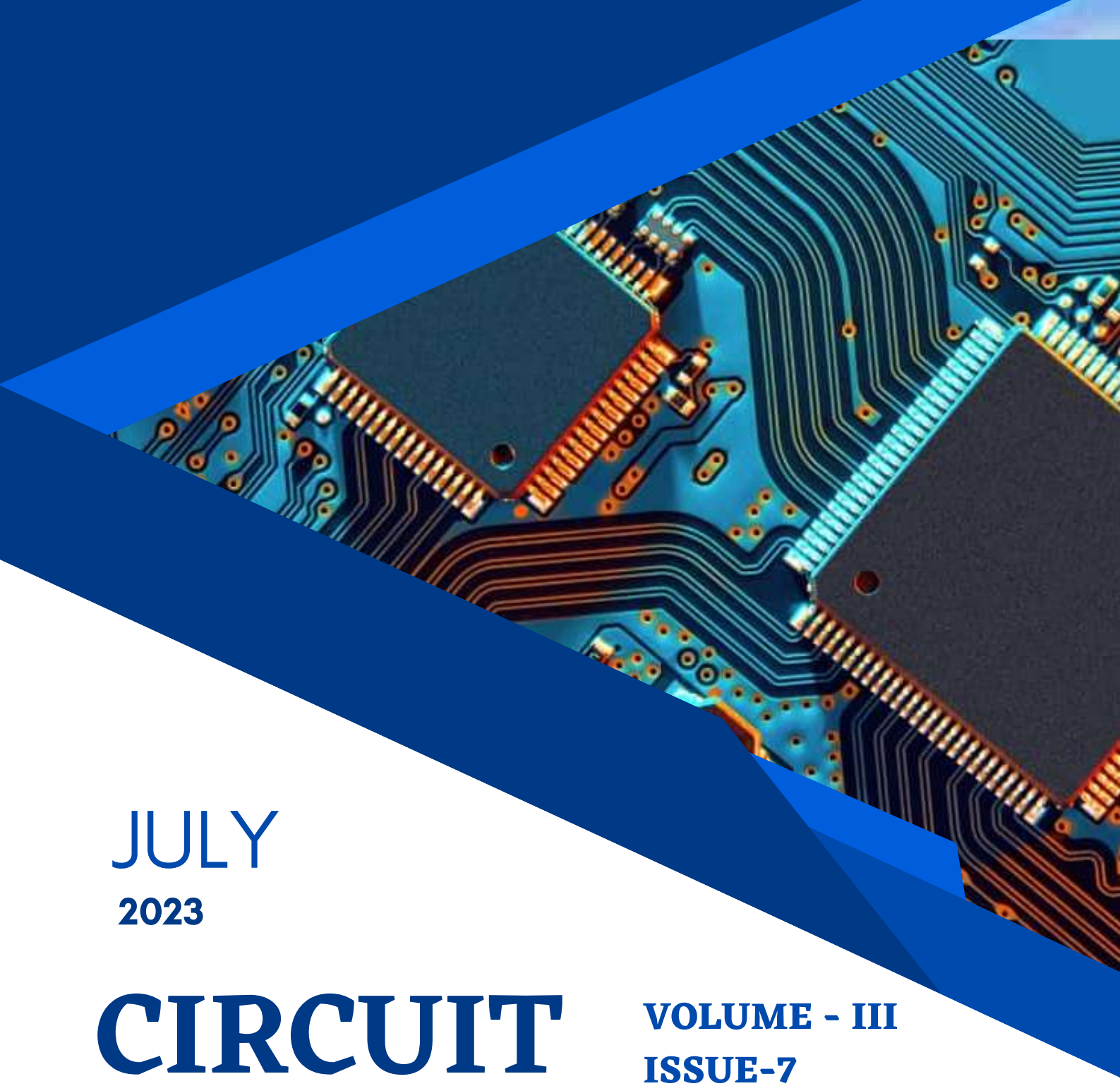

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SVCE | SRI VENKATESWARA COLLEGE OF ENGINEERING

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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VISION OF THE DEPARTMENT

To excel in offering value based quality education in the field of Electronics and Communication Engineering, keeping in pace with the latest developments in technology through exemplary research, to raise the intellectual competence to match global standards and to make significant contributions to the society.

MISSION OF THE DEPARTMENT

- To provide the best pedagogical atmosphere of highest quality through modern infrastructure, latest knowledge and cutting edge skills.
- To fulfill the research interests of faculty and students by promoting and sustaining in house research facilities so as to obtain the reputed publications and patents.
- To educate our students, the ethical and moral values, integrity, leadership and other quality aspects to cater to the growing need for values in the society.

Program Educational Objectives (PEOs)

PEO1: Create value to organizations as an EMPLOYEE at various levels, by improving the systems and processes using appropriate methods and tools learnt from the programme.

PEO2:Run an organization successfully with good social responsibility as an ENTREPRENEUR, making use of the knowledge and skills acquired from the programme.

PEO3:Contribute to the future by fostering research in the chosen area as an ERUDITE SCHOLAR, based on the motivation derived from the programme.

Program Specific Outcomes (PSOs)

PSO-1: An ability to apply the concepts of Electronics, Communications, Signal processing, VLSI, Control systems etc., in the design and implementation of application oriented engineering systems.

PSO-2: An ability to solve complex Electronics and communication Engineering problems, using latest hardware and software tools, along with analytical and managerial skills to arrive appropriate solutions, either independently or in team.

FACULTY ARTICLE

Industry 5.0—Bringing Empowered Humans Back to the Shop Floor !!!

Mrs.K.S.Subhashini, Assistant Professor/ECE

Introduction

Industry 5.0, also known as the fifth industrial revolution, is a concept that envisions humans working alongside advanced technology and A.I.-powered robots to enhance workplace processes. Building upon the advancements of Industry 4.0, which focused on the integration of digital technologies and automation, Industry 5.0 emphasizes the importance of human-centric collaboration and interaction coupled with increased resilience and an improved focus on sustainability.

Motivation :

Industry 4.0 standard has revolutionized the manufacturing sector by integrating several technologies, such as artificial intelligence (AI), the Internet of Things (IoT), cloud computing, cyber physical systems (CPSs) and cognitive computing. The main principle behind Industry 4.0 is to make the manufacturing industry "smart" by interconnecting machines, devices that can control each other throughout the life cycle.In Industry 4.0, the main priority is process automation.Industry 4.0 focuses on improving mass productivity and performance through the provision of intelligence between devices and applications using machine learning (ML). Industry 5.0 is currently conceptualized to leverage the unique creativity of human experts to collaborate with powerful, smart and accurate machinery. Broadening the concepts of Industry 4.0, this new industrial revolution is described by the European Union as providing, "a vision of industry that aims beyond efficiency and productivity as the sole goals, and reinforces the role and the contribution of industry to society."

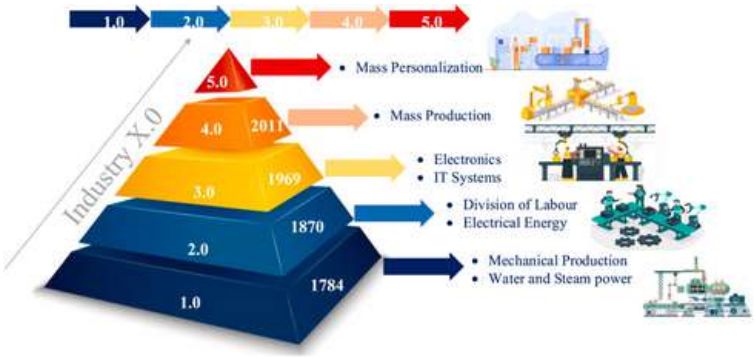
Evolution of the Industrial Revolution (Industry 1.0 to 5.0)

Industry 1.0
Beginning in around 1780, this first revolution focused on industrial production based on machines that were powered by steam and water.

Industry 2.0
Some 100 years later, in 1870, this second industrial revolution was based on electrification and took place with mass production through assembly lines.

Industry 3.0
Stepping forward another 100 years, to 1970, Industry 3.0 saw automation through the use of computers and electronics. This was enhanced by globalization (Industry 3.5), involving offshoring of production to low-cost economies.

Industry 4.0
We are currently living in the fourth industrial revolution, which is based around the concept of digitalization and includes automation, artificial intelligence (AI) technologies, connected devices, data analytics, cyber-physical systems, digital transformation, and more.



Industry 5.0
We are now entering the fifth industrial revolution with a focus on men and machines working together. Based upon personalisation and the use of collaborative robots(Cobots), workers are free to deliver value-added tasks for customers. This latest iteration goes beyond manufacturing processes to include increased resilience, a human-centric approach, and a focus on sustainability.

Industry 5.0 recognizes the power of industry to achieve societal goals beyond jobs and growth to become a resilient provider of prosperity, by making production respect the boundaries of our planet and placing the wellbeing of the industry worker at the center of the production process.

Technology Enablers of Industry 5.0:

(1)Exoskeletons are **wearable robotic devices** designed to augment and support human workers in various tasks. They are often made of lightweight materials such as carbon fiber and are equipped with motors, sensors, and actuators that interact with the wearer's movements. Here are some key aspects of exoskeleton technology in Industry 5.0:

- **Enhanced Strength and Endurance:** Exoskeletons provide workers with increased strength and endurance, allowing them to perform physically demanding tasks with reduced effort.
- **Ergonomic Support:** Exoskeletons are designed to improve ergonomics by promoting correct body posture and reducing strain on the musculoskeletal system. They offer support to specific body parts, such as the back, arms, or legs, reducing the risk of injuries and musculoskeletal disorders caused by repetitive or strenuous movements.
- **Precision and Control:** Some exoskeletons are equipped with advanced sensors and control systems that enable precise movement control. This allows workers to perform delicate or intricate tasks with greater accuracy and control, such as handling fragile objects or operating complex machinery.

- **Safety Assistance:** Exoskeletons can provide an extra layer of safety to workers. For example, they can include proximity sensors to detect potential collisions or hazards and provide alerts or even physical assistance to avoid accidents. In hazardous environments, exoskeletons can protect workers by acting as a barrier against extreme temperatures, radiation, or other dangers.
- **Rehabilitation and Assistance:** Exoskeleton technology can also be used in rehabilitation settings to aid individuals recovering from injuries or disabilities. By providing support and assistance to weakened or impaired body parts, exoskeletons help individuals regain mobility and functionality.
- **Training and Skill Development:** Exoskeletons can be utilized for training purposes, allowing workers to simulate and practice complex tasks in a safe and controlled environment. By providing real-time feedback and guidance, exoskeletons help workers improve their skills and reduce the learning curve for new processes or equipment.

(2) Additive Technology

Additive technology refers to the use of additive manufacturing, commonly known as 3D printing, in industrial processes. Additive manufacturing is a process where three-dimensional objects are created by adding material layer by layer.

- Additive technology plays a crucial role in Industry 5.0 by enabling customization, rapid prototyping, waste reduction, supply chain optimization, spare parts production, and design innovation.
- It enhances manufacturing capabilities, improves efficiency, and supports the development of more sustainable and customer-centric production processes

(3) 5G and Beyond:

Industry 5.0 is a concept that envisions the integration of advanced technologies, including the Internet of Things (IoT), artificial intelligence (AI), robotics, and automation, with human workers in the industrial sector. It aims to foster collaboration between humans and machines to improve productivity, efficiency, and overall industrial processes.The role of 5G and beyond in Industry 5.0 is crucial as it provides the necessary communication infrastructure to enable seamless connectivity and real-time data exchange.The key aspects are:

➢ Ultra-Fast and Reliable Connectivity
➢ Massive IoT Connectivity in large-scale Industrial IoT deployments.
➢ Edge Computing Capabilities
➢ Enhanced Automation and Robotics
➢ Augmented Reality (AR) and Virtual Reality (VR)
➢ Smart Factories and Supply Chains

(4) Mixed Reality:
Mixed reality combines elements of virtual reality (VR) and augmented reality (AR) to create immersive and interactive experiences. The key aspects are:

➢ **Enhanced Design and Visualization:** Mixed reality can enable designers and engineers to visualize and interact with complex 3D models in real time. It allows for virtual prototyping, making it easier to identify design flaws and optimize product development processes.

➢ **Remote Collaboration and Training:** Mixed reality can facilitate remote collaboration by bringing together experts from different locations in a shared virtual environment. This can streamline decision-making processes, reduce travel costs, and enable efficient knowledge sharing. Additionally, mixed reality can be used for training purposes, allowing workers to learn and practice tasks in simulated environments without the need for physical equipment.

➢ **Real-Time Data Overlay:** Mixed reality can overlay real-time data and information onto physical objects or machinery, providing workers with valuable insights and instructions. For example, technicians can use AR-enabled headsets to receive step-by-step guidance during maintenance or repair tasks, improving accuracy and efficiency.

➢ **Digital Twin Integration:** Industry 5.0 may involve the increased use of digital twin technology, which is a virtual replica of physical assets or systems. Mixed reality can enhance the integration and interaction with digital twins by overlaying virtual data and simulations onto the physical environment, allowing for real-time monitoring, analysis, and optimization of industrial processes.

Human-Robot Collaboration: Mixed reality can facilitate human-robot collaboration by providing intuitive interfaces and visual cues for workers interacting with robots or cobots (collaborative robots). AR overlays can display instructions, safety information, and real-time feedback, enabling seamless cooperation between humans and machines.

(5) Industrial Blockchain

In the context of Industry 5.0, industrial blockchain refers to the application of blockchain technology specifically within industrial processes and supply chains. Here are some ways in which industrial blockchain can impact Industry 5.0:

Supply Chain Management: Blockchain can provide end-to-end visibility and traceability across the entire supply chain. By recording transactions and data at each stage of the production and distribution process, blockchain enables real-time tracking of goods, verification of authenticity, and identification of potential bottlenecks or issues.

Smart Contracts: Blockchain can automate and enforce contracts through smart contracts, which are self-executing agreements with predefined rules and conditions.

Quality Control and Compliance: With blockchain, it becomes easier to track and verify the origin and quality of products. The immutable nature of blockchain records ensures that information about manufacturing processes, certifications, and compliance standards remains tamper-proof.

Data Security: Blockchain's decentralized architecture and cryptographic techniques make it highly resistant to hacking or unauthorized access.

Collaborative Manufacturing: By securely sharing data and information on a blockchain network, manufacturers, suppliers, distributors, and even customers can have real-time access to relevant data, enabling seamless coordination, improved visibility, and faster response times.

(6)Drones:

Drones have found various applications and play a significant role in enhancing efficiency, safety, and productivity in different industrial sectors. Some of the key roles of drones in Industry 5.0 include:

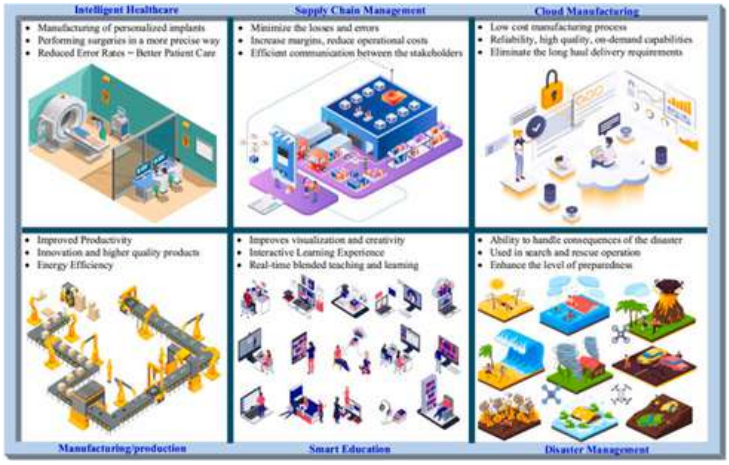
Surveillance and Inspections: Drones equipped with cameras and sensors can perform aerial inspections of industrial facilities, such as power plants, oil rigs, and pipelines.

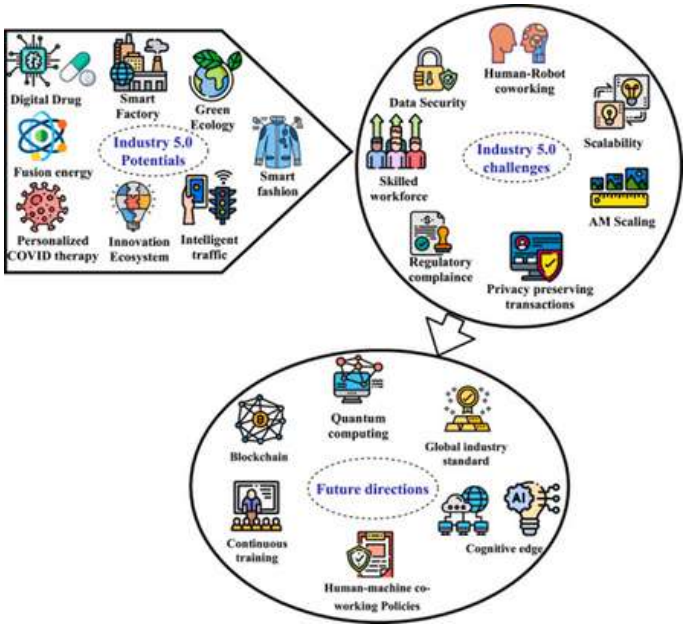
Inventory Management: Drones can be utilized in warehouses and large storage facilities for inventory management tasks. They can autonomously scan and track inventory, providing real-time updates on stock levels and locations, thereby streamlining logistics and reducing manual labor.

Transportation and Delivery: Drones have the potential to revolutionize logistics and last-mile delivery. They can transport goods and packages efficiently, especially in remote or hard-to-reach areas.

Infrastructure and Construction: Drones can be utilized for surveying and mapping construction sites, monitoring progress, and conducting inspections.

Emergency Response and Disaster Management: Drones can be deployed in emergency situations for search and rescue missions, assessing damage, and providing situational awareness.





Conclusion:

Industry 5.0, and its integration with AI, Big-data and IoT suggests building safer and complicated hyper-connected networks that can be the future of many domains in the industry.Though Industry 5.0 can empower the most customized services to the end user through the cognitive enabled manufacturing processes,there are critical challenges that must be addressed.They include :

➢Security
➢Privacy
➢Humans–robots as co-workers in factory
➢Scalability
➢Skilled workforce
➢Regulatory compliance.

In Industry 5.0, machines are designed to assist and empower human workers, taking on repetitive and physically demanding tasks while humans focus on complex decision-making, creative problem-solving, and interpersonal interactions.As the world faces growing concerns over environmental impact and social inequalities, Industry 5.0 seeks to integrate these considerations into manufacturing practices.By harnessing the power of technology while embracing human skills and values, Industry 5.0 aims to create a future of manufacturing that is not only efficient and innovative but also socially responsible and environmentally sustainable.This means developing technologies and processes that minimize waste, reduce energy consumption, and promote ethical production and consumption patterns.While many countries are still trying to embrace the Industry 4.0 standard ,this paradigm shift towards the emergence of experience driven manufacturing economy, will progress through the future which is Digital,Smart,Flexible and Intuitive.

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ACHIEVEMENTS

FACULTY PARTICIPATION

- Dr.K.Kavitha, Mrs.S.M.Abinaya, Mr.D.Silambarasan and Mr.L.K.Balaji Vignesh have successfully participated in Two Week National Level Virtual Workshop on "Advanced Research Methodology" organized by the Department of Commerce, Information Systems and Management, SRM Institute of Science and Technology, Ramapuram Campus, Chennai from 3rd July 2023 to 18th July 2023.

- Dr.M.Bindu, Dr.K.Kavitha, Mr.L.K.Balaji Vignesh and Mr.D.Silambarasan have successfully attended Two Days New Faculty Induction Program 2023-24 organized by Sri Venkateswara College of Engineering (Autonomous), Sriperumbudur from 10th July 2023 to 11th July 2023.

- Mrs.S.M.Mehazabeen has actively participated in the webinar on "Framing Questions In Line With Bloom's Taxonomy" organized by the Department of Computer Science and Engineering, SRM Madurai college for Engineering and Technology on 14th July 2023.

- Mr.P.Arul has successfully completed the Five-Days Faculty Development Programme on "Artificial Intelligence and Machine Learning" organized by Dhanalakshmi College of Engineering (Chennai), Chennai from 17th July 2023 to 21st July 2023.

- Mrs.S.M.Mehazabeen has actively participated in the webinar on "Artificial Intelligence and its Real-time Applications" organized by the Department of Computer Science and Engineering, SRM Madurai College for Engineering and Technology on 20th July 2023.

- Dr.R.Priyadharshini has attended two day Global workshop on "Advances in Optical Communications" organized by IIT Madras under the aegis of the Department of Telecommunications from 22nd July 2023 to 23rd July 2023.

- Mr. R. Ramesh Kumar has successfully completed Six-Days Faculty Empowerment Programme on “Transmission Lines and RF Systems” organized by MIT, Chromepet from 24th July 2023 to 29th July 2023.

- Mr.L.K.Balaji Vignesh acted as a reviewer for first “IEEE International Conference on Data Science and Network Security (ICDSNS-2023)” organized by the Department of Computer Science and Engineering, Kalpataru Institute of Technology, Tiptur from 28th July 2023 to 29th July 2023.

- Dr.T.J.Jeyaprabha reviewed 3 Papers in AICTE Sponsored “IEEE International Conference on Networks, Multimedia and Information Technology (NMITCON)” organized by the Department of Electronics and Communication Engineering, NITTE Meenakshi Institute of Technology, Bengaluru

REVIEWER/EDITORIAL BOARD MEMBERS

- Mr.L.K.Balaji Vignesh reviewed five Papers in AICTE Sponsored “IEEE International Conference on Networks, Multimedia and Information Technology (NMITCON)” organized by the Department of Electronics and Communication Engineering, NITTE Meenakshi Institute of Technology, Bengaluru.

FACULTY PUBLICATION

- Dr.A.Prasanth filed a patent titled “IOT-BASED ELECTRONIC WHEELCHAIR” which was published and granted in the Indian Patent office. (Application number: 367203-001) (Grant Certificate Generated: 18/07/2023)

INTERNSHIP

- 124 Students from Third year ECE have successfully completed Internships at various organizations.

NPTEL Course Completion

- Totally 47 students have successfully participated and secured good grade in Nptel Course such as Data Analytics With Python (01), Introduction to Database Systems (02), Introduction to Internet of Things (06), Programming in Java (06) and The Joy of Computing using Python (32).

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