ELECTRICAL AND ELECTRONICS ENGINEERING
NIT TIRUCHIRAPPALLI

EEE ASSOCIATION

TRONICALS

VOLUME 8 | ISSUE 1

SWARM ROBOTICS

COVER STORY

CONTENTS

MESSAGE FROM HOD

It gives me immense pleasure to pen the prologue for Tronicals, the bi-annual magazine published by the department of Electrical and Electronics Engineering, NIT Tiruchirappalli. Tronicals brings to light the quintessence of our department and provides the perfect platform for the students and staff to showcase their creative and technical acumen in print. This edition of Tronicals covers a gamut of topics from insightful internship diaries to intriguing articles on cutting-edge research and development.

The EEE Association plays a pivotal role in organizing diverse activities - symposiums, guest lectures, technical contests, quizzes, etc. I wholeheartedly wish them success in all their endeavours and hope they scale greater heights this year.

I'd like to congratulate all the contributors and the editorial team for their unstinted efforts and enthusiasm for the successful launch of this edition. I hope the readers find it informative and enlightening. Happy reading!

Dr. M.P.Selvan, HoD , EEE

MESSAGE FROM FACULTY ADVISOR

On behalf of the EEE Association (EEEA) and Tronicals, I am elated to extend my warm greetings to the EEE family of NITT. It is my pleasure to assume the role of faculty advisor to guide and support the EEEA. The EEE Association plays an integral role in shaping departmental activities to be informative and innovative by conducting various technical workshops, events, guest lectures, and an annual technical symposium, Currents which has garnered enthusiastic participation from students all over India. I take this opportunity to laud the meticulous planning, diligence, and zest of the EEEA Team, and wholeheartedly wish them a successful year ahead.

Tronicals, our in-house technical magazine, portrays a wide assemblage of technical articles on the latest developments in the field of Electrical and Electronics Engineering. This edition also throws light on the coveted internships undertaken by our students in various companies and foreign institutes, hoping to kindle the interests of aspiring students. It also highlights the updates about the activities and accomplishments of the students and distinguished faculty.

This magazine is an earnest attempt to broadcast, inform, inspire and pique the curiosity of the diverse readership. I congratulate the editorial team for their consistent efforts and creativity in curating this magazine and sincerely hope this edition provides a holistic and exciting reading experience.

-Dr. Josephine R.L., Faculty Advisor, EEEA

EDITORIAL TEAM

“Time stands still best in the moments that look suspiciously like ordinary life”

Atlast, we have completed a semester completely offline for once, in the past 2 years. Credits to the COVID-19 outbreak and its after effects, that kept us away from our campus and its vibrant lifestyle. But fret not! We are already up and running. We, the students of the Electrical and Electronics Engineering Department, bring to you the Issue 1 of Tronicals (2023).

This time, we bring to you articles on various topics that are a matter of bleeding-edge research at several research groups across the globe. The topics range from super junction transistors to aerospace electrification and are written by the students after going through existing literature that is legitimate. We have tried to provide a birdseye overview of the aforementioned topics and hope you are intrigued by the same!

In addition to the articles, we have put together a collection of Intern Diaries, that gives insights into the students perspective on their Research/Company Internship experience, hoping to help the interested juniors to take up this experience as a stepping stone for their future endeavors.

We hope that this edition of Tronicals will keep you enamored with well-curated content on enriching experiences and fascinating articles.
Stay tuned!

N. Srikrishna and J. Soundarya
Editors-in-Chief, Tronicals
Batch of 2019-2023


J. Soundarya

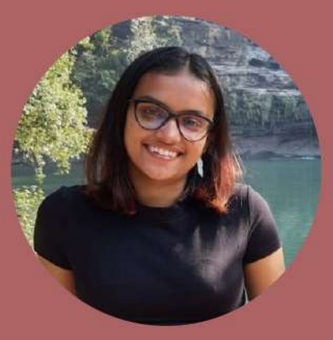

N. Srikrishna


K. Rajalakshmi


Koustabh Sau


Yash Chaturani


Fahmida Hiba Fathima


Shakambari Saxena


Jyosna

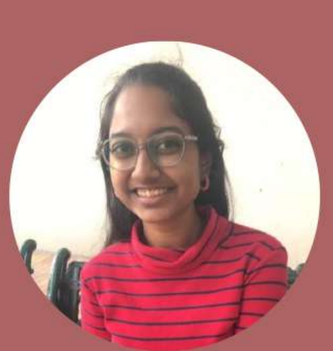

Manush Patel


Janam


Keerthana


Sreeya


Uma Gomathi


Akshaya


Diya


Sriram

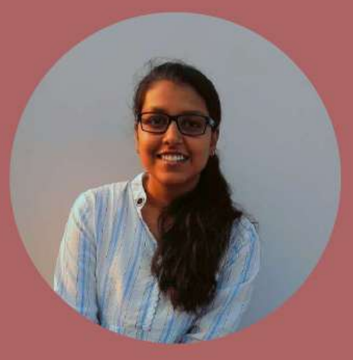

Varun


Abinisha


Tanuja


Saranya


Varshini


Muskan Sachan


Suganth

VISION AND MISSION OF THE DEPARTMENT

ABOUT

The Department of Electrical and Electronics Engineering, NIT, Tiruchirappalli was started in the year 1964. It offers one Under-Graduate programme (B.Tech.), two Post-Graduate programmes (M.Tech. in Power Systems and Power Electronics) and also research programmes (M.S. and Ph.D.) in the various fields of Electrical and Electronics Engineering. After the institute became NIT, the department has grown not only in terms of student and faculty strength, but also in improving the laboratory facilities for the teaching and research purposes. Thus, the department has dedicated and state of the art teaching / research laboratories. The department is recognized for excellence in research (First Department in NIT-T to be accorded QIP status for Ph.D. programe), teaching and service to the profession.

The faculty members have strong sense of responsibility to provide the finest possible education for both graduate and undergraduate students. The academic strength of the faculty is reflected by the alumni, many of whom are in the top echelons of industry and academia both in India and abroad.

MISSION

To be a centre of excellence in Electrical Energy Systems.

VISION

- Empowering students and professionals with state-of-art knowledge and Technological skills.
- Enabling Industries to adopt effective solutions in Energy areas through research and consultancy.
- Evolving appropriate sustainable technologies for rural needs

B.TECH
PROGRAMME

PROGRAM EDUCATIONAL OBJECTIVES (PEOS) :

The major objectives of the B.Tech. programme in Electrical and Electronics Engineering are to prepare students:

for graduate study in engineering

- to work in research and development organizations
- for employment in electrical power industries
- to acquire job in electronic circuit design and fabrication industries
- to work in IT and ITES industries

Programme Outcomes (POs) :

- will have an ability to apply knowledge of mathematics and science in EEE systems.
- will have an ability to provide solutions for EEE problems by designing and conducting experiments, interpreting and analysing data, and reporting the results.
- will have comprehensive understanding of the entire range of electronic devices, analog and digital circuits with added state-of-art knowledge on advanced electronic systems.
- will have knowledge and exposure on different power electronic circuits and drives for industrial applications.
- will have in-depth knowledge in transmission and distribution systems, power system analysis and protection systems to pursue a career in the power sector.
- will have a good knowledge in microprocessors/microcontrollers, data structures, computer programming and simulation software.
- will be able to develop mathematical modelling, analysis and design of control systems and associated instrumentation for EEE.
- will be able to systematically carry out projects related to EEE.
- will have an ability to participate as members in various professional bodies as well as multidisciplinary design teams.
- will demonstrate the ability to choose and apply appropriate resource management techniques so as to optimally utilize the available resources.
- will be proficient in English language in both verbal and written forms which will enable them to compete globally.
- will have confidence to apply engineering solutions with professional, ethical and social responsibilities.
- will be able to excel in their professional endeavours through self-education.
- will be able to design and build renewable energy systems for developing clean energy and sustainable technologies.

M.TECH

IN POWER SYSTEMS

PROGRAM EDUCATIONAL OBJECTIVES (PEOS) :

The major objectives of the M.Tech. programme in Power Systems are to equip the students with adequate knowledge and skills in Power Systems Engineering and to prepare them for the following career options:

- research programmes in Power Systems Engineering
- employment in power research and development organisations
- to work in electric power industries and energy sectors
- faculty positions in reputed institutions

Programme Outcomes (POs) :

A student who has undergone M.Tech. programme in Power Systems (PS) will:

- have an ability to evaluate and analyse problems related to Power Systems and be able to synthesise the domain knowledge and incorporate the principles in the state of art systems for further enrichment
- be able to critically investigate the prevailing complex PS scenarios and arrive at possible solutions independently, by applying the acquired theoretical and practical knowledge
- be able to solve PS problems such as load flows, state estimation, fault analysis and stability studies
- be able to develop broad-based economically viable solutions for unit commitment and scheduling
- be able to identify optimal solutions for improvising power transfer capability, enhancing power quality and reliability
- be able to evolve new schemes based on literature survey, and propose solutions through appropriate research methodologies, techniques and tools, and also by designing and conducting experiments
- be able to interpret power system data and work on well-defined projects with well defined goals to provide real time solutions pertaining to PS
- be able to develop, choose, learn and apply appropriate techniques, various resources including hardware and IT tools for modern power engineering, including prediction and modelling with an understanding of the limitations
- be able to develop dedicated software for analysing and evaluating specific power system problems
- be able to participate in collaborative-multidisciplinary engineering / research tasks and work as a team member in such tasks related to PS domain, giving due consideration to economic and financial intricacies, and lead the team in specific spheres
- be able to confidently interact with the industrial experts for providing consultancy
- be able to pursue challenging professional endeavours based on acquired competence and knowledge
- be a responsible professional with intellectual integrity, code of conduct and ethics of research, being aware of the research outcomes and serve towards the sustainable development of the society
- be capable of examining critically the outcomes of research and development independently without any external drive.

M.TECH
IN POWER ELECTRONICS

PROGRAM EDUCATIONAL OBJECTIVES (PEOS) :

The major objectives of the M.Tech. programme in Power Electronics are to equip the students with adequate knowledge and skills in Power Electronics and to prepare them for the following career options:

- research programmes in Power Electronics and related areas
- employment in R & D organisations related to sustainable technologies
- to work in power electronic circuit design and fabrication industries
- faculty positions in reputed institutions

Programme Outcomes (POs) :

A student who has undergone M.Tech. programme in Power Electronics (PE) will:

- have an ability to evaluate and analyse problems related to Power Electronic Systems and incorporate the principles in the state of art systems for further improvement
- be able to investigate critical PE problems and to arrive at possible solutions independently, by applying theoretical and practical considerations
- be able to solve PE problems such as switching control, converter design, analysis and control of solid state drives and stability studies
- be able to develop appropriate power converters for sustainable energy technologies
- be able to identify optimal solutions for improvising power conversion and transfer capability, enhancing power quality and reliability through PE based solutions
- be able to evolve new power electronic topologies and control schemes based on literature survey and propose solutions through appropriate research methodologies, techniques and tools, and also by designing and conducting experiments
- be able to work on small, well-defined projects with particular goals to provide real time solutions pertaining to power electronics
- be able to develop, choose, learn and apply appropriate techniques, various resources including sophisticated digital controllers and IT tools for modern power electronic system simulation, including prediction and modelling with existing constraints
- be able to develop dedicated software for analysing and evaluating specific power electronics and control problems
- be able to participate in collaborative-multidisciplinary engineering / research tasks and work as a team member in such tasks related to PE domain, giving due consideration to ecological and economical intricacies, and lead the team in specific areas
- be able to confidently interact with the industrial experts for providing consultancy
- be able to pursue challenging professional endeavours based on acquired competence and knowledge
- be a responsible professional with intellectual integrity, code of conduct and ethics of research, being aware of the research outcomes and serve towards the sustainable development of the society
- be capable of examining critically the outcomes of research and development independently without any external drive.

JOURNALS & PUBLICATIONS

Padghan, Pavan Ramchandra, Samuel Arul Daniel, and Raja Pitchaimuthu. "Grid-tied energy cooperative trading framework between Prosumer to Prosumer based on Ethereum smart contracts." Sustainable Energy, Grids and Networks 32 (2022): 100860.

Sujikannan, M., A. Rakesh Kumar, and S. Arul Daniel. "Sizing of Rooftop PV Array and Community-Run Battery Storage for an Energy Cooperative in Prosumer Cluster." Distributed Generation & Alternative Energy Journal (2022): 1797-1822.

Boddapati, Venkatesh, A. Rakesh Kumar, S. Arul Daniel, and Sanjeevikumar Padmanaban. "Design and prospective assessment of a hybrid energy-based electric vehicle charging station." Sustainable Energy Technologies and Assessments 53 (2022): 102389.

Suresh, N. S., N. S. Padmavathy, S. Arul Daniel, and Ramakrishna Kappagantu. "Smart Grid in Indian Scenario." Smart Grids and Microgrids: Technology Evolution (2022): 175-194.

Boddapati, Venkatesh, A. Rakesh Kumar, D. B. Prakash, and S. Arul Daniel. "Design and Feasibility Analysis of a Solar PV and Biomass-based Electric Vehicle Charging Station for Metropolitan Cities (India)." Distributed Generation & Alternative Energy Journal (2022): 793-818.

Subramanian, P. Venkat, Venkatesh Boddapati, and S. Arul Daniel. "Automated Real-Time Transformer Health Monitoring System Using the Internet of Things (IoT)." In Advancement in Materials, Manufacturing and Energy Engineering, Vol. I, pp. 503-511. Springer, Singapore, 2022.

Boddapati, Venkatesh, and S. Arul Daniel. "Design and feasibility analysis of hybrid energy-based electric vehicle charging station." Distributed Generation & Alternative Energy Journal (2022): 41-72.

Mandal, Arunangshu, M. S. Suhanya, and N. Kumaresan. "A unified control strategy for improved performance of Totem-Pole Power Factor Correction Boost Converter." In 2022 IEEE Global Conference on Computing, Power and Communication Technologies (GlobConPT), pp. 1-6. IEEE, 2022.

Das, Dipjoy, N. Kumaresan, and Hanumanthu Kesari. "A Modified Second Order Sliding Mode Control Technique for the Operation and Control of a 3-Level Bidirectional NPC Converter." In 2022 IEEE IAS Global Conference on Emerging Technologies (GlobConET), pp. 465-470. IEEE, 2022.

Sekhar, Nindra, and Natarajan Kumaresan. "Operation and control of a stand-alone power system with integrated multiple renewable energy sources." Wind Engineering 46, no. 1 (2022): 221-239.

Akbarali, Mahaboob Subahani, Senthilkumar Subramaniam, and Kumaresan Natarajan. "Analysis and control of SEIG-based wind energy conversion system supplying low voltage dc microgrid." In 2022 IEEE International Conference on Power Electronics, Smart Grid, and Renewable Energy (PESGRE), pp. 1-6. IEEE, 2022.

JOURNALS & PUBLICATIONS

Ansar, Shameem A., S. Sudha, and Suresh Francis. "Identification and classification of landslide susceptible zone using geospatial techniques and machine learning models." GEOCARTO INTERNATIONAL (2022).

amalapathi, K., Nayak, P.S.R. and Tyagi, V.K., 2022. Analysis of Dual Input Buck-Boost Converter for Solar PV Integration with Wireless Electric Vehicle Charger. Distributed Generation & Alternative Energy Journal,pp.73-102. doi:10.13052/dgaej2156-3306.3714

Nayak PS, Peddanna G. Mutual inductance estimation between rectangular structures magnetic coils with various misalignments for wireless EV charger. International Journal of Electric and Hybrid Vehicles. 2022;14(3):pp 250-68. doi:10.1504/IJEHV.2022.125586

.K. Kumba, S. P. Simon, K. Sundareswaran, P. S. R. Nayak, K. A. Kumar and N. P. Padhy, "Performance Evaluation of a Second-Order Lever Single Axis Solar Tracking System," in IEEE Journal of Photovoltaics, vol. 12, no. 5, pp. 1219-1229, Sept. 2022 doi: 10.1109/JPHOTOV.2022.3187647.

Madhavan Namboothiri, K., K., S., Nayak, P.S.R. et al. State of Charge Estimation of Lithium-Ion Batteries Employing Deep Neural Network with Variable Learning Rate. J. Inst. Eng. India Ser. B (2022). doi: 10.1007/s40031-022-00848-x

Peddanna, G., Nayak, P.S.R. Mutual Inductance Analysis of Asymmetrical Rectangular Structure Coils at Possible Misalignments for EV Battery Charging Application. Arab J Sci Eng 47, 14037–14054 (2022). doi:10.1007/s13369-022-06598-8

Madhavan Namboothiri, K., K., S., Nayak, P.S.R. et al. State of Charge Estimation of Lithium-Ion Batteries Employing Deep Neural Network with Variable Learning Rate. J. Inst. Eng. India Ser. B (2022). https://doi.org/10.1007/s40031-022-00848-x

Ehsan, R.M., Simon, S.P., Kinattingal, S. et al. Effects of nanocoatings on the temperature-dependent cell parameters and power generation of photovoltaic panels. Appl Nanosci 12, 3945–3962 (2022). https://doi.org/10.1007/s13204-022-02633-0

P Sasidharan, M., Kinattingal, S. & Simon, S.P. Comparative Analysis of Deep Learning Models for Electric Vehicle Charging Load Forecasting. J. Inst. Eng. India Ser. B (2022). https://doi.org/10.1007/s40031-022-00798-4

S. Sreekumar, K.C. Sharma, R. Bhakar, S.P. Simon, A. Rana,Multi interval Zero Carbon Flexible Ramp Product,Electric Power Systems Research,Volume 212,2022,108258,ISSN 0378-7796,https://doi.org/10.1016/j.epsr.2022.108258. (https://www.sciencedirect.com/science/article/pii/S037877962200460 6)

Mallikarjuna Golla, Sankar S., Chandrasekaran K., Sishaj P. Simon, Narayana Prasad Padhy,An Integrated Power Control Module for Photovoltaic Sources in DC Microgrid System,International Journal of Electrical Power & Energy Systems,Volume 142, Part B,2022,108348,ISSN 0142-0615,https://doi.org/10.1016/j.ijepes.2022.108348

JOURNALS & PUBLICATIONS

V. Gundu, S. P. Simon, V. Kasi, N. P. Padhy and D. K. Khatod, "Priority-Based Residential Demand Response for Alleviating Crowding in Distribution Systems," in Journal of Modern Power Systems and Clean Energy, doi: 10.35833/MPCE.2022.000034.

Puthusserry, G. V. ., Sundareswaran, K. ., Simon, S. P. ., & Krishnan, G. S. . (2022). Maximum Energy Extraction in Partially Shaded PV Systems Using Skewed Genetic Algorithm: Computer Simulations, Experimentation and Evaluation on a 30 kW PV Power Plant. Distributed Generation &Amp; Alternative Energy Journal, 37(06), 1773–1796. https://doi.org/10.13052/dgaej2156-3306.3763

K. Kumba, S. P. Simon, K. Sundareswaran, P. S. R. Nayak, K. A. Kumar and N. P. Padhy, "Performance Evaluation of a Second-Order Lever Single Axis Solar Tracking System," in IEEE Journal of Photovoltaics, vol. 12, no. 5, pp. 1219-1229, Sept. 2022, doi: 10.1109/JPHOTOV.2022.3187647.

Sreenu Sreekumar, Sumanth Yamujala, Kailash Chand Sharma, Rohit Bhakar, Sishaj P. Simon, Ankur Singh Rana,Flexible Ramp Products: A solution to enhance power system flexibility,Renewable and Sustainable Energy Reviews,Volume 162,2022,112429,ISSN 1364-0321,https://doi.org/10.1016/j.rser.2022.112429

M. Golla, S. Thangavel, S. P. Simon and N. P. Padhy, "An Enhancement of Power Quality With Efficient Active Power Transfer Capability in a PV–BSS-Fed UAPF for Microgrid Realization," in IEEE Systems Journal, 2022, doi: 10.1109/JSYST.2022.3179182

M. Golla, S. Thangavel, S. P. Simon and N. P. Padhy, "A Novel Control Scheme using UAPF in an Integrated PV Grid-tied System," in IEEE Transactions on Power Delivery, 2022, doi: 10.1109/TPWRD.2022.3180681

M. Arumuga and M. J. B. Reddy, "An Intelligent Distance Relay Sensing Methodology Immune to Power Swing and Load Encroachment," in IEEE Sensors Journal, vol. 23, no. 1, pp. 800-811, 1 Jan.1, 2023, doi: 10.1109/JSEN.2022.3223905

Arumuga, M., Reddy, M.J.B. Critical analysis of the effect of source impedance ratio and power flow on the performance of the distance relay during non-fault and fault conditions. Electr Eng (2022). https://doi.org/10.1007/s00202-022-01659-5

R, S., Sankaranarayanan, V. Optimal Scheduling of Electric Vehicle Charging at Geographically Dispersed Charging Stations with Multiple Charging Piles. Int. J. ITS Res. 20, 672–695 (2022). https://doi.org/10.1007/s13177-022-00316-2

Shukla, Hiramani, Srete Nikolovski, Ankur Singh Rana, and Pawan Kumar. "SMES-GCSC Coordination for Frequency and Voltage Regulation in a Multi-Area and Multi-Source Power System with Penetration of Electric Vehicles and Renewable Energy Sources." Energies 16, no. 1 (2023): 251.

Sreekumar, N.U. Khan, A.S. Rana, M. Sajjadi, D.P. Kothari,Aggregated Net-load Forecasting using Markov-Chain Monte-Carlo Regression and C-vine copula,Applied Energy, Volume 328,2022,120171, ISSN 0306-2619, https://doi.org/10.1016/j.apenergy.2022.120171

CONVOCATION 2022

B.Tech

M.Tech : Power Systems

M.Tech : Power Electronics

MEDAL WINNERS

B.Tech
Sandipan Roy
9.54

M.Tech
(Power Systems)
Grandhe Sravani
9.78

M.Tech
(Power Electronics)
Dipjoy Das
9.30

MASTER OF SCIENCE (RESEARCH)

SR.NO	NAME OF THE GUIDE	ROLL NUMBER	NAME	TITLE OF THESIS
1.	Dr. P. Srinivasa Rao Nayak	307915051 20th January 2022	DASARATHA SAHU	Design and Analysis Of Solar Powered and E-Rickshaw Charging and Drive Train System

DOCTOR OF PHILOSOPHY (PH.D)

SR.NO	NAME OF THE GUIDE	ROLL NUMBER	NAME	TITLE OF THESIS
1.	Dr. P. Raja	407114054 21st March 2022	GANESH MOORTHY J	Design and Development of Simplified Active Power Regulation Scheme for Solar Photovoltaic Grid-Tied Micro-Inverters
2.	Dr. S. Senthil	407115051 4th February 2022	BABU N	Design and Development of Solar February Electric Power Generation Systems for Industrial Applications
3.	Dr. S. Senthil	407918002 8th February 2022	NAMANI RAKESH	Investigation of Reconfiguration Techniques and Fault Detection February Algorithms for Photovoltaic Systems using Power Electronic Controllers
4.	Dr. N. Kumaresan	407116003 10th May 2022	NINDRA SEKHAR	Design and Operation of a New Hybrid System Employing Wind- Driven DFIG, Solar PV Panels and Bio-Gas Driven SCIG using Power Electronic Controllers
5.	Dr. Sishaj P Simon	407117002 11th April 2022	VENKATESWARLU GUNDU	Demand Response Schemes in a Distribution System using Deep Learning Techniques
6.	Dr. M.P. Selvan	407914001 11th April 2022	P KALIAPPAN	Investigations on Protection Schemes of Certain Operational Wind Farms in India, Monitoring using Phasor Measurement Unit and Its Compliance
7.	Dr.M. Venkatakirthiga	407915001 18th May 2022	MH RAVICHANDRAN	Investigations on Transverse Flux Motor for a Direct Drive Low Speed Precision Mechanism for Spacecraft Application

CURRENTS 2022

AN OVERVIEW

Currents is the annual technical symposium of the department of Electrical and Electronics Engineering of NIT Trichy. From its humble inception in 1990, it has taken a quantum jump and has progressed to become one of the largest technical symposia in South Asia. Conducted by the EEE Association, the three-day symposium strives to provide the perfect platform for the student community to showcase their technical acumen, enrich their electrical and electronics skillset, and network with like-minded peers from across the country.

The 32nd edition of Currents took place virtually from 18th to 20th February 2022 and was a grand success with an unheralded virtual footfall of over 2500. Currents'22 kickstarted with a virtual inauguration presided over by Dr. Subhanshu Gupta, an alumnus of our Institute (2002 batch) and Associate Professor at Washington State University as the Chief Guest. The event was graced by Dr. N. Kumaresan, Dean Students Welfare, NIT Trichy; Dr. V. Sankaranarayanan, HoD EEE; Dr. Josephine R.L., Faculty advisor; faculty, EEEA members, and the student community. A special lecture on "IoT and Communications" was delivered by the Chief Guest after the ceremony and was followed by a short Q&A session.

With the release of the official website, several events like Capture Currents – an online photography competition, Colloquim – Paper Presentation event, Dhruva – an event testing problem-solving and aptitude skills, and Code Currents – a coding contest to test one's programming skills with specially curated coding challenges began accepting responses about a week before the inauguration.

Day 0 of Currents (February 17th) saw an interesting workshop on designing combinational and sequential logic circuits using the programming language, Verilog. Day 1 entailed Currents Inauguration, PCB Design Workshop, and Guest Lecture by Dr. Subhanshu Gupta. Day 2 was packed with 3 workshops - Web Development, Machine Learning, and Electric Vehicles and charging.

Day 2 concluded with an informative guest lecture titled "Neural prostheses for amputees and patients with spinal cord injuries" by Dr. V. John Mathews, Professor, School of Electrical Engineering and Computer Science, Oregon State University. On Day 3, 2 workshops and a Guest Lecture were organized. Image Processing Workshop – a heuristic approach to design a gesture-controlled camera using image processing with Python and Embedded Programming with Arduino Workshop – focusing on developing a retro shooter game using embedded programming in Arduino kept the students engrossed in the vast possibilities in tech. Further, Mr. Dominic Cordeiro, Technical Director, Masibus Automation and Instrumentation, and Dr. Sumanta Bose, Founder and CEO of Datakrew presented the 3rd Guest Lecture of this edition on "Industrial IoT". It was an interactive session where they shared invaluable insights and knowledge in their fields of expertise. Finally, the symposium came to a close with the announcement of much-awaited results and list of winners of various events.

Overall Currents 2022, a 3-day event replete with 7 technical workshops, 4 online events, and 3 guest lectures was a phenomenal success. With another successful year of online events and workshops, the enthusiasm shown by the students was the key to making Currents '22 live in our memories.

High **Performance** Computing

Shakambari Saxena
Year III

Data is the fuel for game-changing inventions, the source of ground-breaking scientific discoveries, and the improvement of billions of people's quality of life worldwide. Advancements in science, industry, and society are primarily based on high-performance computing. The number and volume of data enterprises must work with is expanding dramatically because of technologies like the Internet of Things (IoT), artificial intelligence (AI), and 3-D imaging. Analyzing real-time data is essential for many tasks, like streaming a live event, monitoring weather progression, testing new goods, and examining market trends.

High-performance computing (HPC) is a technique that processes enormous multi-dimensional information (big data) and solves complex problems at high-speed rates using parallel clusters of powerful computers. HPC systems often operate more than one million times faster than the fastest commercial desktop, laptop, or server computers.HPC is often used as a synonym for supercomputing. The components of high-performance computers that small and medium-sized organizations are interested in today are clusters of computers: processors, memory, discs, and OS. Linux and Windows are two popular software for HPC. Computer servers must be networked together in a cluster for HPC architecture. On a server in a cluster, programs and algorithms are running simultaneously. The output is obtained when the cluster is networked to data storage.

Together, this results in a vast body of worthwhile work. Multiple tasks are done concurrently using numerous computer servers or processors. Computing in parallel with tens of thousands to millions of processors or cores is called massive parallel computing. An HPC cluster comprises several networked high-speed computers, and a central scheduler manages the workload for parallel computing. High-performance multi-core CPUs or, more often today, GPUs (graphics processing units) are used by the nodes, which is the name for each server. These processors are well suited for complex mathematical calculations, machine learning models, and graphics-intensive applications. One HPC cluster may contain 100,000 nodes or more. The key benefit of using this is that each node can cooperate to tackle an issue that is harder for a single computer to handle alone. These nodes are interconnected to the point where they can talk to one another and create helpful output.

Until a decade ago, the exorbitant expense of HPC, which required purchasing or renting a supercomputer or constructing and operating an HPC cluster in-house, made it unaffordable for most businesses. Today, HPC in the cloud, a service or HPCaaS- offers businesses a substantially faster, more scalable, and more cost-effective method to benefit from HPC. HPCaaS often offers ecosystem capabilities (such as AI and data analytics) and HPC expertise in addition to access to HPC clusters and infrastructure in a cloud service provider's data center.

The HPC cloud is driven by surging demand from organizations and industries worldwide. All top public cloud service providers provide HPC services. Additionally, many enterprises are embracing or migrating to private-cloud HPC solutions provided by hardware and solution suppliers. At the same time, some continue to operate highly regulated or sensitive HPC work loads on-premises. For instance, HPC is increasingly used to detect credit card fraud, which almost all of us rely on and have encountered at some point.

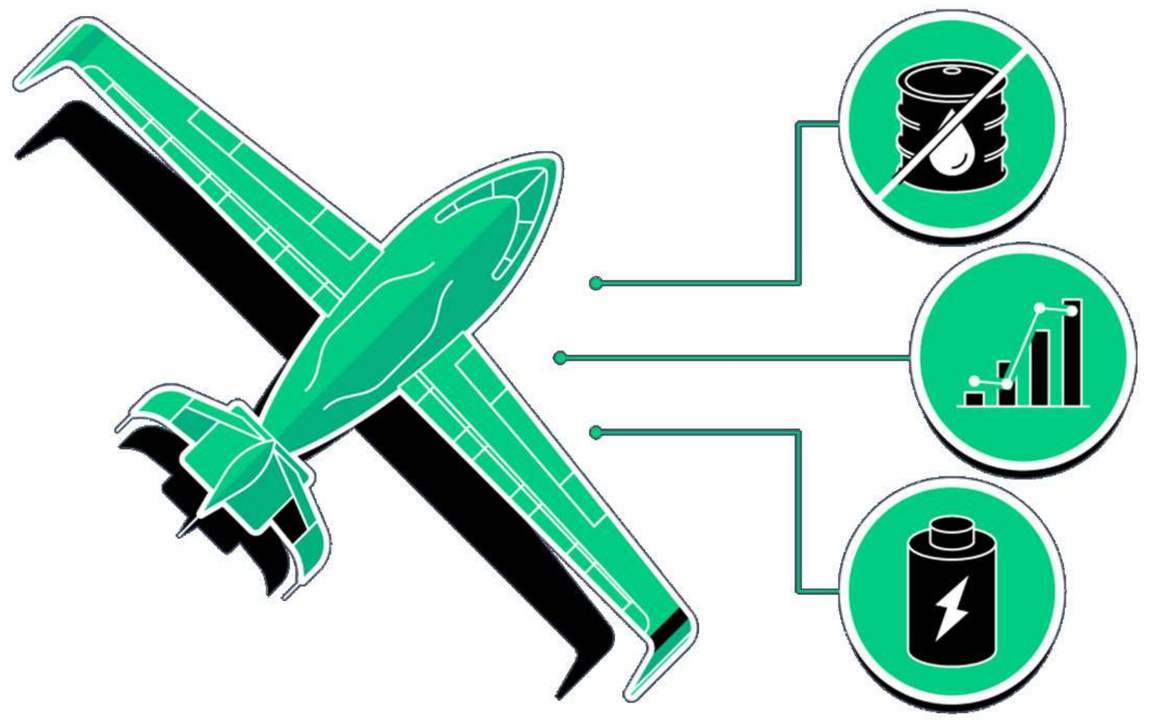
HPC applications in genomics are driving continuous innovation. HPC systems can sequence a human genome in less than a day, compared to the first attempt, which took 13 years. Rapid cancer diagnosis, molecular modeling, and drug discovery and design are other HPC applications in healthcare and life sciences. Weather forecasting and climate modeling, which both involve enormous processing volumes of historical meteorological data and millions of daily changes in climate-related data points, are two expanding HPC use cases in this field. Research on energy and intelligence work are two other government and defense uses. Processing seismic data, simulating and modeling reservoirs, geospatial analytics, wind simulation, and terrain mapping are examples of HPC uses.

Aerospace Electrification

Fahmida Hiba Fathima
Year III

With the increased concerns about climate change, there has been a shift in the outlook of people in the manner in which they lead their lives. One of these is the adoption of electric forms of transport. As of now, we have been able to see the changeover from fossil fuel-powered engines to engines that run on electricity majorly in road and rail travel. The next towards a greener future would be electrified aviation.

The current operation of aircrafts has degraded the air quality in or around where an airport is located. The risk to public health comes from the production of emissions which include nitrous oxides, NOx , fine particulate matter, PM2.5, and ozone O3 as has been documented widely with scientific evidence. Apart from the substandard air conditions, neighborhoods near the airports experience higher noise levels. More recent aircraft designs have reduced noise levels, but there are still improvements needed. We can observe the start of electrification in the aviation industry as seen in the Airbus A350 and Boeing 787 increasing usage of batteries to power onboard systems. The 787 also exhibits its greater use of electric power engine-installed led generators.



This approach is described as the ‘more-electric aircraft’. Future progression to electric propulsion is increasingly being proposed; first, by considering a hybrid option with energy still provided by hydrocarbon fuel but powering electric propulsion – then, progressing to a fully electric system with batteries providing the energy. A hybrid-powered solution is much more likely to be available sooner. This could deliver real benefits through reduced emissions. It would also allow for the development of electric propulsion motors and power electronics so that these would be ready for the switch to full electric operation.

The gas turbine and the electrical generator, which are existing, are put together. Jet fuel – kerosene, which could include biofuels for further environmental benefit – powers the gas turbine, which drives the electrical generator. A new power electronics system is likely to be required to then transfer this electrical energy to new electric motors to provide thrust. A ‘More Electric-Hybrid’ system could extend the use of batteries to power all remaining systems on the aircraft. A ‘Full Hybrid’ solution would combine the power available from the generator and batteries to power all aircraft systems, with each means of energy supply augmenting the other in different ratios during different fight phases.

Both architectures can collectively be described as hybrid solutions, with a high likelihood that prototype testing will enable the jump straight to the Full Hybrid solution with electrical energy being combined from both sources to power all systems. The current generation of gas turbine engines are designed to fulfill the different thrust requirements that are needed for take-off, climb, and cruise, as well as different air flows coming onto the aircraft and changes in altitude, but do not function with optimal efficiency in all cases. In a hybrid solution, the gas turbine could be kept relatively isolated from those shifting conditions, so that its only job is to power a generator and it can run at an optimized, single speed.

Then, in turn, it would power an electrical generator that drives the conversion systems needed to give electrical energy. A risk to this approach would be the reliance on unproven power distribution systems and high-power electric motors – but this is one of the issues being addressed through prototype development, such as with the Airbus E-Fan X, which does so initially by switching one, of four, engines to be powered in this way. This system could then be developed by changing the energy source from a kerosene-powered gas turbine and generator to the use of batteries in an 'All Electric' system.

The full propulsion and electrical system, combining all the technical operation equipment inside the aircraft, would almost certainly become heavier than the current systems it replaces. Also, the aircraft will land at a higher proportion of the take-off weight compared to today's aircraft, due to the batteries. Some estimates suggest that to compensate for these effects we'd need to reduce the airframe mass by around twenty percent. The potential reductions required for a fully electric system are greater still. Siemens has already developed a new type of electric motor that, with a weight of just fifty kilograms, delivers a continuous output of about two hundred and sixty kilowatts – five times more than comparable weight systems – using a hybrid-electric propulsion system. While this is pushing boundaries, the two hundred and sixty kilowatts produced is a small amount compared to the needed power to make a commercial aircraft viable for travel is from two to fifty megawatts.

Currently, jet fuel in the wings depletes as the fight continues, and the structure of the wing accounts for that. Batteries could help in a future wing because they'd be a fixed mass throughout the fight, and adding their mass into the wing could help with aeroelastic tailoring. That means there's a possibility of tuning the wings to make them more aerodynamically efficient by allowing them to become longer and thinner. The change to an electrical system could also enable distributed propulsion allowing radically different aircraft configurations.

With advancements in electronics required for the conversion and the reduction of weight of the engine and a possibility of a differently oriented aircraft might be the next revolution the aviation industry faces and from this, we will be closer to reaching our goal of a greener and more sustainable world to reside in.

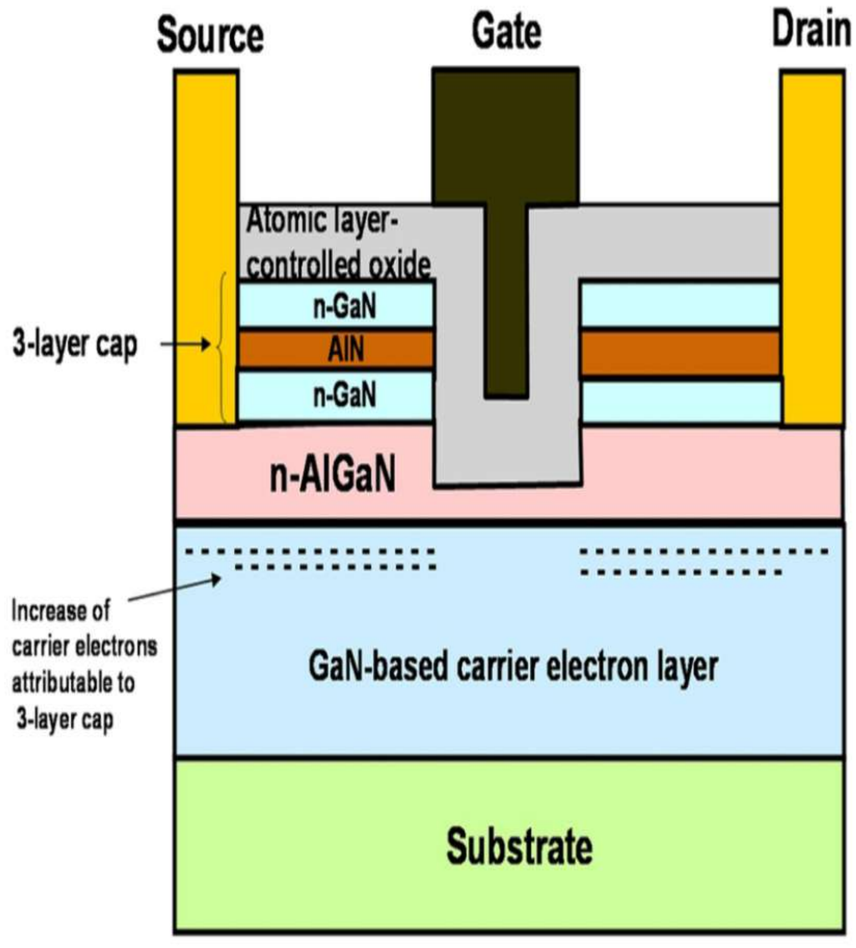
HEMTs GaN

Yash Chaturani
Year III

Have you ever wondered how your chargers keep getting smaller while still getting faster and more efficient at charging your devices? This is the result of a recent significant transition in the electronics industry towards GaN-based battery chargers.
More recently, as more and more innovations in battery charging technology emerge and enter the power charging market, the new GaN-based charging technology is rising to fame. However, there are numerous other important-to-know applications for GaN HEMTs as well. This article should take you through the basics of what GaN HEMTs are all about and why it has recently become a buzzword

What are GaN HEMTs, and why do we need them?

Gallium Nitride (GaN) High Electron Mobility Transistors (HEMTs) are a type of high-power, high-frequency transistor that is widely used in a variety of electronic and electrical applications, such as radio-frequency (RF) power amplifiers, high-voltage switches, and inverters. They are made from gallium nitride (GaN), a wide bandgap semiconductor material with high electron mobility and high breakdown voltage. GaN HEMTs offer several advantages over traditional transistor technologies, including high breakdown voltage, high switching speed, and high thermal stability, making them well-suited for use in high-power, high-frequency applications such as switching power supplies, wireless high-speed communication systems, radar systems, portable electronic devices, and other applications where space is limited.



How are GaN HEMTs made, and how do they work?

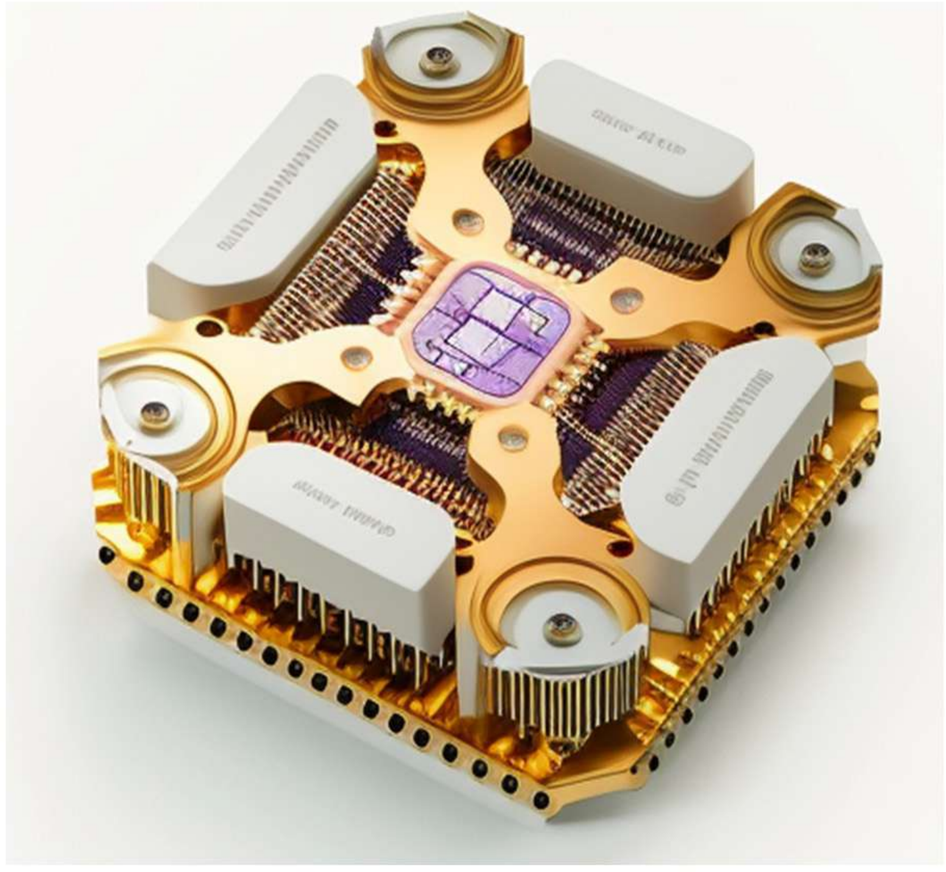
GaN HEMTs are typically grown on a substrate material such as silicon or sapphire using a process called metal-organic chemical vapour deposition (MOCVD). The GaN layer is then patterned using photolithography and etching techniques to create the active region of the transistor. A gate electrode is then deposited on top of the active region, and source and drain electrodes are deposited on either side of the gate electrode.
The operation of a GaN HEMT is similar to that of other types of transistors. When a voltage is applied to the gate electrode, it creates an electric field that modulates the flow of electrons between the source and drain electrodes. This allows the GaN HEMT to act as a switch, allowing current to flow through the device when the gate voltage is high and blocking current when the gate voltage is low.

So, why all the buzz about GaN-based tech? Why are they better than our traditional Si-based tech?

One of the key features of GaN HEMTs is their high electron mobility. Electron mobility is a measure of how easily electrons can move through a material, and it is an important factor in determining the performance of a transistor. GaN has very high electron mobility, which allows it to conduct electricity more efficiently than other materials, such as silicon. This makes GaN HEMTs particularly well-suited for use in high-frequency applications, where high electron mobility is necessary to enable fast switching speeds. This is why GaN chargers often find applications in fast charging technology.

Another vital feature of GaN HEMTs is their high breakdown voltage. Breakdown voltage is the voltage at which a transistor will fail, which is a critical factor in determining the maximum power a transistor can handle. GaN HEMTs have a much higher breakdown voltage than other types of transistors, making them capable of handling higher power levels. This makes them well-suited for use in high-powevr applications, such as RF power amplifiers, where high breakdown voltage is necessary to prevent transistor failure.
They have high thermal stability, which allows them to operate at high temperatures without degrading. They also have a low output capacitance, enabling them to switch on and off quickly, making them suitable for use in high-speed switching applications.

They also have a high power density, meaning they can handle large amounts of power in a small package. This is why GaN-based chargers are much smaller than traditional Si-based chargers for the same power rating.

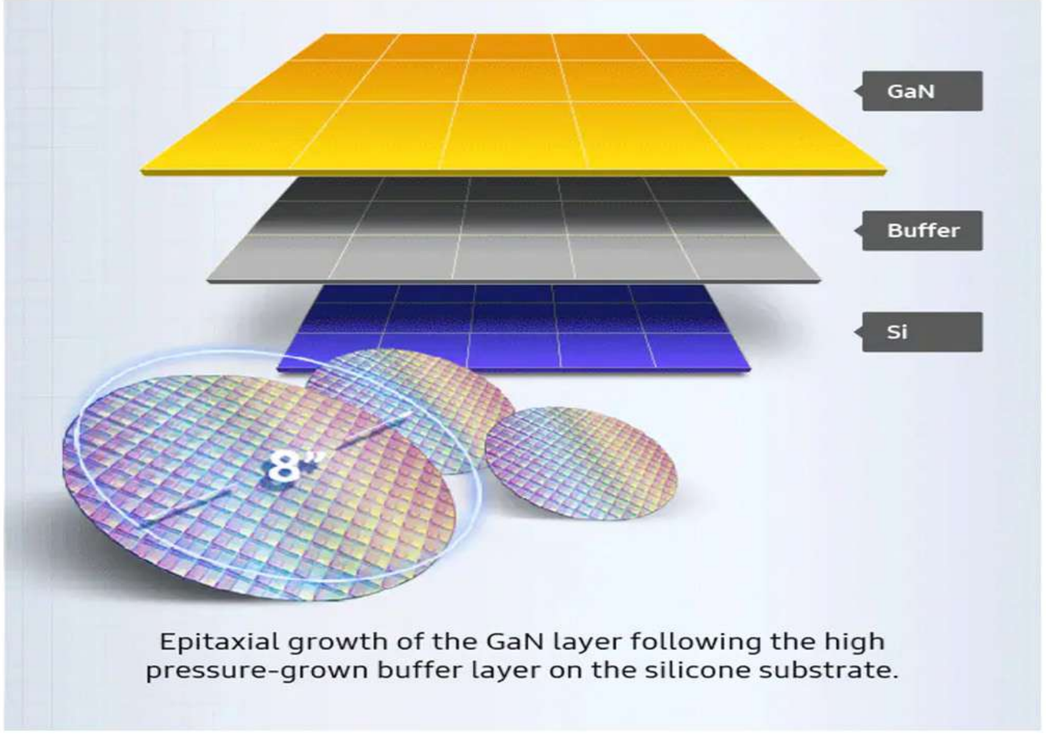


Are there any downsides to adopting GaN technology?

Despite their many advantages, GaN HEMTs are not without their challenges. One of the main challenges is the high cost of manufacturing GaN HEMTs, which can be significantly higher than the cost of manufacturing other types of transistors. This is because GaN is a more expensive material than silicon, and the MOCVD process used to grow GaN layers is also more expensive than other semiconductor fabrication techniques. This can make GaN HEMTs unsuitable for some cost-critical applications. Additionally, GaN HEMTs are more susceptible to voltage spikes, and electrical overstress than other types of transistors, which can lead to device failure if not properly managed.

Conclusion:

Despite these challenges, GaN HEMTs continue to become increasingly prevalent in a wide range of applications due to their unique combination of high-power, high-frequency performance, high-power density and high thermal stability. They are used in various electronic and electrical devices, including RF power amplifiers, high-voltage switches, inverters, and power converters, as well as in various military and aerospace applications. With continued research and development, GaN HEMTs will likely continue to play a significant role in the electronic and electrical industries in the coming years.



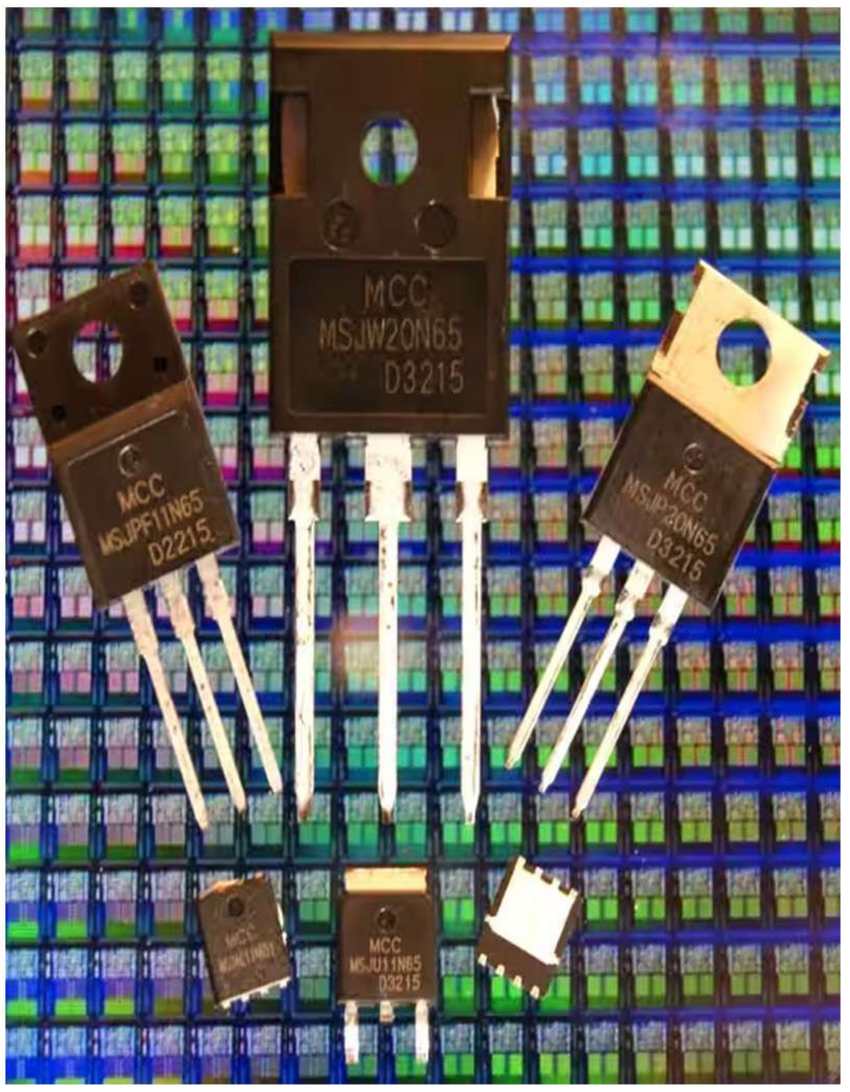
Epitaxial growth of the GaN layer following the high pressure-grown buffer layer on the silicone substrate.

SUPERJUCTION TRANSISTORS

Kanagambujam Venkatramani
Year III

In high-voltage switching converters, power MOSFETs based on superjunction technology have established themselves as the standard. The preeminent design platform for high-voltage devices was based on planar technology before superjunction MOSFETs became commercially available.
The super-junction structure was created in the field of power transistors in order to go beyond the limitations of planar structures. A flat or planar transistor is a structure that is planar. The disadvantage of this arrangement is that as the rated voltage is increased, the drift layer thickens, increasing the ON-resistance. In contrast, a super-junction structure is one in which numerous vertical pn junctions are constructed. As a result, a high voltage is maintained while a low ON-resistance and lowered gate charge are obtained. Therefore, the concept of charge balancing serves as the foundation for the physical design of superjunction MOSFETs.

The principal use of the superjunction idea is in 500-800 V rated power devices. However, its boundaries are constantly shifting to lower voltages with integrated solutions and to higher voltages (1.2 kV), where it must contend with wide-bandgap materials like gallium nitride (GaN) and silicon carbide (SiC), as well as silicon bipolar devices like the insulated gate bipolar transistor (IGBT). One must examine the benefits and, more crucially, the drawbacks of the power Metal Oxide Semiconductor Field Effect Transistor in order to comprehend the need for the superjunction (MOSFET).



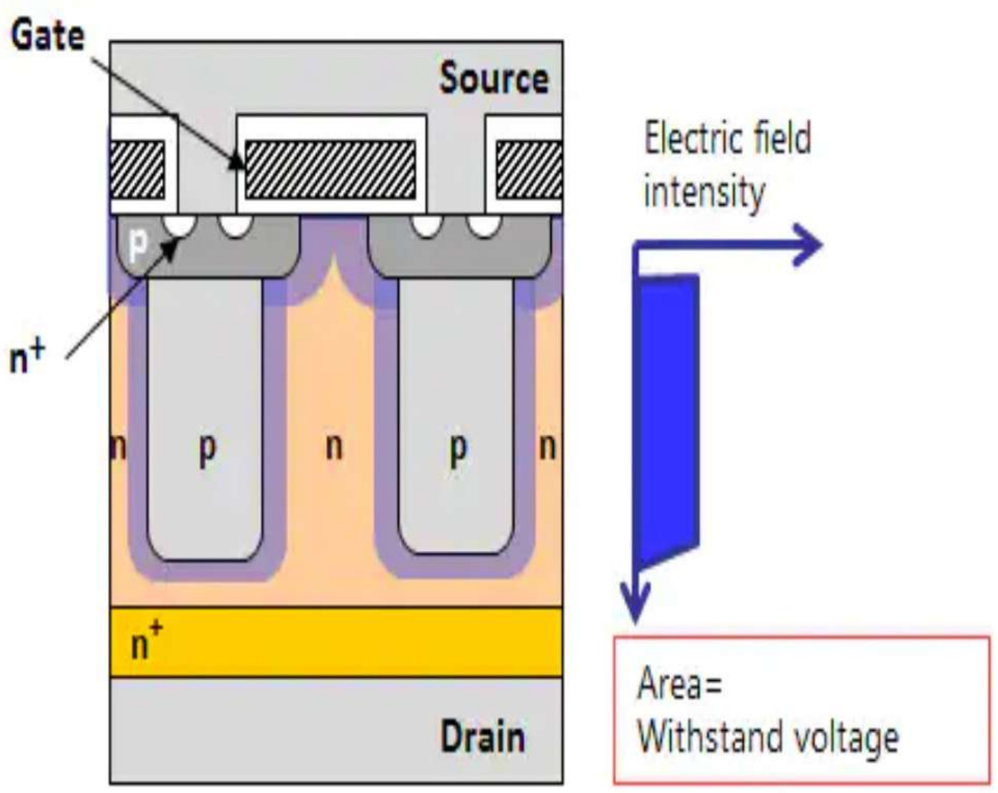
History of superjunction power devices:

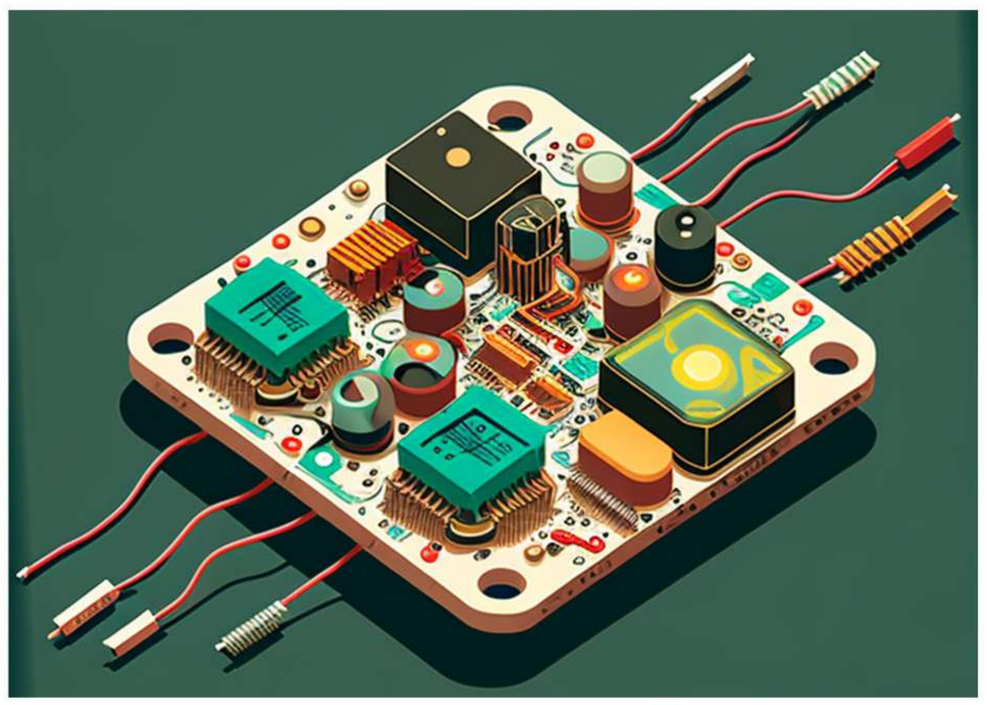
Superjunction devices were originally addressed in the patent field in the 1980s and 1990s, but it wasn't until the late 1990s that they were actually put into practical use, with Infineon and ST Microelectronics taking the lead with their respective brand products CoolMOS and MDMesh. Today's marketplace and specialist literature are filled with commercial goods and a variety of publications. Superjunction is expected to have a global market worth $1 billion by 2017 with a compound annual growth rate of above 12%.

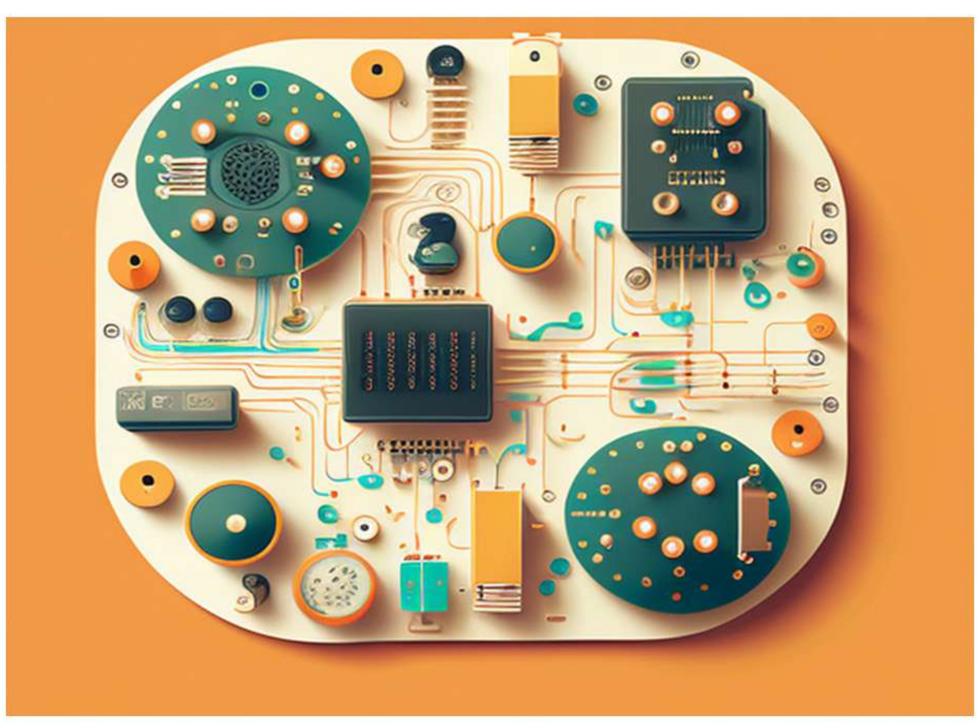
Breakthrough to Commercialisation:

The development of CoolMOS as a commercial product is closely related to establishing a process flow for mass manufacturing as well as to addressing a number of conceptual issues. Although a perfect superjunction device would have roughly equal doping in the n- and p-regions, such a device would not be avalanche resistant and would not even permit measurement of the breakdown voltage with a forced drain-to-source current in the milliampere range. The voltage is raised to the point where the electrical field achieves its maximum field strength and the creation of electron-hole pairs begins as a result of avalanche events brought on by switching of unclamped load currents.Electrons move to the drain, whereas holes flow to the source contact, separating the carriers through the electrical field.

In this scenario, the avalanche current would produce a filament and, at extremely little current, instantly destroy the gadget. Therefore, areas with a distinct surplus of one doping type must be included in the design of an avalanche-resistant superjunction device to enable a stable breakdown characteristic. The design parameter that may be flexibly selected is the current density at which flat field is attained. However, tradeoffs in ON-state resistance and cost are related to avalanche toughness. In the end, avalanche capability is only necessary in low power Flyback converters at relatively low current levels, according to our experience over the past almost two decades. Overvoltage capability, for instance during surge occurrences at the mains input, is especially crucial in high power applications. Temperature-related increases in breakdown voltage (avalanche onset) provide more headroom for clamping circuits to absorb surge energy. When using vertical device ideas, it becomes necessary to get the high voltage potential supplied to the device's backside to the surface in a controlled way for 600 V rated power MOSFETs. The space charge layer enlarges not just laterally but also vertically as it approaches the chip's edge. Under no circumstances should the device fail in the edge termination. Therefore, voltage headroom must be provided by the border construction to account for changes in the manufacturing technology's chosen processing methods. This is a true three-dimensional challenge because of the corners of the real chip architecture and the curvature of the electric field lines. Consequently, the quest for ever-lower specific ON-resistance of superjunction devices is based on a multiobjective optimization taking into consideration ruggedness and manufacturability factors like avalanche capability.



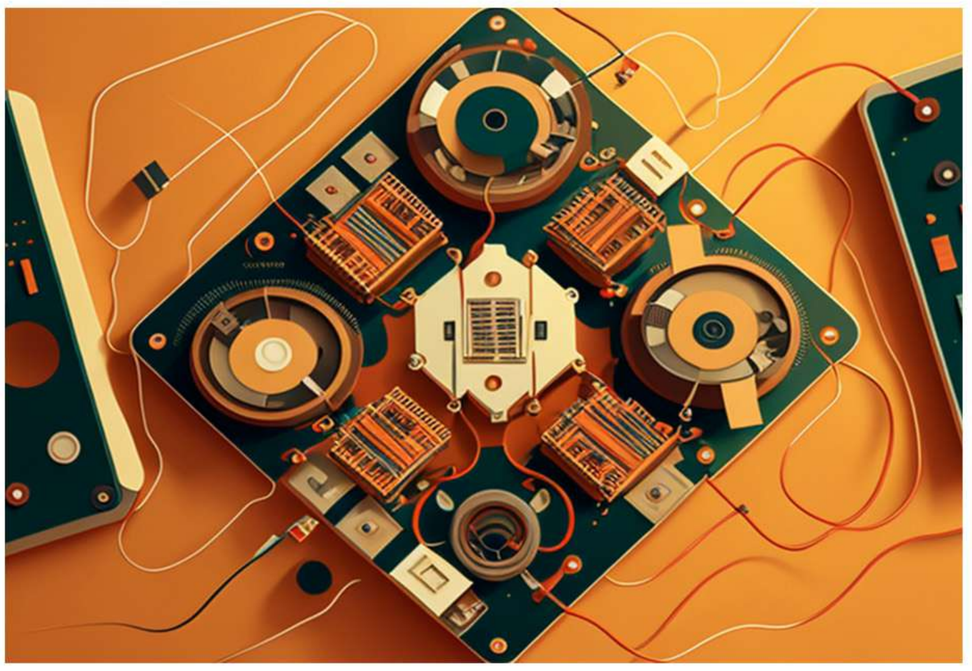




Applications and Conclusion:

The superjunction idea has been crucial in overcoming the restrictions and difficulties in power devices. Without a doubt, silicon's theoretical performance limit was incorrect, and silicon superjunction devices now perform orders of magnitude better than what their theoretical limitations were thought to be.

Today's silicon superjunction devices compete with the more sophisticated, but also more expensive, SiC and GaN devices without entirely outperforming them in terms of performance and nevertheless provide a greater level of manufacturability and shown durability. It is also crucial to emphasize that wide-bandgap devices like SiC and GaN might utilize the superjunction, further strengthening their exceptional potential against silicon-based products. Moreover, the superjunction idea might be used in various structures, including high voltage terminations, Schottky and p-i-n diodes, IGBTs, and other bipolar devices, as well as lateral RESURF-type devices for power integrated circuits.



SWARM ROBOTICS

COVER STORY

Have you ever seen murmuration? Or questioned yourself why thousands of birds gather in murmuration? Interestingly it was found that they exchange information about good feeding areas and also to protect themselves from predators. What if this is an implementation in robotics where machine to machine interaction takes place?

Swarm robotics is one such Embodied Artificial Intelligence system.The idea was inspired by social insectst, which are able to get a global view using only local information. Bees, for instancett, use queueing delays as a cue for balancing the global workload, and ants use pheromone trails to find the shortest paths in large environments.

In swarm robotics, multiple robots are coordinated to perform complex tasks that cannot be done individually by leveraging local interactions among the robots and between the robots and the environment. In this individual robots have processing, communication and sensing capabilities locally on-board so they are able to interact with each other, and react to the environment autonomously. However these algorithms are implemented using centralized control in real world applications.

Swarm behavior is characterized by forming patterns, exploring the environment, and orientating collectively to assign tasks. Self healing, self reproduction and human-swarm interaction are miscellaneous swarm behaviors. Self healing minimizes the impact tof robot failure by recovering the swarm from faults caused by deficiencies of individual robots.
Swarm allows itself to replicate the pattern created to produce a new robot by eliminating the human engineer. Human swarm interaction allows us to control or receive information.

RECENT ADVANCEMENTS AND PROJECTS

Swarms of robots will revolutionize many applications, from targeted material delivery to farming. Several projects focus on developing robotic swarm systems that can provide more secured, autonomous, flexible, and even profitable swarm operations. Some recent projects include :

Secure and Secret cooperation in robot swarms

An MIT Project studies deployment of swarms of robots in cooperative robotics missions in which the “blueprint” of the swarm’s mission is provided without disclosing its raw data. They carried out 2 missions - foraging and maze formation. In both missions, the swarm robots should autonomously secure its peer-to-peer communication through cryptography and carry out sequential tasks without explicit knowledge of the mission’s high level objectives. Their simulation and real-robot implementation demonstrated the feasibility of Merkle Trees as a successful decentralized cooperation mechanism for swarm robotics systems where privacy plays a critical role - network of IoT devices, multi-robot factories, healthcare automation, and many more.

Crazyswarm: A Large Nano-Quadcopter Swarm

Crazyswarm is a project conducted by USC in 2017 where they studied a large swarm of miniature quadcopters flying in dense formation indoors. The large number of small vehicles motivates novel design choices for state estimation and communication using motion-capture marker arrangements and radio communication. They achieved reliable flight with accurate tracking by implementing the majority of computation onboard, including sensor fusion, control, and some trajectory planning. They implemented their system architecture and studied latency and tracking performance for swarms with up to 49 vehicles. Their system can serve as a foundation for a wide range of future work in multi-robot planning, coordination, and control.

Kilobots: A Thousand-Robot Swarm

The Kilobot is a swarm of 1024 robots demonstrated by Harvard in 2014, is the largest swarm to date. It allows "hands-off" programming, powering on, charging all robots. Each robot has the basic capabilities required for an autonomous swarm robot (programmable controller, basic locomotion, and local communication), but is made with low-cost parts. Kilobot swarm was developed to investigate collective "artificial" intelligence (e.g. sync, collective transport, self-assembly) and to explore new theories that link minimal individual capabilities to achievable swarm behaviors. By using a combined theory-experiment approach, they aim to develop new algorithmic insights into robustness, scalability, self-organization, and emergence in collectives of limited individuals.

APPLICATIONS

MILITARY

Swarms of military robots can form an autonomous army that can steer and take offensive actions by themselves. They are unmanned and can be loaded with explosives to deter and destroy the enemy.

EXPLORATION AND MAPPING

Inspection processes such as space explorations are time-consuming and cost-intensive and can be carried out using localization methods combtined with the information exchange between robots to create a distributed framework.

PRECISION AGRICULTURE AND SMART FARMING

Deployment of configurable, scalable, and adaptive swarm systems of unmanned aerial vehicles (UAVs) and ground robots enables optimal use of fertilizer, minimal use of water, reduction in soil compaction, and non-chemical weed control. Swarm robotics could also potentially be used to create artificial bees and insects to pollinate crops and other important plants to ensure their survival.

FORAGING

This demands several fundamental skills from a group of robots, such as collective exploration, shortest path finding, and efficient task allocation. Some examples of applications of foraging scenarios are toxic waste clean-up, search and rescue (SAR), and collection of terrain samples.

DANGEROUS TASKS

Individuals that create a swarm-robotic system are dispensable making the system suitable for domains that contain dangerous tasks. For instance, demining can be cheaply accomplished by a swarm of robots.

OIL SPILL CLEAN-UP

MIT's Senseable City Lab developed a fleet of low-cost oil-absorbing robots called Seaswarm, an autonomous and low-cost solution for ocean environment protection. A nanomaterial robot can absorb oil up to 20 times its weight.

CHALLENGES

The development of swarm robotics in real-life applications is still in its infancy. Most tests for swarm robotic systems are limited to simulators. These simulators are mostly not able to take real-life circumstances into account. Dute to this, a system that has been tested successfully in a simulator is not necessarily also successful in real life.

Research shows that the evolution of swarm robotics is growing in the direction of huge similarity with natural swarms. These natural swarms are autonomous, have no direct communication, self-organized, coordinated, and cooperative. The focus of building swarm robotic systems aims to build systems that are able to achieve complex goals while staying simple. However, building systems with such properties is not an easy task. There is a lot to be accomplished in the development of swarm robotics hardware and software.

FUTURE SCOPE

1 Nanorobots in Medicine

Scientists are finding ways to develop nanorobots that are capable of navigating inside a human body and targeting and killing diseased cells (cancer/HIV). Designing such nanorobots cant be very costly and complicated as they need to be very precise and accurate so that they only target diseased cells and not healthy ones.

2 Snake Robots for many Purposes

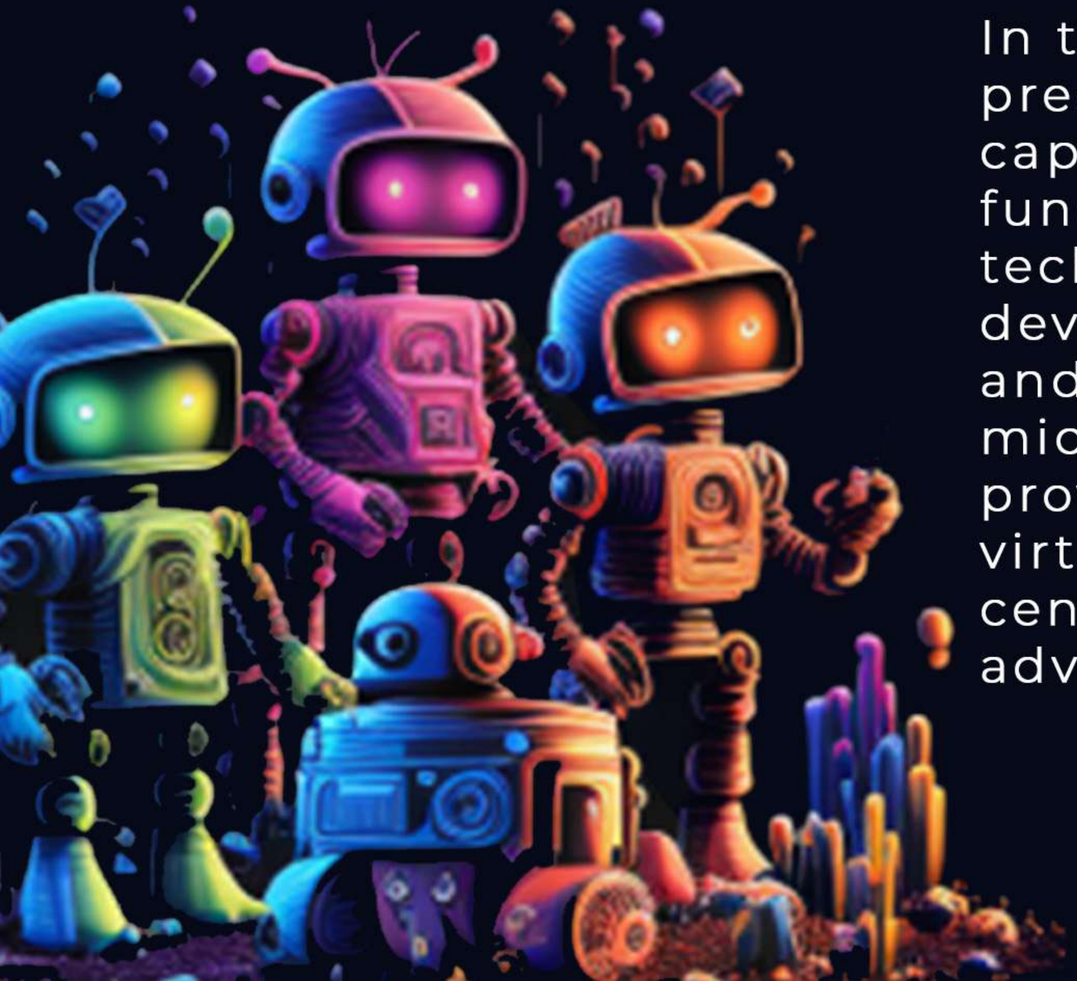
Swarms of snake robots can be a very effective choice for surveillance and reconnaissance systems. Snake robots are flexible, self-contained robots that can access places that are not accessible to humans. For example, looking for survivors in a collapsed building or in a radioactive environment. They can be used as spy cameras, for conventional open surgery, surveillance underwater, climbing mountains or buildings, etc.

3 Replacing Labour

Swarm robotics can be used to replace labor. However, it is important that these robots have Artificial Intelligence, only then would it be possible to replace humans with automation. Many other jobs can be replaced completely, or human assistance can be decreased with the help of robots. For example, robotic swarms can be hired as assistance for cleaning in a factory or store, for helping customers in transporting heavy items to their cars, helping in making food or drinks, or in restaurants for delivering food items to tables.

CONCLUSION

The field of swarm robotics has seen significant advances in recent years equipping it with capabilities and traits like collective decision-making, autonomy, scalability, and adaptability, making swarm robotics extremely suitable for tackling real-world challenges.



In the film Big Hero 6, the protagonist, Hiro Hamada presents his invention, microbots - tiny robots capable of forming together in whichever shape or function as per the user's command. Though swarm technology still has a long way to go before we develop systems that can mimic self-organization and coordination features as displayed by the microbots, the potential for swarm robotics to provide solutions for many of our challenges appears virtually limitless, which could make it one of this century's most significant technological advancements.

Jyosna Siripuram, Year III
J. Soundarya, Year IV

RESEARCH INTERNSHIPS

MITACS RESEARCH INTERNSHIP - UNIVERSITY OF GUELPH

I did my internship at the "University of Guelph." It is a beautiful and affordable city. I got to know about Mitacs Research when our seniors briefed us during the 2nd year break.

I did my 3rd Year Mitacs internship under Prof. Eranga Ukwatta focusing on newly developing “Federated Learning”. It is a machine learning technique in which a machine learning algorithm is trained across multiple decentralized devices using the local data available on the device. Using this technique, we ensure that local data available on one device isn't visible to another. Hence, it makes sure that it trains on multiple local data without compromising its privacy. A Ph.D. scholar, Zachary Szentimrey was also assigned to assist me throughout the internship. During the initial few weeks, I had to read a few research articles to cover the basics, and later we started working on our project. There were no strict timings to visit our lab. Both my professor and my scholar were amiable.

I was also assigned to Mr. Ali Ahmadi to make me comfortable with the city. I traveled to Niagara and Toronto and managed to buy a few gifts and chocolates for my family and friends. On the whole, I had a wonderful internship experience. It helped me learn many new things, visit new places, meet many amazing people, and make friends worldwide.

If you are interested in doing MITACS Internship in 3rd year, then try doing an internship under a professor from any IIT/NIT in your preferred domain as it would increase your chances.
Best of Luck!!

PRANAV KUMAR A V
YEAR IV

NTU-INDIA CONNECT RESEARCH INTERNSHIP

The NTU-India Connect Research Internship Program is a prestigious academic research program by Nanyang Technological University, Singapore. It is open to pre-final year graduates/undergraduates who have not studied at NTU previously. It is held in three different batches of 8-12 weeks throughout the year, Batch 1 (January–June), Batch 2 (May–July), and Batch 3 (August-December). I applied for Batch 2 (May-July) in my fifth semester in December 2021. The application requires three project preferences from the available project statements in the NTU website and one academic letter of recommendation. My application got accepted in March 2022 via email. Even though it is usually an offline program, we had to do it online due to strict COVID restrictions of the Singaporean government.

I was assigned a project titled “Wave Dynamics Compensation during Navigation of an Autonomous Unmanned Surface Vehicle” under Dr. Xie Ming. Professor Xie Ming is an Associate professor in Nanyang Technological University, Singapore and the President of Robotic Society of Singapore. The project started in May 2022. It majorly involved concepts related to Robotics and software like ROS and Gazebo were used. My work mainly revolved around building a controller to navigate between two points. During the project term, weekly online meets were held with the professor in charge and the team. Discussions regarding the project took place in the meeting, and the status was updated. The professor in charge and the NTU-India Connect committee verified the final project report before granting the fellowship. By the end of 11 weeks, our project report was verified and declared over.

This program provides creative and engaging problem statements which are highly appreciable. The peer groups involved in a project are competitive and comfortable. I had a great learning and working experience overall. Being a prestigious fellowship, it was also a great addition to my Resume. If you are looking for an impressive research experience, do give NTU-India Connect a try.

VENKATA NAGARJUN
YEAR IV

RESEARCH INTERNSHIPS

MITACS RESEARCH INTERNSHIP - WESTERN UNIVERSITY

LEKHA DASARI MURUGAPPA
YEAR IV

I had the opportunity to do my 3rd Year internship at the Western University located in the lovely neighborhood of London in Canada. My project was based on " Smart Meter data Compression using 1-D Convolutional Autoencoders" and I was guided by Dr. Firouz Badrkhani Ajaei. The project was based on Core topics such as Power Systems and Power Electronics which were then combined with AI and ML. Smart meter (SM) data can be used to implement demand-side control, fault detection, and system monitoring. To handle massive amounts of data, both in terms of storage and transmission, a convolutional autoencoder is proposed to compress data to reduce the volume for transmission and storage purposes and to restore the original data. Our objective was to develop a 1-D convolutional autoencoder which can compress the smart-meter data with a high compression ratio and when reconstructed (decompressed) it should be able to provide a low reconstruction error.

During the internship, I also got the chance to visit amazing places such as Niagara falls and Toronto. Not only the place but the people were also so nice and kind towards us. I am grateful that I got a chance to do Foreign Research Internship which expanded my knowledge in Power Systems and will also help me in my future ambitions.

I would encourage MITACS aspirers to maintain a CGPA of 8.5+ and pursue relevant projects in their 2nd Year summer. If you plan to pursue further education, research internships like MITACS will definitely boost your profile. I am truly grateful for having this opportunity to share my experience with you. Hopefully, it's helpful to you in the future.
All the Best !!

IUSSTF - VITERBI PROGRAM

VISWESWARAN,
YEAR IV

I interned at the University of Southern California, Viterbi School of Engineering through the IUSSTF-Viterbi Internship Program under the guidance of Professor Quan Nguyen at the Dynamic Robotics and Control Laboratory in offline mode for 8 weeks starting May 15th,2022. The application process was through the online application portal where I had to provide basic academic information and a couple of write-ups on my research interests, professors that I would like to work with, previous technical experiences, and career goals.

For the internship, my problem statement was to explicitly estimate the dynamics of a loaded quadruped to improve the stability of a model-based controller. Model Predictive Control(MPC) is a model-based controller which uses a dynamic model of a system to produce an effective control input that is extremely robust but only in the vicinity of the defined dynamical model. When the quadruped(legged robot) is loaded, the dynamics of the system change and a new model needs to be defined for the stable operation of MPC. My role in the team was to develop machine learning algorithms and use the predictions to improve the controller's robustness and stability of a quadruped. I proposed a framework with feedback that used LSTMs to predict the required parameters which were simulated and tested in both MATLAB and ROS.

Through the internship, I learned in-depth about Model Predictive Control and control of a quadruped to perform walking and trotting gaits and to implement machine learning models to optimize classical control methods. I also gained invaluable experience in the simulation of robots in gazebo and MATLAB as well as implementing my approach on actual hardware such as A1 quadruped robot.

This internship provided me with an opportunity to gain a holistic understanding of robot control and optimization in conjunction with machine learning. Apart from the technical aspect of the internship, it was also an exciting and new experience living in Los Angeles. It was overall a very rewarding experience and I thank IUSSTF, USC Viterbi, and NITT for this wonderful opportunity.

COMPANY INTERNSHIPS

INTERN DIARIES

BOEING

I completed my internship at Boeing India Pvt. Ltd. as Electrical Analysis Intern Engineer. I got this internship through the Training and Placement Cell of NITT. The mode of the internship was offline,and I was in Hebbal, Bangalore for about two months from June 8, 2022, to August 8, 2022. I had completed two projects during my internship.

My first project was titled BCA: Process tools and Initiative with the team under Boeing Commercial Airlines. I worked with a team of ten members, including my reporting manager Mr. Chirag Trivedi. Our work was based in the electrical domain, and my role was to develop a tool with the help of Python to help the team derive the accurate output. My interaction with my manager used to happen daily. He guided me, helped me with my project, and I updated him regarding the same. The other project which I did was under Boeing Defence Systems and it was to make an Excel Macro for monitoring and tracking an employee's performance.

Some of the major takeaways from my internship are Office Etiquette and the taste of Corporate life. There is a considerable difference between the college and the corporate world. I also got to know more about Boeing, how the MNC works, their manufacturing and products, assembling, and a lot more. Boeing had a pleasant and welcoming work culture, making it very comfortable to work with. And the best part was to see the real time application of what I learned through my B.Tech.

One interesting fact about Electrical Domain is that it actually runs on software. There are sufficient hardware applications as well, but for beginners and interns, it’s more of tools and software. The ease of working with a company also depends on your adaptability and learning skills, rather than just reproducing already-learned concepts. Students can familiarize themselves with the software environment rather than fearing machines which will be helpful while doing simulations etc. Most of the domains require software knowledge in the present scenario.

K. Rajalakshmi, Year IV

GOOGLE

I did my Summer Internship at Google India as a Software Engineering Intern. It was a wonderful and best-of-the-kind experience. My project was a part of the Google Ads team, and I primarily worked on the Server Side of an internal API involving Database Management. My coding work mainly consisted of Java, Protocol Buffers and several other internal tools. My Host Manager and co-host were super supportive and most welcoming, allocating time every day for a short meeting to clarify any doubts I had and discuss progress updates despite their busy schedule. I want to thank my team for providing me with a warm and welcoming environment that helped me get comfortable and made it easier to discuss ideas and improve my understanding of the projects under the team. My internship was a virtual internship for two months, and Google made me feel as though I was working from the office and in person with my teammates with their many helpful tools and culture. The culture of Google is the best part of working at Google, where everyone treats each other with equal respect, and we are given the freedom and trust to complete our work effectively. Each person working at Google is highly enthusiastic about sharing their knowledge. It was a great learning experience for me working with the best software engineers in the industry - learning to write clean code, testing software, high-level and low-level design of products and many more. I also got to improve my soft and communication skills, which are indispensable for a promising professional career.

Strong knowledge of basic Data Structures and Algorithms, Advanced Data Structures such as Graphs and Trees, and good Problem-Solving Skills help clear the selection process. As the interview involves writing code, equip yourself with the practice of writing bugless clean code in the first run. It is also essential to have solid projects and a good resume, and I recommend pursuing Competitive Programming and pursuing projects that follow your specific CS interest.

The Google Selection process and these two months of Summer Internship changed my life, and I made the best memories of my life working there and gained many new friends and excellent mentors for life.

Subramaniyam G

COMPANY INTERNSHIPS

INTERN DIARIES

TEXAS INSTRUMENTS

I completed my Internship as an Analog Design Intern at Texas Instruments. I got the internship through an On-Campus Employment Campaign. The required CGPA was 7.0 or higher to qualify for the company. The selection procedure began with an online aptitude test that included sections on Digital, Software, and Analog Electronics. Candidates were shortlisted for further interviews based on test performance. I had a Digital, Analog, and ATD interview. The interview stage included fundamental inquiries to determine the extent of our subject understanding.

I had a hybrid internship, working two weeks online and the remaining seven offline. I was assigned a supervisor who helped me throughout the process and worked closely with me. I handled a real-world project where I had to model electrostatic air discharge. There was some hardware in my project. So, I had the opportunity to visit the TI lab facility in Bangalore. Working on actual hardware gave me great pleasure and helped me grasp lab etiquette. The project also included simulation work, all of which was based on extensive literature reading. I had to give my mentor weekly reports and deliver a final presentation to the entire team. Following the presentation, we had a fruitful conversation regarding the project's prospects and acquired information concerning project handover.

One of the best things about working at TI was their culture, where anyone could voice a problem or offer a recommendation regarding a project, reflecting their inquisitive learning nature. The entire internship experience taught me several aspects of working in a corporate environment and professional values. If you are interested in working in the electronics industry, TI offers one of the best internship opportunities.

Anuj Agrawal , Year IV

NVIDIA

I completed my 3rd Year Summer Internship at NVIDIA in online mode. I got the internship through an On-Campus Recruitment Drive for the Hardware Engineer Intern role at NVIDIA.
The CGPA cut-off was 8 or above. The selection process had 3 rounds. Firstly, the candidates go through a CV screening stage. Second round involved an 1-hour test (Online Assessment-OA) consisting of 20 questions with negative marking. The OA focussed on testing the candidate's knowledge in Digital Electronics and their Problem solving ability. It had 2 sections - General Aptitude (5 questions) and Digital Electronics (15 questions). I had referred to Digital Electronics by Morris Mano for theory to cover knowledge gaps and practiced questions online from several websites like asicdigitaldesign.wordpress.com and vlsi4freshers.com. In the third round, candidates who cleared the OA are interviewed. In my interview, I was asked to introduce myself and explain my previous projects and internships in detail. Then, I was tested on Digital Electronics Basics, STA, Memory Systems and Pipelines, and digital design. I was asked to solve a design question and an Aptitude question.

My project at NVIDIA was based on functional coverage. I had to evaluate and implement the best model using the CHI protocol, compile all my observations and results in a PPT and internally present it to the team. My work focused on performing Nodal and Interface Coverage of my model to ensure that all the components are working as expected. Through the internship, I got some real-world working exposure. By working on challenging projects, I got to know more about my strengths and weaknesses. Not only my technical skills but also my soft skills honed during this internship.

I hope this article helped you find the information you were looking for. To all the aspirers out there, I would encourage you to be optimistic throughout the process and trust your preparations. Put in your best efforts and your day will come soon. I would be extremely happy to help in case you have doubts. You can connect with me at uthanpratik4@gmail.com.

Pratik Uthan ,Year IV

COMPANY INTERNSHIPS

INTERN DIARIES

P&G

"It's not the convention."
I said , Why not?

Throughout my academic years in college, I was inclined towards management and wanted to further explore the same. In this journey I found out that this vast domain had scope in several fields like supply chain, people management, data analytics and many more.

I secured an opportunity to intern with P&G via campus recruitment in the summer of 2022. The selection process involved two rounds of online test which was followed by resume shortlisting. The selected candidates were called for a final round of personal interview.

My 10 week long internship was based in P&G consumer health plant, Goa. My project involved doubling the productivity in packing line units. People Management was the key domain I worked under. I focused on eliminating man power in possible areas to establish a more effective work system. I also played a major role in suggesting and implementing methods that improved the machine efficiency. I laid the groundwork for solutions to problems that needed long term resolvement and handed it over for further process . For problems at a smaller scale, I solved and implemented solutions then and there.

My internship tested not only my promptness to identify a problem, but my spontaneity to efficiently solve the same as well. I learnt the method of root cause elimination- that is, looking through a problem on a deeper scale to identify and eliminate the prime cause of it. This not only helped me during my internship, but in my daily life as well. I also had to manually collect data on the factory floor and study the same, which taught me to thoroughly analyse data.

I saw my managerial game level up, as I started taking new initiatives and found varied methods to solve a problem. This built my crisis management and adaptive leadership skills. Looking back, my growth curve during this internship was indeed exponential. It fueled my growth mindset that navigated to my goals in future.

At college, being part of several teams and leading them definitely helped me build my skill set that got me through. Our institution provides opportunities for infinite possibilities, which, if utilized properly, will definitely enrich one's aspirations and get him/closer to his/her goals. Never be hesitant to seek the same. One should remember that keeping track of academics is also equally important.

If interested in the Techno-Managerial domain, it is wise to focus on learning further about Data Analysis methods. Interaction with a like minded peer set also helps in quantum to get an idea about setting your goal path. On the whole, this internship was one of the best experiences in my career development journey. All the best to all the aspirers out there!

Nandika Ramadurai, Year IV

MICROSOFT

I got an opportunity to intern at Microsoft as a software development intern. The selection process included one OT and three rounds of interviews. The online test was of moderate difficulty. The first two interviews were technical, and the third round was HR. It was a virtual internship. I joined the Bing Ads Team.

My project was the Risk Recommender, and it was based on risk analysis and fraud detection. One thing to look forward to was the work culture at Microsoft. I was also invited to join the team offline for a couple of days.

The most exciting part of my internship was that I got to interact with a couple of sister teams and get their input on various aspects of my project. At Microsoft, I had the liberty to get my hands dirty by trying multiple things. I was encouraged to pursue different ideas and techniques, and my project had a bit of software development, a few statistics, and machine learning as well. In essence, I had a very interesting and knowledgeable experience at Microsoft.

Keerthana S, year IV

M P Selvan
HoD

Josphine R L
Faculty Advisor

EEEA CORE' 23

Priyadharshini Vasudevan
Chairperson

V Prakash
Overall Coordinator

Nandika Ramadurai
Treasurer

Harini M
General Secretary

Bokka Naga Venkata
Durga Prasad
Joint secretary

Krittika
Mtech Secretary

Abhaya Kumar Sahoo
PhD Secretary

Soundarya J
Content Head

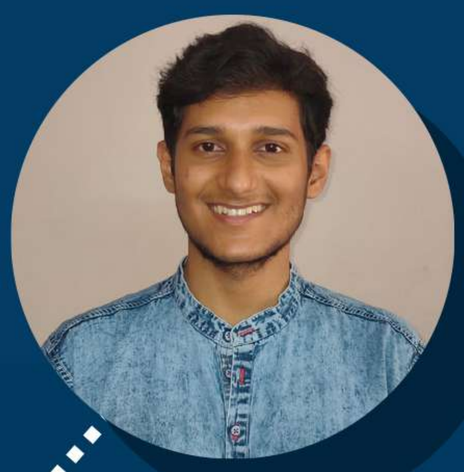
Srikrishna N
Content Head

Sriram
Design Head

Varun A
Design Head

Roshan B
Devops

Srihari Sridhar
Devops



Astitva Shukla
Events

Machikalapudi Rani Samyuktha
Events

Nandini Dutta
Guest Lectures

Shreya Anand
Guest Lectures

Ram Kannan
Marketting

Kamalesh S
Marketting

Girish T
Organising Commitee

Saran B M
Organising Commitee

J Abhinaya
Publicity

Muhilan R
Publicity

Nadimetla Digvijay
PR and H

Bhuvan P
PR and H

Ashish Thomas
Quality Assuranca

Shashank subramaniam
Quality Assurance

Akshaya Shree S T
SR and I

Aishwarya G P
SR and I

Shanmuga Sundaram
Workshops

Lokesh keshav S
Workshops

Satish Kumar L
Workshops

EDITORIAL BOARD

HOD

M P Selvan

FACULTY ADVISOR

Josephine R L

CHIEF EDITORS

J. Soundarya | N. Srikrishna

CHIEF DESIGNERS

Sriram Srinivasan | Varun Anand

EDITORIAL TEAM

K. Rajalakshmi | Koustabh Sau | Yash Chaturani | Fahmida Hiba Fathima | Shakambari Saxena | Kanagambujam Venkatramani | Jyosna Siripuram | Leela Raagamayi | Manush Patel | Janam | Keerthana | Shreeya Rajaganapathy | Uma Gomathi | Akshaya | Diya |

DESIGN TEAM

Saranya Priya | Varshini Giri | Suganth Brabakaran | Muskan Sachan | Tanuja mortha |