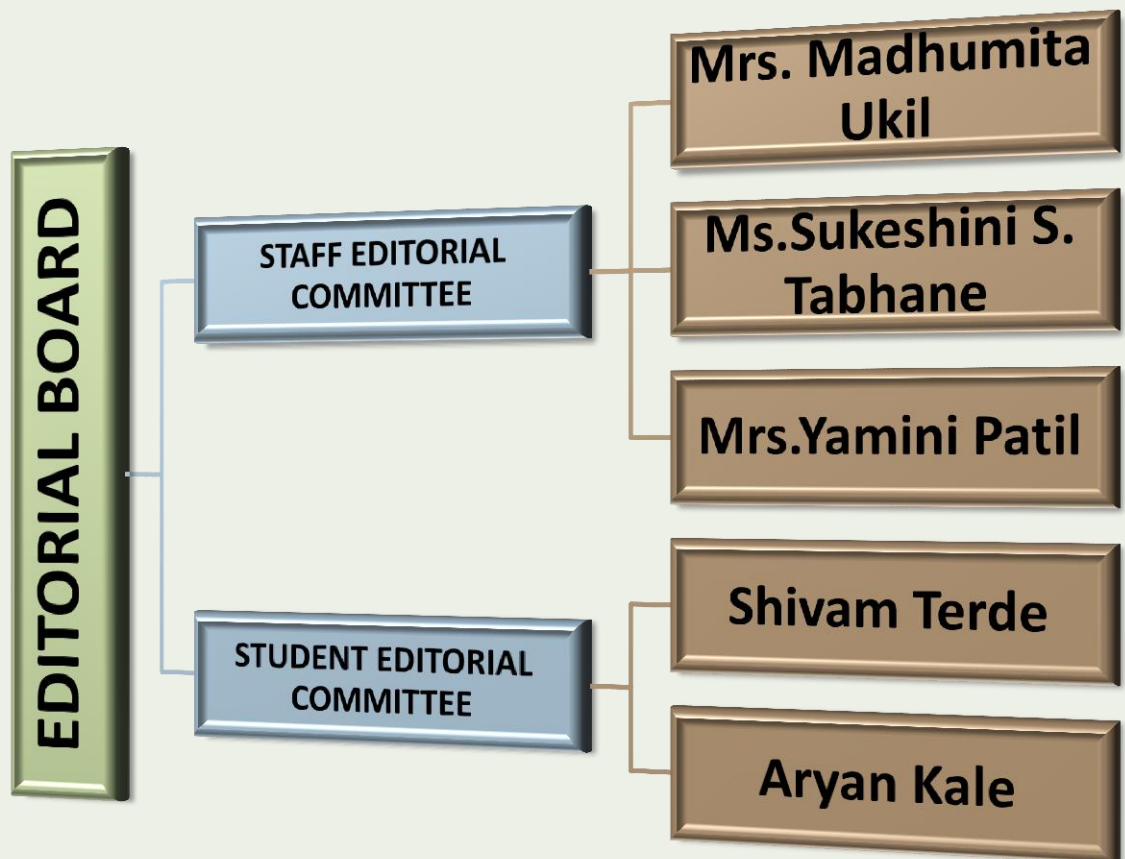
- **PEO 3.** Solve broad-based problems individually and as a team member communicating effectively in the world of work.

### **Program Outcomes (PO)**

- **PO 1. Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, sciences and engineering fundamentals and engineering specialization to solve the engineering problems.
- **PO 2. Problem analysis:** Identify and analyse well-defined engineering problems using codified standard methods.
- **PO 3. Design/ development of solutions:** Design solutions for well-defined technical problems and assist with the design of system components or processes to meet specified needs.
- **PO 4. Engineering tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.
- **PO 5. Engineering practices for society, sustainability and environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.
- **PO 6. Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
- **PO 7. Life-long learning:** Ability to analyse individual needs and engage in updating in the context of technological changes.

### **Program Specific Outcomes (PSO)**

- **PSO 1. Electronics and Telecommunication Systems:** Maintain various types of Electronics and Telecommunication systems.
- **PSO 2. EDA Tools Usage:** Use EDA tools to develop simple Electronics and Telecommunication engineering related circuits.



## From Principal's Desk



*Dear Distinguished Members of the Electronics and Telecommunications Department,*

*It brings me immense pride to welcome you to the unveiling of our department's technical magazine. This compilation is a testament to the brilliance and dedication of our students and faculty in the realm of Electronics and Telecommunications.*

*I extend my heartfelt appreciation to everyone involved in bringing this magazine to fruition. Your passion for pushing the boundaries of knowledge is truly commendable, and I am confident that the discoveries and advancements highlighted here will inspire both our current students and future generations.*

*May this magazine serve as a beacon of inspiration, reflecting our commitment to fostering intellectual curiosity and pioneering spirit within the realm of electronics and telecommunications.*

*Warm regards,*

*Principal*

*P.N.Tandon*

## Electronics Unveiled

In the ever-evolving landscape of technology, electronics stands as the cornerstone, powering the very essence of our interconnected world. From the smallest microchip to the grandest supercomputer, the realm of electronics is a testament to human ingenuity and the relentless pursuit of innovation.

### **The Evolution of Electronics:** A Journey Through Time

The journey of electronics traces back to humble beginnings, with early experiments in telegraphy and telephony paving the way for the intricate circuitry we witness today. The advent of the transistor in the mid-20th century marked a revolutionary turning point, propelling us into the digital age and laying the groundwork for the information era.

### **Miniaturization and Moore's Law:** The Shrinking Wonders

One of the defining features of electronics is the relentless pursuit of miniaturization. Moore's Law, coined by Gordon Moore in 1965, observed that the number of transistors on a microchip would double approximately every two years. This prediction has held true, driving a technological surge that has given birth to compact yet immensely powerful devices, from smartphones to wearable gadgets.

### **The Digital Symphony:** Understanding Integrated Circuits

At the heart of modern electronics lie integrated circuits (ICs), where millions of transistors work harmoniously to process information. This digital symphony enables the seamless functioning of devices, from computing and communication to the intricate operations of everyday appliances.

### **Powering the Future:** Renewable Energy and Electronics

As environmental concerns take center stage, electronics plays a pivotal role in shaping a sustainable future. The integration of renewable energy sources, such as solar and wind, with advanced electronic systems opens new frontiers in power management and conservation.

### **Internet of Things (IoT):** A Connected Tomorrow

The rise of the Internet of Things exemplifies the transformative power of electronics. Everyday objects are becoming smart, interconnected entities, communicating seamlessly to enhance efficiency and convenience. From smart homes to industrial automation, IoT is reshaping the way we live and work.

### **Challenges and Opportunities:** Navigating the Electronic Frontier

While electronics propels us into a future of boundless possibilities, it also presents challenges. Issues of cyber security, electronic waste management, and ethical considerations in artificial intelligence underscore the need for responsible innovation and thoughtful exploration of the electronic frontier.

In conclusion, the field of electronics continues to captivate our imaginations,

steering humanity towards a future where innovation knows no bounds. As we stand on the precipice of uncharted technological territories, the journey through the world of electronics promises to be an exciting odyssey, unlocking new realms of possibility and reshaping the very fabric of our existence.

*MANASI MHATRE (TYEJ)*



## Polytronics

Silicon has largely influenced the Electronics industry and would continue to do so over a period of time. However, technologists are now looking at other alternatives, mainly “PLASTIC CIRCUITS”, to meet our future needs. Here is a look into how plastics would influence the world of electronics.

The study of usage of polymeric materials in electronics is termed as “POLYTRONICS”. This polytronics has some advantages over silicon technology. They are

1. Easy Manufacturability (mass production).
2. Low cost.
3. They can be recycled and reused (decreases environmental stress).
4. Consumes less power.
5. They are mobile, small, and light in weight.
6. They are used to make display devices that have extraordinary picture quality.

The feasibility of developing entire electronic components on basis of polymers is met by “INKJET PRINTING TECHNOLOGY” and is illustrated by several applications such as electronic paper, plastic batteries, etc

### Inkjet Printing Technology

The huge cost of manufacturing Silicon microchip is due to the large complex processes involved. Photolithographic techniques are used to pattern wafers with

microcircuit, which is grown in powerful vacuum, while the wafers are baked at temperatures of several hundred centigrades. The INKJET PRINTING TECHNOLOGY provides continuous production line of plastic circuits on plastic substrates and then cut into individual units. The substrates are made of acetate material that is as transparent as vugraph sheets. This printing technology plays a major role in the development of “flat screen” displays. Principle

A piezoelectric material expands when a voltage is passed across it, pressing on a reservoir fluid and sending droplets flying out on to the substrates. Here, the construction of “TOPGATE TRANSISTOR” is explained below .

The water based droplets contain an organic conductor-POLY (3,4-ethylenedioxythiophene) doped with a solution of polystyrene sulphonic acid otherwise known as PEDOT/PSS. As the droplets dry they become a conducting layer and form source and drain of a transistor. They are then coated with a layer of semiconducting polymer (9, 9-dioctyl flourene-co-bithiophene) followed by a dielectric layer of polyvinylphenol. Finally gate is printed, creating a so called top gate transistor. How the semiconductor polymer dries is very crucial.



The molecular chains must line up in a way that makes it easy for an electron to hop from one chain to another, but the polymers tend to form into disordered microstructure that reduces electron charge.

Resolution of the screen can be improved by coating glass substrate with a hydrophobic film of polyimide pattern. When the water based droplets fall on the surface they are forced away from the hydrophobic regions in the required pattern

#### Plastic Batteries

Plastic batteries are new type of low power batteries that do not require a case and are thin enough to be printed on a paper. They are of low cost and can be mass produced as the battery material is roughly 0.5 millimeters thick.

- The new battery consists of 3 different layers.

- It has conventional zinc manganese dioxide components as anode and cathode which are thin foil-like plastic sheets.

- Electrolyte is a polymer gel placed between electrodes.

Uses: .

- They can be used for incorporating power source in integrated circuits.
- The polymer battery system can be used to power space satellites, giving them uninterrupted power supply by harnessing solar energy.

#### Conclusion and Future Scope

In today's world of ever-expanding technology, Polytronics is going to change the whole world of consumer electronics and form the principal root for the major advancement in the design of electronic circuits and manufacture of printed circuit boards (PCB).

*SIDDHI DHANAWADE –(FYEJ)*

## Signal Processing

In the digital age, where information flows like a river, signal processing stands as the maestro orchestrating the symphony of data. This transformative field not only shapes our communication systems but permeates countless aspects of modern life, from audio enhancement to medical imaging. Let's explore the nuances of signal processing and its profound impact on the way we perceive, transmit, and extract meaning from the vast sea of information that surrounds us.

### 1. **Understanding Signals:** The Language of Information:

At its core, signal processing deals with signals – representations of information. Signals can be audio, visual, or even numerical. Signal processing seeks to manipulate and analyze these signals to extract meaningful insights, enhance quality, or facilitate efficient transmission.

### 2. **Analog to Digital:** The Digital Revolution:

The journey of signal processing often begins with converting analog signals into digital format. This shift, spurred by the advent of computers, allows for precise manipulation, storage, and transmission of information. Analog-to-digital conversion is the gateway to a realm where signals become malleable entities, ready to be shaped and transformed.

### 3. **Filtering and Enhancement:** Sharpening the Signal's Clarity:

Signal processing incorporates various techniques, such as filtering, to enhance the quality of information. Whether it's removing noise from an audio recording or sharpening an image in medical imaging, these processes refine signals, ensuring that the information they carry is clear and accurate.

### 4. **Compression:** Maximizing Efficiency in Information Transmission:

In the era of bandwidth limitations and storage constraints, signal processing plays a pivotal role in compression. Through algorithms that reduce redundant information, such as in JPEG images or MP3 audio files, signal processing enables the efficient transmission and storage of vast amounts of data.

### 5. **Real-time Processing:** Enabling Instant Insights:

In applications like audio processing for live performances or radar systems for defense, real-time signal processing is essential. The ability to analyze and act upon signals instantaneously is a testament to the speed and efficiency of signal processing algorithms, contributing to the seamless operation of various technologies.

### 6. **Signal Processing in the Digital Age:**

As we embrace technologies Internet of Things, signal processing takes center stage. The fusion of advanced algorithms with powerful computing capabilities opens new frontiers, enabling us to process massive datasets, extract intricate patterns, and make informed decisions in real-time.

**Conclusion:**

Signal processing, in its elegant dance with technology, has become an indispensable part of our daily lives. From the clarity of a phone call to the precision of medical diagnostics, its impact is profound and pervasive. As we continue to push the

boundaries of what is possible in the digital realm, the symphony of signal processing will undoubtedly compose new melodies, unveiling ever more sophisticated ways to harness, refine, and understand the information that surrounds us.

*TAIKHOOM RAJKOTWALA - TYEJ*

## Plasma Display

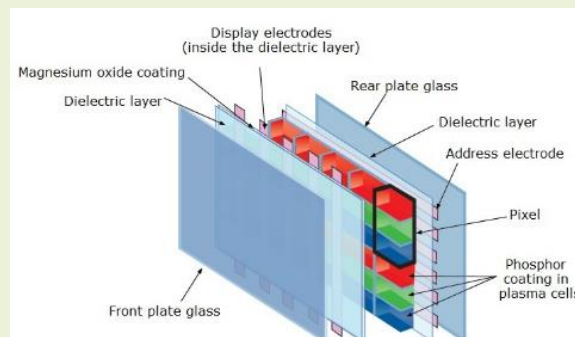
In this mad rush, particles are constantly bumping into each other. These collisions excite the gas atoms in the plasma, causing them to release photons of energy.

Xenon and neon atoms, the atoms used in plasma screens, release light photons when they are excited. Mostly, these atoms release ultraviolet light photons, which are invisible to the human eye. But ultraviolet photons can be used to excite visible light photons

### Inside the Display

The xenon and neon gas in a plasma television is contained in hundreds of thousands of tiny cells positioned between two plates of glass. Long electrodes are also sandwiched between the glass plates, on both sides of the cells. The address electrodes sit behind the cells, along the rear glass plate. The transparent display electrodes, which are surrounded by an insulating dielectric material and covered by a magnesium oxide protective layer, are mounted above the cell, along the front glass plate.

Both sets of electrodes extend across the entire screen. The display electrodes are arranged in horizontal rows along the screen and the address electrodes are arranged in vertical columns. As you can see in the diagram below, the vertical and horizontal electrodes form a basic grid.



### The Basics of Plasma Displays

Plasma display technology is a new "emmissive" flat panel display technology which gives you the rich, accurate color fidelity of conventional Cathode Ray Tube (CRT) monitors in a large display that is thin enough to hang on the wall. It's the best way to achieve flat panel displays with excellent image quality and large screen sizes viewable in any environment. This technology known as "plasmavision" is an array of cells, known as pixels, which are composed of 3 sub-pixels, corresponding to the colors red, green and blue.

Gas in a plasma state is used to react with phosphors in each sub-pixel to produce colored light (red, green or blue). These phosphors are the same types used in conventional cathode ray tube (CRT) devices such as televisions and standard computer monitors. You get the rich, dynamic colors you expect. Each subpixel is individually controlled by advanced electronics to produce over 16 million different colors. You get perfect images that

are easily viewable in a display that is less than 4 inches thick.

Step 1: Address electrode causes gas to change to plasma state. Step 2: Gas in plasma state reacts with phosphors in discharge region. Step 3: Reaction causes each subpixel to produce red, green, and blue light.

### **Conventional Plasma Displays**

Basic plasma display technology has been around since the 1960's, and works this way: a mixture of neon and xenon gas fills the space between two parallel sheets of glass, which contain millions of tiny cells filled with the gas mixture. This mixture is

stimulated by electrical current and is changed into a plasma. As a result, ultraviolet (UV) light is emitted. Red, blue, and green fluorescent substances in the cells absorb this UV light, then re-radiate this energy as visible light to produce the colors and images you see on the screen.

This process creates a bright, vibrant picture. And since these individual cells are creating light and color, there's no need for the large cathode ray tubes (CRT's) used in conventional and projection TV's, and the display can be very thin and relatively lightweight. Plus, the flat screen eliminates the problem of images bending at the edge of the picture, as seen in conventional TV's.

*VRUSHABH BARIA - SYEJ*

## Organic Light Emitting Diodes (OLED)

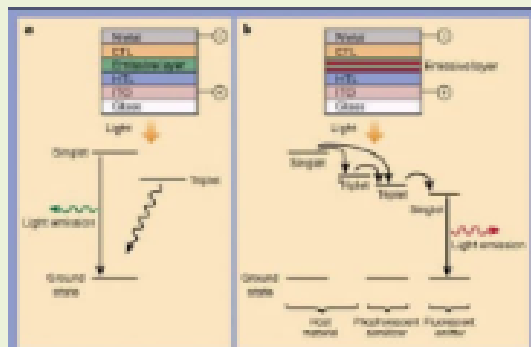
Common light emitters today, Light Emitting Diodes (LEDs) and ordinary light bulbs consume more power than organic diodes do. And the strive to decrease power consumption is always something of matter. Other reasons for the industrial attention are i.e. that eventually organic full color displays will replace today's liquid crystal displays (LCDs) used in laptop computers and may even one day replace our ordinary CRT-screens.

Organic light-emitting devices (OLEDs) operate on the principle of converting electrical energy into light, a phenomenon known as electroluminescence. They exploit the properties of certain organic materials which emit light when an electric current passes through them. In its simplest form, an OLED consists of a layer of this luminescent material sandwiched between two electrodes. When an electric current is passed between the electrodes, through the organic layer, light is emitted with a color that depends on the particular material used. In order to observe the light emitted by an OLED, at least one of the electrodes must be transparent.

When OLEDs are used as pixels in flat panel displays they have some advantages over backlit active-matrix LCD displays - greater viewing angle, lighter weight, and quicker response. Since only the part of the display that is actually lit up consumes power, the

most efficient OLEDs available today use less power.

Based on these advantages, OLEDs have been proposed for a wide range of display applications including magnified microdisplays, wearable, head-mounted computers, digital cameras, personal digital assistants, smart pagers, virtual reality games, and mobile phones as well as medical, automotive, and other industrial applications.



### OLED Versus LED

Electronically, OLED is similar to old-fashioned LEDs -- put a low voltage across them and they glow. But that's as far as the similarity goes: instead of being made out of semiconducting metals, OLEDs are made from polymers, plastics or other carbon-containing compounds. These can be made very cheaply and turned into devices without all the expensive palaver that goes with semiconductor fabrication.

Light-emitting diodes, based upon semiconductors such as Gallium Arsenide, Gallium Phosphide, and, most recently, Gallium Nitride, have been around since the late '50s. They are mostly used as indicator lamps, although they were used in calculators before liquid crystals, and are used in large advertising signs, where they are valued for very long life and high brightness. Such crystalline LEDs are not inexpensive, and it is very difficult to integrate them into small high-resolution displays.

The operation of an LED is based upon the fact that semiconductors can be of two types, p-type or n-type, depending upon whether dopants pull electrons out of the crystal, forming "holes", or add electrons. An LED is formed when p-type and n-type materials are joined. When a voltage is applied, causing electrons to flow through the structure, electrons flow into the p-type material, and holes flow into the n-type material. An electron-hole combination is unstable; there is too much potential energy to be released. As a result, they combine and release the energy in the form of light. This can be a very efficient way to convert electricity to light.

There is a wide class of organic compounds, called conjugated organics or conjugated polymers, which have many of the characteristics of semiconductors. They have energy gaps of about the same magnitude, they are poor conductors without dopants, and they can be doped to conduct by electrons (n-type) or holes (p-

type). Initially, these materials were used as photoconductors, to replace inorganic semiconductor photoconductors, such as selenium, in copiers. About fifteen years ago it was discovered that, just as with crystalline semiconductors, p-type and n-type organic materials can be combined to make light-emitting diodes whereby a current passing through a simple layered structure produces visible light with high efficiency.

Since light-emitting diodes, as their name suggests, actually generate their own light while using very little battery power, they have long been viewed as an obviously better way to create displays. Unfortunately, while conventional L.E.D.'s work well in giant screens and advertising displays like those in Times Square, they cannot easily be used to create small, high-resolution screens for portable computers.

OLED is an emissive display technology based on thin organic light-emitting films. Like conventional inorganic light emitting diodes (LED), OLED requires a low-drive voltage to produce bright visible light. But unlike discrete LEDs, which have crystalline origins, thin film-based OLEDs have area emitters that can easily be patterned to produce flat-panel displays. Because OLEDs are self-luminous, backlights are not required as in liquid-crystal displays (LCDs). OLEDs have very low power requirements and are thin, bright and efficient.



Because crystalline order is not required, organic materials, both molecular and polymeric, can be deposited far more cheaply than the inorganic semiconductors of conventional LED's. Patterning is also easier, and may even be accomplished by techniques borrowed from the printing industry. Displays can be prepared on flexible, transparent substrates such as plastic. These characteristics form the basis for a display technology that can eventually replace even paper, providing the same resolution and reading comfort in a long-lived, fully reusable (and eventually recyclable) digital medium.

Also OLEDs are much more efficient than today's components when it comes to

power consumption and produced light. Common light emitters today, Light Emitting Diodes (LEDs) and ordinary light bulbs consume more power. To tell something about the efficiency of components we will use the concept of Quantum Efficiency (QE), which is defined as the relation between photons produced and electrons injected. To achieve a high QE for a light bulb it would be necessary to change the relation between produced heat and produced light. To increase the QE for a LED it is necessary to limit the absorption of the photons produced. It has been generally observed that organic devices can and will produce high quantum efficiencies than organic diodes do.

*RIYA GORADE -TYEJ*

## Orbital Debris

### Introduction:

The vast expanse of space, once considered a pristine environment, is now increasingly cluttered with remnants of human exploration and satellite activities. Orbital debris, also known as space junk, poses a growing concern for the sustainability of space operations and the long-term health of Earth's orbital environment.

### The Silent Menace:

Orbital debris comprises defunct satellites, spent rocket stages, and fragments from collisions or disintegration events. This section delves into the magnitude of the issue, highlighting the thousands of tracked objects and the countless smaller, untraceable particles that collectively pose a threat to operational satellites and future space missions.

### Collision Risks and Consequences:

As the density of orbital debris increases, so does the risk of collisions. We explore the potential consequences of such collisions, from the creation of more debris to the heightened danger for operational satellites and crewed space missions. The Kessler Syndrome, a theoretical scenario in which a chain reaction of collisions generates even more debris, is examined for its implications.

### Mitigation and Prevention Efforts:

Efforts to mitigate and prevent the growth of orbital debris are crucial. This section outlines current strategies, including satellite design for post-mission disposal, debris removal technologies, and international guidelines for responsible space activities. The challenges associated with implementing effective debris management practices are also discussed.

### Space Sustainability Initiatives:

The rise of space sustainability initiatives reflects a global acknowledgment of the orbital debris problem. We explore collaborative efforts among space agencies, private companies, and international organizations to address the issue collectively. The development of guidelines for responsible space behavior and the promotion of sustainable space practices are central themes.

### Emerging Technologies for Debris Removal:

Innovative technologies are being developed to actively remove debris from orbit. This section highlights advancements in debris removal, including concepts like robotic arms, nets, and harpoons designed to capture and de-orbit defunct satellites and fragments. The challenges and prospects of implementing these technologies on a large scale are examined.

**Conclusion:**

Orbital debris presents a formidable challenge as humanity continues to explore and exploit the vastness of space. This article underscores the urgency of addressing this issue through global collaboration, technological innovation, and

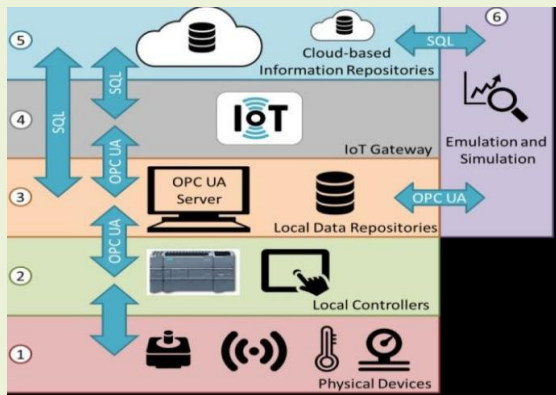
responsible space practices. The fate of our orbital environment and the sustainability of future space endeavors depend on our ability to navigate the perilous sea of orbital debris.

*MANASVI MENGADE - FYEJ*

## Digital Twin

### 1. Introduction:

A digital twin is a virtual replica of a physical object, system, or process. This technology has gained widespread adoption across various industries, revolutionizing the way products are designed, manufactured, and maintained. By creating a digital counterpart, organizations can simulate, monitor, and analyze real-world scenarios, unlocking new levels of efficiency, innovation, and optimization.



### 2. Key Components:

**Geometry and Visualization:** Digital twins capture the physical attributes and appearance of their real-world counterparts, allowing for a visual representation of the object or system.

**Sensor Data Integration:** Real-time data from sensors and IoT devices are integrated into the digital twin, providing a continuous stream of information about the physical entity's performance and condition.

**Physics-based Models:** Advanced simulations and physics-based models help replicate the behavior and interactions of the physical system in the virtual environment.

### 3. Applications Across Industries:

#### a. Manufacturing:

Digital twins enable manufacturers to optimize production processes, simulate different scenarios, and enhance overall operational efficiency. Predictive maintenance based on real-time data minimizes downtime and reduces maintenance costs.

#### b. Healthcare:

In healthcare, digital twins of individual patients or organs aid in personalized treatment planning. They facilitate simulation of medical procedures and contribute to the development of innovative medical devices.

#### c. Aerospace and Automotive:

Designing and testing prototypes in a virtual environment before physical production reduces development costs. Digital twins are used for predictive maintenance of aircraft and automobiles, ensuring optimal performance.

#### d. Smart Cities:

Digital twins of urban infrastructure help city planners simulate the impact of changes, optimize traffic flow, and enhance public services. This technology is pivotal in creating sustainable and efficient smart cities.

#### **4. Advantages:**

**Predictive Analysis:** By analyzing real-time data from the digital twin, organizations can predict potential issues, improving decision-making and reducing downtime.

**Optimization:** Continuous monitoring and simulation allow for the optimization of processes, leading to increased efficiency and resource utilization.

**Innovation:** Digital twins serve as a platform for testing new ideas and innovations in a risk-free virtual environment before implementation in the physical world.

#### **5. Challenges:**

**Data Security:** Protecting the integrity and security of the data within digital twins is a significant concern, especially as these virtual replicas often contain sensitive information.

**Interoperability:** Ensuring compatibility and interoperability between different systems and platforms is a challenge when implementing digital twin technologies.

#### **6. Future Trends:**

**Integration with AI:** Combining digital twins with artificial intelligence will enhance predictive capabilities and decision-making processes.

**Edge Computing:** Processing data closer to the source (edge computing) will reduce latency and improve real-time interactions within the digital twin environment.

#### **7. Conclusion:**

Digital twins are at the forefront of the fourth industrial revolution, transforming industries and offering a holistic approach to product lifecycle management. As technology continues to advance, the seamless integration of digital twins with other emerging technologies will unlock even greater potential, shaping the future of innovation and efficiency across various sectors.

*ANKIT JHA -SYEJ*

## Stratellite

Wireless communication is simply data communication without the use of landlines. This may involve cellular telephone, two-way radio, fixed wireless (broadband wireless), laser (freespace optics) or satellite communication systems. Mobile wireless technologies are going to act as glue towards bringing together the wired and wireless to share and distribute information seamlessly across each other's areas of reference.

Since from the beginning of wireless communications, there have been a number of developments in each generation. Considering the future generation of wireless communication i.e; 4G .

Stratellite is a brand name trademark of Sanswire for a future emissions-free, high-altitude stratospheric airship that provides a stationary communications platform for various types of wireless signals usually carried by communications towers or satellites . The Stratellite is a concept that has undergone several years of research and development, and is not yet commercially available; Sanswire, with its partner TAO Technologies, anticipates its current testing sequence to include the launch of a Stratellite into the stratosphere .

A new generation of cellular standards has appeared approximately every tenth year since 1G systems were introduced in 1981/1982. Each generation is characterized by new frequency bands, higher data rates and non backwards compatible transmission technology. The first release of the 3GPP Long Term Evolution (LTE) standard does not completely fulfill the ITU 4G requirements called IMT-Advanced. First release LTE is not backwards compatible with 3G, but is a pre-4G or 3.9G technology, however sometimes branded "4G" by the service providers. Its evolution LTE Advanced is a 4Gtechnology. WiMAX is another technology verging on or marketed as 4G.

### Stratellite

A "stratellite" is a high-altitude airship (HAA) "25 times larger than the Goodyear blimp" employed much like a satellite for remote sensing, navigation, and communications. Instead of being stationed on orbit, stratellites are positioned in the stratosphere approximately 13 miles above the Earth. This altitude places the airships above both commercial air traffic and weather effects but significantly lower than standard low earth orbits. From this height stratellites can service a 300,000-square-mile-area.

### Construction of Stratellites

The initial Stratellite was 188 feet long, 60 feet wide and 42 feet high. It is provided with a new steering method which uses a hybrid electric system that drives large, slow-turning propellers. This gives the airship helicopter-like agility by being able to move both up and down, and side to side. The outside layer, or "envelope," is made out of a high-tech material called Spectra - a fabric used in bullet-proof vests and parts of space shuttles. Spectra contains fibre 10 times as strong as steel of the same weight and has the unique feature of being easy to cut but virtually impossible to tear.



The inside layer, made from a thin but strong polyester film called Mylar, is fitted inside the envelope and filled with a mixture of helium and air as helium is an inert gas and is therefore not flammable. With this design, the helium expands as the airship rises, forcing air out and lifting the airship.

*SAYALI MASKE -TYEJ*



## Report on Flexible Printed Circuit Boards (Flex PCBs)

### Introduction:

#### a. Definition:

Flexible Printed Circuit Boards (Flex PCBs), also known as flex circuits or flexible electronics, are a type of electronic interconnect technology characterized by their ability to bend, twist, and conform to irregular shapes. They provide a flexible and lightweight alternative to traditional rigid printed circuit boards (PCBs) in various electronic applications.



### Design and Structure:

#### a. Materials:

Flex PCBs are typically made from flexible polymer materials, such as polyimide or polyester. These materials offer durability, flexibility, and resistance to heat and chemicals.

#### b. Conductive Traces:

Conductive traces are patterned onto the flexible substrate using copper or other

conductive materials. These traces establish the electrical connections between different components on the Flex PCB.

#### c. Coverlay and Solder Mask:

A coverlay, typically made of polyimide or similar material, is applied over the conductive traces to protect them from environmental factors and physical damage. Solder mask layers are also used to insulate and protect the traces.

### Advantages:

#### a. Flexibility and Form Factor:

Flex PCBs provide the ability to conform to three-dimensional shapes, making them suitable for applications where space is limited or where flexibility is a design requirement.

#### b. Weight and Size Reduction:

Flex PCBs are lightweight and compact, contributing to weight and size reduction in electronic devices. This is particularly beneficial in portable and wearable electronics.

#### c. Reliability:

With fewer interconnects and solder joints compared to rigid PCBs, Flex PCBs can offer increased reliability by minimizing points of failure and enhancing shock and vibration resistance.

**d. High-Density Integration:**

Flex PCBs support high-density integration of electronic components, enabling the creation of complex electronic systems within a small form factor.

**Applications:****a. Consumer Electronics:**

Flex PCBs are widely used in smartphones, tablets, and wearable devices where space and weight considerations are critical.

**b. Medical Devices:**

In medical applications, Flex PCBs are utilized in devices such as medical sensors, flexible electrodes, and implantable devices due to their conformability.

**c. Automotive Electronics:**

The automotive industry employs Flex PCBs in various applications, including infotainment systems, instrument clusters, and under-the-hood electronics, benefiting from their resistance to temperature variations and vibrations.

**d. Aerospace and Defense:**

Flex PCBs are used in aerospace applications, where their lightweight and

flexible nature is advantageous for space-constrained environments.

**Challenges:****a. Cost:**

Flex PCBs can be more expensive to manufacture than rigid PCBs due to the specialized materials and manufacturing processes involved.

**b. Design Complexity:**

Designing for Flex PCBs requires specialized knowledge and considerations, especially regarding bend radius, component placement, and material properties.

**Conclusion:**

Flexible Printed Circuit Boards represent a transformative approach to electronic interconnects, providing unparalleled flexibility and versatility. Their applications span various industries, from consumer electronics to healthcare and aerospace. As advancements continue in materials science and manufacturing techniques, Flex PCBs are poised to play a pivotal role in the evolution of electronic devices, enabling innovation in design and functionality.

*SOHAM BAKKAR – SYEJ*

## Li-ion Batteries and Nuclear Batteries

### Introduction:

#### a. Li-ion Batteries:

Lithium-ion (Li-ion) batteries are rechargeable energy storage devices widely used in various applications, from portable electronics to electric vehicles. They have become a cornerstone in the transition towards cleaner and more sustainable energy solutions.

#### b. Nuclear Batteries:

Nuclear batteries, also known as radioisotope thermoelectric generators (RTGs) or atomic batteries, convert the heat generated by radioactive decay into electrical power. While not as commonplace as Li-ion batteries, nuclear batteries offer a unique solution for specific scenarios, such as space exploration.

### Li-ion Batteries:

#### a. Composition and Operation:

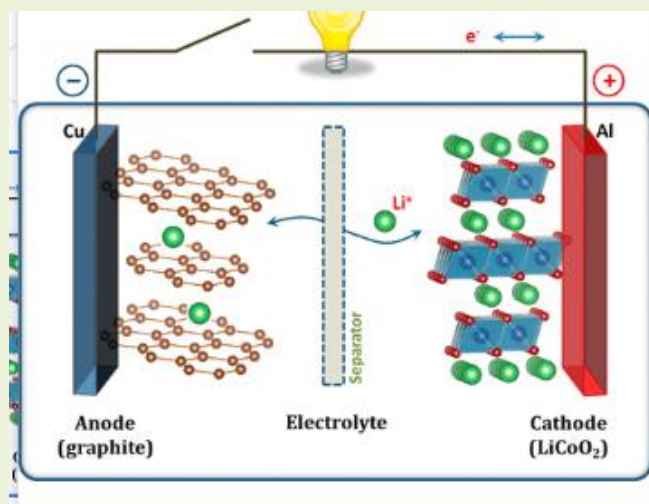
Li-ion batteries typically consist of a cathode, an anode, and an electrolyte. During discharge, lithium ions move from the anode to the cathode, creating an electric current. During charging, the process is reversed. Common cathode materials include lithium cobalt oxide, lithium manganese oxide, and lithium iron phosphate.

#### b. Advantages:

**High Energy Density:** Li-ion batteries offer a high energy density, providing more energy storage capacity for their size and weight.

**Long Cycle Life:** They generally have a longer cycle life compared to traditional rechargeable batteries.

**Widespread Use:** Li-ion batteries power a



broad range of devices, from smartphones to electric vehicles.

### Nuclear Batteries:

#### a. Operation:

Nuclear batteries utilize the heat generated by the radioactive decay of isotopes, such as plutonium-238, to produce electricity through thermoelectric conversion. This process ensures a continuous and reliable power source for extended periods.

**b. Advantages:**

**Long Lifespan:** Nuclear batteries have a long operational life, making them suitable for missions with extended durations, such as space exploration.

**High Energy Density:** They offer a high energy density, particularly useful in scenarios where frequent recharging or replacement is impractical.

**c. Challenges:**

**Radioactive Material Handling:** The use of radioactive isotopes raises concerns regarding safety, disposal, and potential environmental impact.

**Limited Applicability:** Nuclear batteries are not suitable for all applications due to their specific requirements and regulatory constraints.

**Future Outlook:****a. Li-ion Batteries:**

Ongoing research aims to enhance the energy density, reduce costs, and address raw material supply issues. Advancements may expand their use in electric vehicles,

renewable energy storage, and portable electronics.

**b. Nuclear Batteries:**

Continued exploration of advanced materials and safety measures may broaden the application of nuclear batteries. They are likely to remain integral for deep space missions and other scenarios where long-lasting, reliable power sources are critical.

**Conclusion:**

Li-ion batteries and nuclear batteries represent distinct but important contributions to the evolving landscape of energy storage solutions. Li-ion batteries play a central role in our daily lives, supporting portable electronics and the shift toward electric transportation. Nuclear batteries, though less common, offer unique advantages in specific applications, particularly those requiring long-term, reliable power sources, such as space exploration. The future development of both technologies will be shaped by ongoing innovations, addressing challenges, and the growing demand for sustainable and efficient energy solutions.

*PRATHAMESH KARJEKAR - TYEJ*

## The ECG T-Shirt

The integration of wearable technology into healthcare has reached a new pinnacle with the advent of the ECG T-Shirt. This report explores the groundbreaking implications of this innovative wearable, providing real-time electrocardiogram (ECG) monitoring in the form of a comfortable and practical garment.

### Introduction:

The ECG T-Shirt merges fashion with functionality, offering users a non-intrusive and continuous monitoring solution for heart health. This section introduces the concept, emphasizing the potential impact on preventive healthcare and the convenience it provides for individuals seeking continuous cardiac monitoring.

### Technology Behind the ECG T-Shirt:

Exploring the core technology, this section details how the ECG T-Shirt incorporates sensors seamlessly into the fabric. The integration of conductive materials and miniaturized electronics allows for accurate ECG measurements, capturing vital data without the need for traditional adhesive electrodes.

### Continuous Monitoring and Data Analysis:

One of the key advantages of the ECG T-Shirt is its ability to provide continuous monitoring. Users can gain insights into their heart health over extended periods,

enabling early detection of irregularities. This section discusses the importance of continuous data collection and how it facilitates more comprehensive analysis.

### User Experience and Comfort:

Focusing on user-centric design, this section highlights the comfort and ease of use of the ECG T-Shirt. Wearers can seamlessly incorporate it into their daily lives, promoting long-term adherence to monitoring routines. The garment's washability and durability contribute to its practicality.

### Applications in Healthcare:

The ECG T-Shirt extends beyond personal use, finding applications in healthcare settings. This section explores how healthcare professionals can leverage the continuous monitoring data for diagnostics, treatment planning, and remote patient monitoring, potentially revolutionizing the approach to cardiac care.

### Data Security and Privacy:

Addressing concerns related to data security and privacy is crucial. This section discusses the measures in place to ensure the confidentiality and integrity of the sensitive health data collected by the ECG T-Shirt. Compliance with healthcare regulations and standards is emphasized.

**Future Developments:**

As with any emerging technology, this section outlines potential future developments, including improvements in sensor technology, enhanced connectivity features, and integration with other health metrics. Additionally, it addresses challenges such as standardization, affordability, and user education.

**Conclusion:**

The ECG T-Shirt represents a paradigm shift in cardiac monitoring, blending technology

and everyday apparel to bring continuous heart health insights to individuals and healthcare professionals alike. As the wearable technology landscape evolves, the ECG T-Shirt stands as a testament to the transformative power of innovation in improving healthcare outcomes.

*ARGHYA DAS - TYEJ*

## The Smart Note Taker

### Introduction:

In an era dominated by digital advancements, the convergence of technology and note-taking has given rise to the Smart Note Taker—a game-changer in the realm of productivity. This article explores the innovative features and transformative impact of this digital marvel.

### The Essence of Smart Note Taking:

At its core, a Smart Note Taker is designed to bridge the gap between traditional note-taking methods and the efficiency of digital technology. It seamlessly combines the tactile experience of jotting down notes with the intelligence to digitize and organize information effortlessly.

### Handwriting Recognition Technology:

One of the standout features of a Smart Note Taker is its ability to convert handwritten notes into digital text. This section delves into the intricacies of handwriting recognition technology, highlighting how machine learning algorithms decipher and translate individual handwriting styles into editable, searchable text.

### Synchronization Across Devices:

The true power of a Smart Note Taker lies in its ability to synchronize notes across various devices. Whether on a tablet,

smartphone, or computer, users can access and edit their notes seamlessly. This section explores the convenience and flexibility this feature provides in a world characterized by multi-device usage.

### Voice-to-Text Functionality:

Going beyond traditional typing, Smart Note Takers often incorporate voice-to-text functionality. Users can dictate their thoughts, ideas, or meeting minutes, and the device converts spoken words into written text. This feature enhances accessibility and facilitates note-taking in diverse environments.

### Intelligent Organization and Search:

Navigating through a plethora of notes is made effortless by the intelligent organization and search capabilities of these devices. This section explores how Smart Note Takers employ tags, categories, and keyword recognition to help users quickly locate specific information within their digital notes.

### Annotation and Drawing Tools:

For those who prefer visual communication, Smart Note Takers offer annotation and drawing tools. Users can sketch diagrams, highlight important points, or annotate existing content directly on their digital notes. This section explores the creative



and collaborative aspects facilitated by these features.

**Cloud Integration and Security:**

Smart Note Takers often leverage cloud integration for seamless backup and accessibility. This section addresses the importance of cloud storage in ensuring data security, as well as the measures taken to protect sensitive information in an era where privacy is paramount.

**Environmental Impact and Sustainability:**

Reducing paper usage and promoting sustainability is a significant benefit of Smart Note Takers. This section discusses how the digital shift in note-taking contributes to environmental conservation, making it an eco-friendly choice for individuals and organizations.

**Conclusion:**

The Smart Note Taker emerges as a pivotal tool in the digital evolution of note-taking, offering a harmonious blend of traditional methods and cutting-edge technology. With handwriting recognition, synchronization, and intelligent organization, it not only enhances productivity but also contributes to a more sustainable and connected future. As we witness the continuous evolution of smart devices, the Smart Note Taker stands as a testament to the endless possibilities at the intersection of pen and pixel.

*SHIVAM TERDE- SYEJ*

**THANK YOU**