

J. B. Institute of Engineering & Technology

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

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Best Complements
from
The Dept. of ECE

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Message from the Desk of Principal

It gives me immense pleasure and delight to know that the Dept. of ECE, JBIET have mooted up a time needed, need based and innovative move, to bring out a domain specific annual magazine, in the name and style of TECHTRONICS while involving all the faculty, staffs, students and the Electronics Engineering fraternity.

The objectives, as spelled out by the Editorial board of the newly emerging magazines are quite sublime, ennobling as well as triggering of and enlightening about the basic concepts and philosophy of knowledge Engineering among all the knowledge seekers on all the latest vital, pivotal and critical aspects of the profession in the field of ECE and its technology.

Being the Head of the Institution, I congratulate the head of the Dept., the faculty, staffs and students of the Dept. for their keen and vigorous effort in widening the knowledge base through TECHTRONICS.

Dr. P.C. Krishnamachary,
Principal JBIET

Message from the Desk of HOD

I would like to submit my special thanks to our Principal sir, for his help and support. I appreciate all the teaching, non-teaching and students of the Dept. of ECE for their activities in TECHTRONICS to the publication of the magazine.

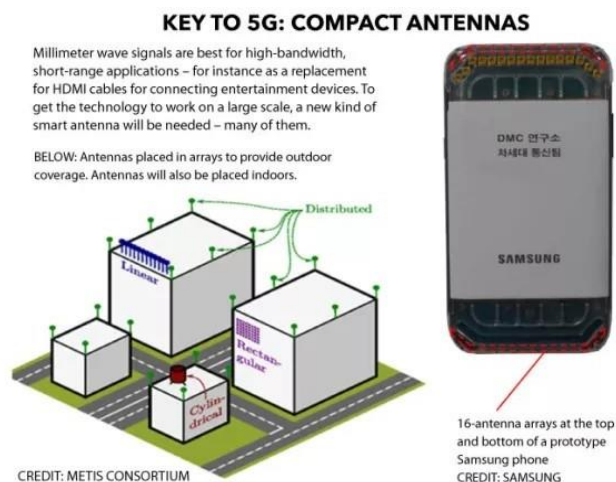
I am very proud of this moment and I remember this great achievement of students and faculty of the department for presenting their innovative ideas in to the paper and contribution in this magazine. As HOD and I wish all my students for their future career and endeavor.

**Dr. Towheed Sultana,
HOD, ECE**

5G Network

The backbone of the 5G standard is comprised of low-, mid- and high-band spectrum. 5G networks operate on different frequencies with sub-6 GHz and millimeter-wave (20-60 GHz) at the low and high ends of the spectrum.

Carriers were already using sub-6 spectrums for existing LTE networks, and now they need more of it to build out 5G. Millimeter-wave frequency was previously unused, and the advent of 5G has given carriers access to the spectrum that will enable the faster speeds we expect with the new standard. But mm Wave has a few drawbacks: Because it's so high-frequency, the waves don't travel long distances. In fact, they can't even travel through windows or buildings. That means a device operating on an mm-Wave-based network, like Verizon, T-Mobile and AT&T's 5G networks, will need to be extremely close to a 5G node to catch a signal. That's fine in a dense metropolitan area, where you can stick a 5G node every few hundred feet. But in rural areas where there are few buildings or cell towers, mm-Wave won't work. That's why both sub-6 and mm-Wave are necessary to make 5G widespread and high speed. Indeed, at Qualcomm's annual developer get-together this month, Qualcomm president Christian Amon said that real 5G will be a combination of the low, mid, and high-band frequencies.



To that end, Sprint is using its existing mid band (2.5 GHz) spectrum to build out its 5G network. At 2.5 GHz, a signal can travel farther but not as fast as with mmWave. We've seen that play out in our testing of Sprint's network, which doesn't deliver the 1Gbps speeds that mmWave-based networks from its rivals do, but does allow you to catch a signal more reliably.

T-Mobile launched its 5G network using mmWave in a half-dozen cities, but now features a nationwide 5G service using low-band spectrum that can reach 5,000 cities in addition to some rural areas.

Rollout: When can We expect 5G?

5G is already here, but unless the stars of your location, the wireless carrier you subscribe to and the smartphone you own are perfectly aligned, you probably can't use it yet.

AT&T, Verizon, T-Mobile and Sprint have all launched their 5G networks, but there are caveats. First, there are only a handful of 5G-compatible smartphones on the market. (More on those in a moment.) And with the exception of T-Mobile's newly launched nationwide service, the carriers have launched service only in some parts of certain cities, with little overlap. Even AT&T's newly launched low-band network is available in a limited number of areas at the moment.

What's more, it's evident many smartphone users aren't sure what 5G is. In fact, one in three Americans think they already have 5G, according to a recent study. The results showed that 47% of AT&T subscribers who own iPhones think their device is 5G-capable.

Don't confuse AT&T's 5G plans with the 5GE logo that appears on AT&T customers' phones. That logo translates to "5G Evolution," AT&T's expanded service with advanced LTE technologies, such as 4X4 MIMO, which doesn't hit the speeds we expect from 5G (or even match Verizon's current 4G service, in our testing).

AT&T is sticking by its decision: "We've been talking about 5G Evolution for a while now. We were pretty public about what we were doing and what we were deploying," Igal Elbaz, senior vice president for wireless technology at AT&T, told us at CES 2019.

Maj Gen Dr. S. S. Dasaka, SM, VSM - Retired
CEO, JB Group.

Metal Semiconductor and Super conductors

Mr. G Anand

Associate Professor, Dept. of ECE

These categories represent fundamental classifications of materials based on their electrical behavior, and each has its own unique properties and applications.

1. Metals:

- Metals are characterized by their high electrical conductivity, which arises from the presence of delocalized electrons in the atomic structure.
- In metals, the valence electrons are not tightly bound to individual atoms but are free to move throughout the material, creating a "sea" of electrons.
- This mobility of electrons allows metals to conduct electricity efficiently.
- Examples of metals include copper, aluminum, gold, and silver.

2. Semiconductors:

- Semiconductors have electrical conductivity between that of conductors (like metals) and insulators.
- Unlike metals, the electrons in semiconductors are not as free to move. They are bound to atoms but can become mobile with the addition of energy, such as heat or light.
- Semiconductors exhibit increased conductivity with increasing temperature, unlike metals which generally have decreased conductivity with temperature rise.
- The conductivity of semiconductors can also be altered by introducing impurities through a process called doping.
- Semiconductors are vital components in electronic devices like transistors, diodes, and integrated circuits.
- Silicon and germanium are the most commonly used semiconductor materials.

3. Superconductors:

- Superconductors are materials that, when cooled below a certain critical temperature, exhibit zero electrical resistance and expel magnetic fields (Meissner effect).
- Unlike metals and semiconductors, superconductors conduct electricity without any energy loss due to resistance.
- Superconductivity is a quantum phenomenon that arises due to the formation of Cooper pairs, pairs of electrons with opposite spins that overcome resistance.

- Superconductors also exhibit the property of persistent currents, which can flow indefinitely without any applied voltage.
- Many superconductors need to be cooled to very low temperatures (near absolute zero) to achieve superconductivity, although there are some high-temperature superconductors that work at higher temperatures, though still very cold by everyday standards.
- Superconductors find applications in various fields such as magnetic resonance imaging (MRI), particle accelerators, power transmission lines, and quantum computing.

Research Analysis:

The crystal structure at the surface of semiconductor materials can make them behave like metals and even like superconductors, a joint Swansea/Rostock research team has shown. The discovery potentially opens the door to advances like more energy-efficient electronic devices. Semiconductors are the active parts of transistors, integrated circuits, sensors, and LEDs. These materials, mostly based on silicon, are at the heart of today's electronics industry. We use their products almost continuously, in modern TV sets, in computers, as illumination elements, and of course as mobile phones. Metals, on the other hand, wire the active electronic components and are the framework for the devices.

The research team, led by Professor Christian Klinke of Swansea University's chemistry department and the University of Rostock in Germany, analyzed the crystals at the surface of semiconductor materials.

Applying a method called colloidal synthesis to lead sulphide nanowires, the team showed that the lead and Sulphur atoms making up the crystals could be arranged in different ways. Crucially, they saw that this affected the material's properties.

In most configurations the two types of atoms are mixed and the whole structure shows semiconducting behavior as expected. However, the team found that one particular "cut" through the crystal, with the so called facets on the surface, which contains only lead atoms, shows metallic character. This means that the nanowires carry much higher currents, their transistor behavior is suppressed, they do not respond to illumination, as semiconductors would, and they show inverse temperature dependency, typical for metals.

Dr. Mehdi Ramin, one of the researchers from the Swansea/Rostock team, said, "After we discovered that we can synthesize lead sulphide nanowires with different facets, which makes them look like straight or zigzag wires, we thought that this must have interesting consequences for their electronic

properties. But these two behaviors were quite a surprise to us. Thus, we started to investigate the consequences of the shape in more detail."

The team then made a second discovery: at low temperatures the skin of the nanostructures even behaves like a superconductor. This means that the electrons are transported through the structures with significantly lower resistance. Professor Christian Klink of Swansea University and Rostock University, who led the research, said, "This behavior is astonishing and certainly needs to be further studied in much more detail."

But it already gives new exciting insights into how the same material can possess different fundamental physical properties depending on its structure and what might be possible in the future. One potential application is lossless energy transport, which means that no energy is wasted. Through further optimization and transfer of the principle to other materials, significant advances can be made, which

The Power of Big Data Analysis

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Insights: The Power of Big Data Analysis

In today's digitally-driven world, data is being generated at an unprecedented rate. From social media interactions to online transactions, every click, swipe, and tap produces a trail of valuable information. This massive volume of data, known as big data, presents both challenges and opportunities for businesses and organizations across various sectors. Amidst this data deluge, the ability to extract actionable insights through effective analysis has become paramount. Enter big data analysis—an essential tool in harnessing the potential of vast and complex datasets.

Understanding Big Data:

Big data is characterized by three key attributes: volume, velocity, and variety.

Volume: Refers to the sheer amount of data generated, often measured in terabytes, petabytes, or even exabytes. Traditional data processing tools struggle to handle such large volumes efficiently.

Velocity: Denotes the speed at which data is generated and needs to be processed. With the advent of real-time analytics, organizations must analyze data streams in near real-time to gain timely insights and respond swiftly to changing conditions.

Variety: Encompasses the diverse types of data generated, including structured (e.g., databases), semi-structured (e.g., XML, JSON), and unstructured (e.g., text, images, videos). Big data analysis techniques must accommodate this variety and extract value from disparate data sources.



The Role of Big Data Analysis:

Big data analysis involves the process of examining large and complex datasets to uncover hidden patterns, correlations, and trends. By leveraging advanced analytics techniques, organizations can derive actionable insights that drive informed decision-making and strategic initiatives.

Key Components of Big Data Analysis:

Data Collection: Involves gathering data from various sources, including internal databases, external APIs, social media platforms, IoT devices, and sensors.

Data Storage: Big data storage solutions, such as data lakes and distributed file systems, are employed to store massive volumes of structured and unstructured data cost-effectively.

Data Processing: Technologies like Hadoop, Spark, and Flink enable distributed data processing, allowing organizations to analyse large datasets in parallel across multiple nodes.

Data Analysis: Advanced analytics techniques, including machine learning, predictive modelling, natural language processing (NLP), and data mining, are applied to uncover insights and patterns within the data.

Data Visualization: Communicating insights effectively is crucial. Data visualization tools and techniques help present complex findings in a clear and intuitive manner, enabling stakeholders to grasp insights quickly.

Applications of Big Data Analysis:

Big data analysis finds applications across diverse domains, including:

Business Intelligence: Analysing customer behaviour, market trends, and operational metrics to optimize business processes and drive growth.

Healthcare: Leveraging patient data to improve treatment outcomes, identify disease trends, and enhance public health initiatives.

Finance: Detecting fraudulent activities, assessing credit risk, and optimizing investment strategies through data-driven insights.

Manufacturing: Implementing predictive maintenance to minimize downtime, optimizing supply chain operations, and improving product quality.

Challenges and Considerations:

While big data analysis offers immense potential, it also presents challenges, including data security and privacy concerns, scalability issues, and the need for skilled data professionals. Organizations must adopt robust data governance frameworks and invest in talent development to fully capitalize on the benefits of big data analysis.

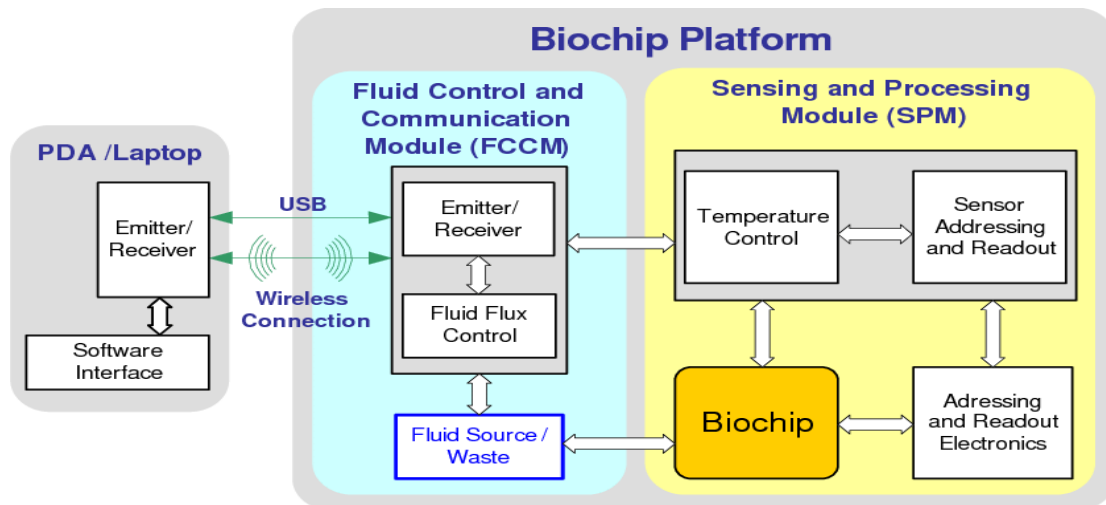
Conclusion:

In an era defined by data abundance, big data analysis emerges as a critical tool for organizations seeking to unlock valuable insights from vast and diverse datasets. By harnessing the power of advanced analytics, businesses can gain a competitive edge, drive innovation, and make data-driven decisions that shape the future.

Introduction:

In the realm of medical technology, biochips stand as one of the most promising innovations of the 21st century. These miniature devices, also known as microarrays, are revolutionizing healthcare by offering rapid, sensitive, and multiplexed analysis of biological samples.

What Are Biochips



Biochips are essentially small glass or silicon chips that contain an array of miniaturized sensors or biological elements such as DNA, proteins, antibodies, or cells. These biological elements are immobilized onto the surface of the chip, allowing for the detection and analysis of specific biological interactions.

Applications in Healthcare

1. **Diagnostics:** One of the primary applications of biochips is in diagnostic testing. They enable the simultaneous analysis of multiple biomarkers, allowing for early detection and diagnosis of various diseases such as cancer, infectious diseases, and genetic disorders. Biochips offer faster results and require smaller sample volumes compared to traditional diagnostic methods.

2. **Drug Discovery and Development:** Biochips play a crucial role in drug discovery by facilitating high-throughput screening of potential drug candidates. They allow researchers to assess drug efficacy, toxicity, and metabolism more efficiently, leading to the development of safer and more effective drugs.
3. **Personalized Medicine:** Biochips enable personalized medicine by analyzing an individual's genetic makeup and predicting their response to specific treatments. This allows for tailored therapeutic interventions that are more effective and have fewer side effects.
4. **Point-of-Care Testing:** Biochips are increasingly being integrated into point-of-care testing devices, enabling rapid and decentralized testing in various settings such as clinics, pharmacies, and even homes. This has the potential to improve access to healthcare, especially in resource-limited areas.

Challenges and Future Directions

While biochips hold tremendous promise, several challenges remain to be addressed. These include optimizing assay sensitivity and specificity, improving biochip fabrication techniques, and addressing ethical and regulatory considerations.

Looking ahead, the future of biochips is bright. Advances in nanotechnology, microfluidics, and data analytics are driving the development of next-generation biochips with enhanced capabilities and functionalities. These innovations promise to further expand the applications of biochips and revolutionize healthcare delivery.

In conclusion, biochips represent a groundbreaking technology with far-reaching implications for healthcare. By providing rapid and accurate analysis of biological samples, biochips have the potential to transform diagnostics, drug discovery, personalized medicine, and point-of-care testing. As research and development in this field continue to progress, biochips are poised to play an increasingly prominent role in shaping the future of medicine.

This article provides an overview of biochips, their applications in healthcare, and the challenges and future directions of this technology. If you need more specific information or have any questions, feel free to ask!

INTERNET OF THINGS

Pawar Aakanksha

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Introduction:

In an increasingly interconnected world, the Internet of Things (IoT) stands as a transformative force, reshaping industries, enhancing efficiency, and revolutionizing how we interact with technology. From smart homes and cities to industrial automation and healthcare, IoT is driving innovation across diverse domains, unlocking new opportunities and challenges in its wake. In this article, we'll delve into the essence of IoT, its applications, implications, and the future it heralds.

Understanding the Internet of Things:



At its core, the Internet of Things refers to a network of interconnected devices as given above embedded with sensors, software, and other technologies that enable them to collect, exchange, and analyze data. These devices, ranging from everyday objects like smartphones and wearables to industrial machinery and environmental sensors, communicate seamlessly, forming a vast ecosystem of interconnected "things."

The Power of Connectivity:

Central to the concept of IoT is connectivity—the ability of devices to communicate with each other and with centralized systems via the internet or other networks. This connectivity facilitates real-time data exchange, enabling businesses, governments, and individuals to monitor, control, and optimize processes remotely. Whether it's optimizing energy consumption in smart buildings, monitoring crop conditions in agriculture, or tracking inventory in retail, IoT connectivity empowers stakeholders with unprecedented levels of insight and control.

Applications Across Industries:

The applications of IoT span a multitude of industries and use cases, including:

- **Smart Homes:** IoT-enabled devices such as thermostats, lighting systems, and security cameras enhance comfort, convenience, and security for homeowners while optimizing energy usage.
- **Smart Cities:** IoT infrastructure, including sensors, actuators, and data analytics platforms, enables cities to monitor and manage traffic flow, optimize waste management, improve public safety, and enhance overall urban sustainability.
- **Industrial IoT (IIoT):** In manufacturing and logistics, IIoT systems leverage sensor data, predictive analytics, and machine learning to optimize production processes, enable predictive maintenance, and enhance supply chain efficiency.
- **Healthcare:** IoT devices such as wearables, remote monitoring systems, and implantable sensors facilitate personalized healthcare delivery, remote patient monitoring, and early detection of medical issues, leading to improved patient outcomes and reduced healthcare costs.

Challenges and Considerations:

While the promise of IoT is vast, its adoption is not without challenges. Data privacy and security concerns, interoperability issues, scalability constraints, and regulatory complexities pose significant hurdles to widespread IoT deployment. Addressing these challenges requires a concerted effort from stakeholders across sectors to develop robust standards, protocols, and security measures that safeguard data and ensure the integrity and reliability of IoT systems.

The Future of IoT:

Looking ahead, the future of IoT is characterized by continued innovation and expansion into new frontiers. Advancements in edge computing, 5G networks, artificial intelligence (AI), and block chain technology are poised to accelerate the growth and adoption of IoT, enabling more intelligent, autonomous, and secure IoT ecosystems. From autonomous vehicles and smart infrastructure to precision agriculture and personalized healthcare, IoT promises to redefine how we live, work, and interact with the world around us.

Conclusion:

As the Internet of Things continues to evolve, it represents not just a technological paradigm shift but a fundamental transformation in how we perceive and interact with our surroundings. By harnessing the power of connectivity, data analytics, and intelligent automation, IoT holds the potential to drive sustainable growth, enhance quality of life, and create a more connected and efficient world for generations to come.

Network of Things: Building Bridges in the Digital Landscape

In the realm of interconnected technology, the Network of Things (NoT) emerges as a sophisticated framework that extends beyond traditional Internet of Things (IoT) concepts. It encapsulates a dynamic network topology where interconnected devices, systems, and platforms collaborate seamlessly, facilitating data exchange, decision-making, and automation. In this article, we'll explore the concept of the Network of Things, its architectural principles, applications, and the transformative impact it heralds in the digital landscape.

Network of Things:

The Network of Things represents an evolution beyond the conventional IoT paradigm, emphasizing the interconnectedness and interdependence of devices, services, and applications within a broader network fabric as shown in figure below. Unlike traditional IoT deployments, which often operate within siloed ecosystems, the NoT framework fosters a unified environment where heterogeneous devices and systems communicate, coordinate, and collaborate in real-time.



Architectural Principles:

At the heart of the Network of Things lie several architectural principles that underpin its functionality and scalability:

1. **Interoperability:** NoT emphasizes interoperability among diverse devices, protocols, and platforms, enabling seamless communication and data exchange across heterogeneous environments.
2. **Scalability:** The NoT framework is designed to accommodate a vast and diverse array of connected devices, scaling effortlessly to support growing data volumes and user demands.
3. **Security:** Robust security measures are integral to the NoT architecture, safeguarding data integrity, privacy, and confidentiality across the network.
4. **Distributed Intelligence:** NoT leverages distributed intelligence, where decision-making and processing capabilities are distributed across the network, enabling faster response times and reduced latency.

Applications Across Domains:

The Network of Things finds applications across a wide range of domains, including:

- **Smart Cities:** In urban environments, the NoT framework facilitates the integration of diverse systems, such as transportation, energy management, public safety, and environmental monitoring, to create more efficient, sustainable, and livable cities.
- **Industry 4.0:** In manufacturing and industrial settings, NoT enables the convergence of operational technology (OT) and information technology (IT), fostering intelligent automation, predictive maintenance, and agile production processes.
- **Healthcare:** Within the healthcare sector, the NoT framework supports remote patient monitoring, personalized medicine, and health analytics, enhancing patient outcomes, reducing costs, and improving access to care.
- **Supply Chain Management:** In logistics and supply chain management, NoT facilitates end-to-end visibility, real-time tracking, and predictive analytics, optimizing inventory management, reducing waste, and enhancing overall efficiency.

Transformative Impact:

The Network of Things promises to revolutionize how we interact with technology, transforming static IoT deployments into dynamic, adaptive ecosystems that evolve and adapt in real-time. By fostering greater

connectivity, collaboration, and intelligence, NoT empowers organizations to unlock new opportunities, drive innovation, and address complex challenges across diverse domains.

Challenges and Considerations:

Despite its transformative potential, the Network of Things faces several challenges, including interoperability issues, security concerns, data privacy considerations, and regulatory complexities. Addressing these challenges requires concerted efforts from industry stakeholders, policymakers, and standards organizations to develop robust frameworks, protocols, and best practices that ensure the reliability, security, and scalability of NoT deployments.

Conclusion:

As the digital landscape continues to evolve, the Network of Things emerges as a pivotal enabler of connectivity, collaboration, and innovation. By fostering a unified ecosystem where devices, systems, and platforms interoperate seamlessly, not paves the way for a more interconnected, intelligent, and responsive world, where the boundaries between physical and digital realms blur, and possibilities abound.



Swami Vivekananda

- When an idea exclusively occupies the mind, it is transformed into an actual physical or mental state.
- All the powers in the universe are already ours. It is we who have put our hands before our eyes and cry that it is dark.
- The more we come out and do good to others, the more our hearts will be purified, and God will be in them.
- Where can we go to find God if we cannot see Him in our own hearts and in every living being.