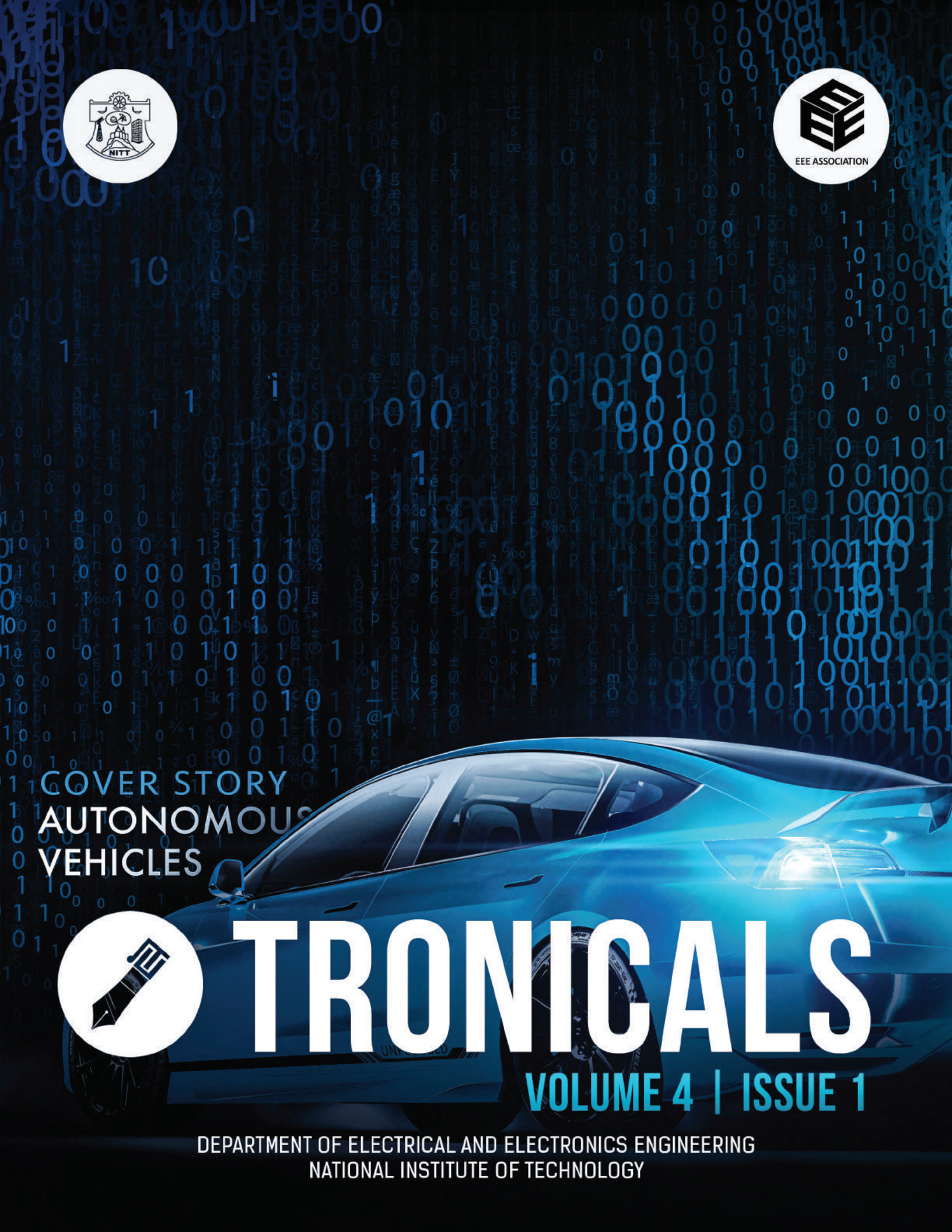
EEE ASSOCIATION
COVER STORY
AUTONOMOUS
VEHICLES
TRONICALS
VOLUME 4 | ISSUE 1
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY

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MESSAGE FROM THE HOD

Dr. S. SUDHA
HoD, EEE

It is my pleasure to congratulate the editorial team for their initiative in producing this magazine. This magazine has recorded achievements such as: research contributions of faculty and students, workshops and special lectures organised by the faculty and competitions won by the students. It is great to find a considerable number of articles, poems, humour and humanism that certainly prove the skill sets of the students. Such value additions are very much essential for the young technocrats, engineers and scientists. I extend my thanks to all the students and staff coordinators for their untiring efforts in bringing out this magazine successfully.

-Dr. S. SUDHA HoD, EEE

MESSAGE FROM THE FACULTY ADVISOR

DR. N. KUMARESAN
Faculty Advisor, EEEA

The present team of Electrical and Electronics Engineering association (EEEA) has made a meticulous planning with a wide spectrum of activities filled with technical, managerial and societal contents spread over the academic year 2018-19. The students are highly motivated towards organizing each and every activity amidst their regular academic work. To add up, the department of EEE organizes the renowned "National Power Systems Conference" (NPSC 2018) during the end of this calendar year. I am happy to inform through this newsletter that the students will be having an opportunity to interact with the distinguished professionals in the area of Power Engineering.

It gives me immense pleasure to be a part of the editorial team of this newsletter which encompasses various curricular, co-curricular and extra-curricular activities of the Department of Electrical and Electronics Engineering, NIT, Tiruchirappalli. The contributions of my colleagues, office bearers, student volunteers and alumni are highly commendable. As it is evident from the newletter proceedings, EEE department contributes at large for shaping the students through teaching and research activities, apart from offering various opportunities for the students to develop the skill sets needed for their self-development and employability. Hence, I congratulate the editorial team for their excellent and timely work in bringing out this newsletter.

-DR. N. KUMARESAN, Faculty Advisor, EEEA

EDITORIAL

Over the years, technology has developed exponentially with needs and expectations growing day by day. While this growth seems rapid, we the citizens of tomorrow learn to move and accommodate to this ever-changing world. Being students under the banner of Electrical and Electronics, we see electronics creeping into what was once driven by mechanical systems. On this note, we the members of Tronicals, present one of the recent advents in technology, the autonomous cars. From companies like Tesla we see a great deal of research in safety and interaction between machines.

In this edition of Tronicals, we discuss the current trends, pros and cons faced and the expectations in the upcoming years. This is aimed at shedding light on areas where we can contribute in these ground-breaking innovations. This also includes few articles and internship experiences to highlight paths available as student of Electrical and Electronics engineering. There is also a creative page for the inquisitive and fun readers. We hope the magazine will prove to be a good read.

-Blissinth Vino John
Chief Editor

TRONICALS TEAM

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 transformation from REC to 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. programme), 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

VISION:

To be a centre of excellence in Electrical Energy Systems.

MISSION:

- 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

Programme Educational Objectives (PEOs):

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

1. for graduate study in engineering
2. to work in research and development organizations
3. for employment in electrical power industries
4. to acquire job in electronic circuit design and fabrication industries
5. to work in IT and ITES industries.

Programme Outcomes (POs):

The students who have undergone the B.Tech. Programme in Electrical and Electronics Engineering (EEE):

1. will have an ability to apply knowledge of mathematics and science in EEE systems.
2. will have an ability to provide solutions for EEE problems by designing and conducting experiments, interpreting and analysing data, and reporting the results.
3. 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.
4. will have knowledge and exposure on different power electronic circuits and drives for industrial applications.
5. will have in-depth knowledge in transmission and distribution systems, power system analysis and protection systems to pursue a career in the power sector.
6. will have a good knowledge in microprocessors/microcontrollers, data structures, computer programming and simulation software.
7. will be able to develop mathematical modelling, analysis and design of control systems and associated instrumentation for EEE.
8. will be able to systematically carry out projects related to EEE.
9. will have an ability to participate as members in various professional bodies as well as multidisciplinary design teams.
10. will demonstrate the ability to choose and apply appropriate resource management techniques so as to optimally utilize the available resources.
11. will be proficient in English language in both verbal and written forms which will enable them to compete globally.
12. will have confidence to apply engineering solutions with professional, ethical and social responsibilities.
13. will be able to excel in their professional endeavours through self-education.
14. will be able to design and build renewable energy systems for developing clean energy and sustainable technologies.

M.TECH IN POWER SYSTEMS

Programme 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:

1. research programmes in Power Systems Engineering
2. employment in power research and development organisations
3. to work in electric power industries and energy sectors
4. faculty positions in reputed institutions.

Programme Outcomes (POs):

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

1. 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
2. be able to critically investigate the prevailing complex PS scenarios and arrive at possible solutions independently, by applying the acquired theoretical and practical knowledge
3. be able to solve PS problems such as load flows, state estimation, fault analysis and stability studies
4. be able to develop broad-based economically viable solutions for unit commitment and scheduling
5. be able to identify optimal solutions for improvising power transfer capability, enhancing power quality and reliability
6. 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
7. 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
8. 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
9. be able to develop dedicated software for analysing and evaluating specific power system problems
10. 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
11. be able to confidently interact with the industrial experts for providing consultancy
12. be able to pursue challenging professional endeavours based on acquired competence and knowledge
13. 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
14. be capable of examining critically the outcomes of research and development independently without any external drive.

M.TECH IN POWER ELECTRONICS

Programme 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:

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

Programme Outcomes (POs):

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

1. 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
2. be able to investigate critical PE problems and to arrive at possible solutions independently, by applying theoretical and practical considerations
3. be able to solve PE problems such as switching control, converter design, analysis and control of solid state drives and stability studies
4. be able to develop appropriate power converters for sustainable energy technologies
5. be able to identify optimal solutions for improvising power conversion and transfer capability, enhancing power quality and reliability through PE based solutions
6. 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
7. be able to work on small, well-defined projects with particular goals to provide real time solutions pertaining to power electronics
8. 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
9. be able to develop dedicated software for analysing and evaluating specific power electronics and control problems
10. 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
11. be able to confidently interact with the industrial experts for providing consultancy
12. be able to pursue challenging professional endeavours based on acquired competence and knowledge
13. 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
14. be capable of examining critically the outcomes of research and development independently without any external drive.

JOURNALS AND CONFERENCE PUBLICATIONS

JOURNAL PUBLICATIONS

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P. Padmagirisan, V. Sankaranarayanan, "Powertrain control of a solar photovoltaic-battery powered hybrid electric vehicle" - to be appear in Frontiers in Energy, Springer, 2018.

Joseph Godfrey, A., Sankaranarayanan, V., "A new electric braking system with energy regeneration for a BLDC motor driven electric vehicle" - to be appear in Engineering Science and Technology, an International Journal,2018.

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C.M. Jenisha, N. Ammasaigounden, N. Kumaresan and K.Bhagyasri, "Power electronic interface with de-coupled control for wind-driven PMSG feeding utility grid and DC load", IET Power Electronics, Vol. 11, Issue.2, February 2018, pp.329-338. (SCIE indexed: Print ISSN: 1755-4535 and Online ISSN 1755-4543).

S. Priyavarthini, C. Nagamani, G. Saravana Ilango, M.A. Asha Rani, "An improved control for simultaneous sag/swell mitigation and reactive power support in a grid-connected wind farm with DVR", International Journal of Electrical Power and Energy Systems, Elsevier, Vol-101, pp. 38–49, March, 2018.

Bepinkumar Bijukumar, Arunadevi Ganesan, Kaushik Raam, Saravana Ilango Ganesan, Chilakapati Nagamani, Maddikara Jaya Bharata Reddy, "MPPT algorithm for thermoelectric generators based on parabolic extrapolation", IET Generation, Transmission & Distribution, 26 March 2018.

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K.Rajbabu, Harshavardhan Srinivas, S.Sudha,"Industrial information extraction through multi-phase classification using ontology for unstructured documents" Elsevier journal on Computers in industry,2018.

K.Rajbabu, S.Sudha and C.Mala, "A Multi-Domain Layered Approach in Development of Industrial Ontology to Support Domain Identification for Unstructured Text", IEEE Transactions on Industrial Informatics, May 2018.

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P Srinivasa Rao Nayak, Kishan Dharavath, Radhakrushna Dey, K. Sundareswaran and Sishaj P Simon "Performance Evaluation of Square Coupled Coils at Different Misalignments for Electric Vehicle Battery Charging" 4th International Conference on Vehicle Technology and Intelligent Transport Systems (VEHITS), Mar 16-18, 2018, Portugal.

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A Karthikeyan , K K Prabhakaran , C Nagamani, "Four quadrant operation of direct torque controlled PMSM drive using speed loop PDFF controller", International Conference on Power, Instrumentation, Control and Computing (PICC), Thrissur, India, 14 June 2018

CONVOCATION '18

The 14th convocation of NIT, Trichy was held on 28th July 2018. The chief guest was Prof. Anil D. Sahasrabudhe (Chairman, All India Council for Technical Education, New Delhi).

Medal Winners - 2018

The institute medal is given to the person with the highest overall CGPA in their respective programme.

Roll Number	Name	CGPA	Programme
107114068	NANDA KISHORE V	9.72	B.Tech
207216016	SREELAKSHMY J MENON	9.68	Power Electronics
107114068	PAILA LAKSHMANA RAO	9.9	Power Systems

Doctor of Philosophy (Ph.D)

S.No.	Guide	Roll Number	Name	Thesis
1.	Dr. K. Sundareswaran	407113007 12th October 2017	Vignesh Kumar V	Design and Implementation of Few Population Based Optimization Algorithms Combined with Perturb and Observe Method Towards MPPTin PV Systems
2.	Dr. S. Senthil Kumar	407113008 16th November	Sumedha M Mahajan	Control Strategies for Stand–Alone Operation of Induction Generator System with Certain Power Electronic Converter Topologies
3.	Dr. G. Saravana Ilango	407112005 29th December	Chakkarappan M	Development of Global Maximum Power Point Tracking Algorithm with Partial Shading Detection and Fault Identification Scheme in PV Systems
4.	Dr. Sishaj P. Simon Co Guide: Dr. K. Sundareswaran	407112006 2nd February 2018	Ram Jethlamani C H	Investigation on Transmission Loss Estimation in Power System Scheduling Problems
5.	Dr. Sishaj P. Simon	407113006 26th February 2018	M Senthil Kumar	Investigations on Time-Frequency Transformation Techniques for Power Transformer Differential Protection
6.	Dr. Sishaj P. Simon	407113001 17th May 2018	Anilkumar T T	Investigations on PICO Hydel Hybrid Power Generation System Incorporating an Open Well Energy Storage
7.	Dr. S. Arul Daniel Co Guide: Dr. N. Ammasai Gounden	407907002 25th June 2018	S Mageshwari	Studies on Employment of Roof Top PV Systems in Rural Households of India
8.	Dr. S. Arul Daniel	407912004 16th July 2018	Kappagantu Ramakrishna	Techno-Economic Analysis of a Smart Indian Distribution System
9.	Dr. S. Arul Daniel	407112004 25th June 2018	Muthuvel P	Sizing and Design of PV Based DC Nano-Grids for Rural Households
10.	Dr. S. Sudha	407113003 16th July 2018	N Hemavathi	Design,Development and Analysis of Novel Energy Efficient Clustering Algorithms for Wireless Sensor Networks

Master of Science (By Research)

S.No.	Guide	Roll Number	Name	Thesis
	Dr. S. Sudha	307912001 6th October 2017	Sathish Kumar A	Design of Controllers for Wireless Sensor Network Based Cold Storage Systems
	Dr. M. Venkata Kiruthiga	307114002 15th December 2017	Kanimozhi K	Stability Constrained Optimal Allocation of DGs in Autonomous Micro-Grids
	Dr. Sishaj P Simon	307914001 20th December 2017	Sriram A	Estimation of Induced Draft Fan Power Consumption in a Thermal Power Station Using Artificial Neural Network
	Dr. C. Nagamani	307115001 3rd July 2018	Shruthi M P	A New Scalar Controlled Approach for Loss Minimization and Dynamic Load Sharing in Induction Motor Drives

CURRENTS 2018

The 28th edition of Currents, the annual National level technical symposium of the Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli, was held from 15th to 18th February. There was a variety of events, workshops and guest lectures conducted and were attended by a large number of students from across the country.

Currents' 18 was initiated with an outreach programme at SNS College of Technology in Coimbatore where a workshop on Machine Learning in Power Systems was conducted on 4th February 2018.

Currents' 18 was inaugurated on 15th February 2018. Mr.Paventhan Arumugam, Director (R&D), ERNET India, Bangalore was the chief guest. Dr. Mini Shaji Thomas, Director of NIT Tiruchirappalli,HOD of EEE Department Dr. S. Sudha, Faculty Advisor of EEE Association Dr. N. Kumaresan and other dignitaries were present for the inauguration. A special address by on was delivered by the chief guest followed the aforementioned event.

During the course of three days of the symposium, there were 8 workshops conducted. The list included PCB Design, FPGA, Smart Grid Modelling, Human Computer Interaction, Renewable Energy and Gesture Controlled Robotics. Students from various colleges attended these workshops in large numbers. Apart from these, there were number of events which catered to technical as well as creative minds. Capture Currents, a pre-Currents photography contest, was aimed at identifying budding photographers. Code Currents, Symulate, Line Follower and General Quiz were conducted and gathered huge participation. All these aside,the paper-presentation Colloquium and the Dhruva contest for the most creative participant were conducted. There were 3 guest lectures delivered by prominent individuals.

Currents 2018, the culmination of determination, hard work and commitment of the students of the EEE Association was spread over 4 days with 8 workshops, 3 guest lectures and 6 events and was concluded as a great success.

Currents
eighteen

IOT-TECHNOLOGY LANDSCAPE AND DEVELOPMENT CHALLENGES

On 16th February 2018, Dr. A. Paventhan, Director (R&D) at ERNET India, addressed the gathering of prefinal years over the topic of technology landscape and development challenges in IoT (Internet of Things). The guest lecture began with the speaker giving a brief introduction about himself. He then went on to talk about ERNET India, an autonomous society under the Ministry of Electronics and IT, Government of India. A member of the Asia Pacific Advanced Networks (APAN), ERNET provides various networking domains and projects in fields of education services, R&D and training.

So, what is IoT? The Internet of Things (IoT) is the network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, actuators, and connectivity which enables these things to connect and exchange data, creating opportunities for more direct integration of the physical world into computer-based systems, resulting in efficiency improvements, economic benefits, and reduced human exertions. According to industry predictions by ERNET, 20 to 50 billion devices will be connected via IoT by the year 2020. This shows the huge advancement and the warm reception from customers across the globe.

The key considerations in IoT are coverage, cost, energy usage, stability, data throughput, frequency band and most importantly, security. To achieve all these conditions is not an easy procedure. There are various architectural challenges faced by the companies of today while developing IoT integrated devices. Many IoT deployments are custom based solutions that are not interoperable, portable across cities, extensible or cost-effective. Lack of resources, leadership, prioritisation, capability and experience have made contradictory standards among these devices causing an imbalance with no common platform for all to function globally.

With such conditions being present, the IoT device is built on questions asked about its use. This can be broken into three sub categories – device, network and application service support layer. Device layer deals with hardware, the range required, network resiliency and interoperability. Network layer mainly stresses on seamless internet connectivity and device-to-network security. Application service layer takes care of availability, cloud facing and application of APIs and data protection which varies from open public data to citizen personal data. Based on these conditions various types of networks are classified – short range RF standards and LPWAN.

The guest lecture was a very enlightening experience for all and the various concepts were explained at length while giving real-time examples which helped in relating to the topic. The lecture came to a close with speaker opening the floor to Q&A after which the gathering dispersed.

ABB IN POWER SECTOR

On 17th February 2018, Mr. Shailesh Vidyarthi, Head of plant optimisation and simulator group, Power generation and Industrial automation of ABB India limited addressed the gathering on the topic of present power plant scenario and ABB's role in power sector of India. ASEA Brown Boveri (ABB) found in 1989, by the merging of the Swedish corporation ASEA and the Swiss company Brown, Boveri & Cie (BBC). The company stands as a global leader in power automation technologies. Present in over 100 countries, the company is ranked as one of the top 500 World's Most Admired Companies.

Moving into the topic, there are four important markets to be focussed on – electrification of products, robotics, industrial automation and power grids. Electrification of products is the use circuital engineering to make mechanical tasks into an easier function. This also includes, accuracy of the device, connectivity and interaction with the other devices both near and far and mainly protection from any damages and safety. Robotics and motion depends on drivers used to power up movement, generators and motors for conversion into usable energy from various other energy forms as well as sensors that detect and accordingly judge the conditions. Industrial automation deals with processes where the processing for various components in the case of oil and gas, chemical or assembly industries. Power grid involves grid automation, grid integration, production and development of high voltage products and transformers.

ABB has developed various methods and solutions for the above markets. Automation in thermal, solar and hydro power plants as well as the water industry to increase the efficiency as well as ease the various stages in each of the plants. Power Generation Care a program by ABB, takes care of the three core aspects of power plants – day to day maintenance, performance optimisation and lifetime extension regardless of plant application or location. This covers the entire portfolio of ABB products and systems for power generation facilities – cyber security, maintenance and sustainability, performance and reliability, operational improvement and system life cycle.

The speaker further went on to describe a few systems used by them in this field like plant safety and primary flame analyser – Symphony plus combustion instruments, turn actuators and Procontrol P13 – a system that allows components or process areas to be upgraded while leaving the rest of the system undisturbed. The floor was then opened to discussions which was concluded with the speaker thanking the audience and dispersing the gathering.

AUTOMOTIVE ELECTRICAL AND ELECTRONICS

On 18th February 2018,Mr. Baburao Kuchipudi, R&D at TAFE Ltd. Chennai, delivered the last guest lecture of Currents'18.The lecture started with a small introduction of speaker by himself. The speaker then moved on to discussing on the different electrical and electronic parts that constitute the vehicle. He moved on slowly to how each part has been on the road of modification as the years pass.

Over the last years electronics and sensors have started to play a major role in the production of a car. Among them CRDI technology was considered as one of major accomplishments. Common Rail Direct Injection or CRDI is a technique used in diesel engines. The current development in CRDI involves use of piezoelectric injectors for increased precision, with fuel pressures up to 2500 bar. In petrol engines a similar device called the Gasoline Direct Injection (GDI) is used. CRDI helps cut down the emissions by greatly decreasing the amount unburnt fuel. BOSCH, DELPHI, Continental and DENSO are some of the major suppliers of CRDI machines in the world. CRDI systems consist of three subsystems – air intake system, common rail system, exhaust system. CRDI engines help in burning fuel more effectively which cause lower emissions, more power, increased fuel efficiency, enhanced exhaust gas circulation, precise injection timing and increase of combustion quality due to pilot and post injection.

Another major breakthrough was the Hauling Automatic Transmission System abbreviated as HATS. The HATS system consists of hardware and software components which operates the hauling automatic gear shifts. Hauling transmission consists of torque converter to play a role during the gear transmission. This helps optimise the fuel as well as change the rpm and torque depending on the load. Before the system can be cleared for use, it needs to be calibrated for various parameters like shift rpm values for automatic gear transition and lockup clutch engagement rpm.

The various service tools such as hand-held diagnostic tool and breakout box were discussed about as well the use of the CRDI and HATS. The lecture ended with the speaker opening the floor to any questions that the gathering may have after which he warmly wished everyone a good future ahead and dispersed the audience.

ADVENT OF NEXT GENERATION NUCLEAR POWER PLANTS

Reasons:

Affordable, free-flowing energy is the bedrock of modern civilization.
However, as the World population skyrockets from 7.63 billion people today to, according to the US Census Bureau, 9 billion by 2040; global energy consumption is expected to rise significantly, creating a looming energy crisis that will be difficult to overcome.

Fossil fuels are at best a temporary fix, known reserves will deplete within a century or two and the burning of the carbon based fuel has accelerated climate change. Meanwhile, while renewable sources of energy like wind and solar, are key components of the solution; they aren't able to fully sustain our growing energy demands.This could be where nuclear reactors come in the picture: They're dense, reliable, emit no carbon, and — contrary to popular sentiment — are among the safest energy sources on earth.

And they're about to get even safer:

Called a molten-salt reactor, the technology was created during the Cold War and uses a liquid nuclear fuel over a solid one, and therefore can "burn" with far greater efficiency than any power technology in existence. Moreover it also generates a fraction of the radioactive waste of today's commercial reactors, and in theory, can never melt down.

Furthermore, feeding a molten state reactor with thorium, a radioactive waste from mining (and 3 to 4 times more abundant than uranium) could "breed" as much nuclear fuel as it burns up. This is why Manhattan Project scientist Alvin Weinberg calculated that if we could harvest all the thorium in the Earth's crust, we could power civilization for tens of billions of years.

What is "breeding"?

Well imagine starting a bonfire, burning dry bark or twigs would light up the fire easily, but they'd burn out quickly as well and is an analogy of the uranium in use today. Thorium promises to be the big logs: Get the nuclear fire hot enough and it will burn for far, far longer.In a thorium reactor, thorium absorbs neutrons and forms a new fuel — uranium-233 — that can then sustain the reaction, by producing enough neutrons to continue turning more thorium into U-233.

One such thorium reactor would be the liquid-fluoride thorium reactor, or LFTR. It is a redesign of the original reactor from the 1960's, which according to a 2015 independent review by the Electric Power Research Institute, "has the potential to transform technology for meeting future energy needs in the face of uncertain market, policy, and regulatory constraints."

And there are some good reasons why:

- **High Fuel burn-up.** LFTRs could fission about 99% of their U-233 liquid fuel, compared to a few percent for solid fuel.
- **Less waste and a shorter half-life.** Radioactive waste left behind from LFTR operations is far less radioactive and requires to be buried for a far shorter period of time.
- **LFTR is immune to meltdowns.** Molten salt that overheats will expand, pushing fissile atoms away from one another and slowing down a chain reaction.
- **They should be much cheaper and faster to build.** LFTRs don't require as many expensive safeguards and their potential to be modular could lead to mass manufacture of parts and reduced cost.
- **And much, much more…**

So what's stopping us?

Well in a word "The science is easy. The engineering is hard."

There are two big barriers to commercial thorium LFTRs:

1. **Molten salt is a health hazard:** LFTR's molten salt contains beryllium and lithium which are health hazard that increases risk of cancer in case of a spill. However with good engineering, proper safety protocols, and protective equipment it would be possible to minimize this risk.
2. **Engineering new reactors takes a long time and costs billions of dollars:** Demonstrating that the technology works, scaling it up, and making sure it is a reliable commercial product, requires a lot of time and a lot of money.

The long road to the Thorium Age:

Current estimates states that it could take up to 2050 to fully realize a commercial LFTR or other types of thorium reactors. However as the research continues, the idea of a next generation reactor has gained traction. Last year the U.S. Department of Energy allocated $82 million in funding for advanced nuclear reactor research and development and China is also investing heavily in R&D for nuclear reactors. Furthermore, last August NRG, a Dutch nuclear research institute fired up the first experiment in nearly half a century on a thorium based nuclear reactor.

-Thomas Mathew

ELECTRIC VEHICLES IN INDIA

Introduction:

The year 2017 has seen a lot of new ideas and innovations in transportation sector. The government has announced a lot of new plans for finding next generation transportation solutions. Out of all, the one which made a serious impact is the government's ambitious plans for a mass scale shift to electric vehicles (EVs) by 2030 so that all vehicles on Indian roads will be powered by electricity. Also the government targets of deploying 5 to 7 million electric vehicles in the country by 2020 with an estimated investment cost of 3 billion USD(approx. Rs23000cr)

But why EV's? What's the problem with the conventional ICE vehicles?

Are the basic questions asked. In the year 2016, just 450 EVs, less than 1% of the total market, were sold in INDIA. Hence the plans mentioned above may look impractical. But we don't have time. The urgency comes against the backdrop of the fact that 13 out of 20 cities in the world with highest air pollution are in India. Also we need to reduce dependency on a fossil-fuel based economy. India's crude oil imports for 2014-15 was 112 billion dollars.

What government has done?

Government has brought a lot of incentive plans. In March 2015 the Motor Vehicles (Amendment) Bill was cleared establishing battery-powered e-rickshaws as a valid form of commercial transport. Under the new goods and services tax (GST) regime starting 1 July, EVs are being taxed at 12%, compared with 28% that petrol and diesel vehicles are subject to. Hybrid vehicles are taxed at 43%. The government is also considering offering benefits that include zero import duties on electric vehicles.

Challenges faced

Implementing all these plans is easier said than done. Making every passenger vehicle electrified is not an easy task. The following four types of batteries are commonly used today in EVs: 1) Lead Acid, 2) Nickel Cadmium (NiCd), 3) Nickel Metal Hydride (NiMH), and 4) Lithium-ion (Li-ion). Out of all Lithium ion batteries are preferred the most as they have higher specific energy relative to the other battery types. These lithium-ion batteries are too poisonous and should be recycled properly. The recycling process is so demanding that even Germany has its doubts and are very expensive too.

Another drawback is the limited number of charging stations. Charging infrastructure for electric vehicles in India has not been fully developed yet. Time to charge an electric car can take as little as 30 minutes or up to 12 hours. The time it takes to charge depends on the size of battery and speed of the charging point. A typical electric car (Nissan LEAF 30kWh) takes 4 hours to charge completely with a 7kW home charging point.

What we engineers are expected to do?

Adequate capacity addition primarily through Renewables in distribution grid in order to meet additional demand created by high penetration of EVs is highly required. Adequate numbers of EV charging station to be designed preferably with rooftop solar generation to minimize dependence on fossil fuels in entire supply chain hence shifting towards clean energy.

Battery disposal/recycling norms as per (Batteries (Management and Handling) Rules, 2001) published by Ministry of Environment, Forest and Climate Change need to be strictly enforced and proper recycling techniques should be developed so as to prevent adverse environmental impacts of battery. Government should also invest in R&D for future battery technologies resulting in batteries with much higher specific energy, environment friendly and lower costs, as batteries constitutes 50% cost of EV's.

CONCLUSION:

Rome wasn't built in a day. Similarly EV's in Indian roads is a slow process. According to a recent survey most pollution linked deaths occur in India with an average of 2.5 million deaths per year. Out of which air pollution accounts for about 72.4 % of the deaths. Gathering people and sweeping the roads is not making India cleaner and greener. It requires some technological improvements. EV's in India is one such small change. While it may seem small, the ripple effects of small things is extraordinary. It is high time for our government and technology to come together and devise sustainable development for the future.

-Prithivi Raj K

ETHICAL CHALLENGES FACED BY AUTONOMOUS CARS

An everyday decision can prove to be mundane and complex. To a normal human being approaching a crosswalk or driving through an intersection can be effortless, but when complex situations arise like a school bus approaching out of nowhere and veering right into you, it becomes a problem that has to be solved in a matter of milliseconds; one would say a job well suited for a machine.

But that would lead to another question, the working of the algorithm used by the car to save the driver and other passengers. In a situation where only one of two vehicles can be saved, the autonomous car will proceed to save itself. Even if this was the most logical decision that could have been taken, morality was entirely out of the equation. A machine got to decide who lives and who dies; this should never be the case.

When a driver decides to overtake another vehicle, there is an understanding between the drivers as to who gets overtook. This human understanding cannot be taught to a machine, also making the car understand that it has to be overtaken is very complicated, as verbal communication cannot work here, and the machine doesn't understand the workings of a human mind either.

As cars become more advanced and they become more electronic they can become prone to getting hacked. Visibility problems exist for the sensors also and the LIDAR sensors that are used are prone to getting fooled by lasers, i.e. they tend to detect lasers as false obstacles as shown by an experiment conducted by security researcher Jonathan Petit. Another issue with the LIDAR sensors is that they have very low visibility in dense smoke/ foggy conditions.

A new problem that arose was the multiple sensor problem, first observed in the Tesla crash, this arises when multiple sensors give contradicting information. Subsequently new technology was developed to establish a hierarchy amongst the sensors, but the problem still exists and has not been eradicated completely.

▲ ***Photo provided by Laguna Beach police shows a Tesla sedan that crashed into a parked police cruiser on Tuesday.***

On May 29, a Tesla car operating in "autopilot" mode crashed into a stationary police car in Laguna Beach, California, leaving the driver injured and the patrol vehicle "totalled", according to an official.

Sgt Jim Cota, the public information officer for the Laguna Beach police department, tweeted photos of the accident, which was reported at 11.07am on Tuesday. The driver of the Tesla, who suffered minor lacerations to the face from his glasses, told police officers the Tesla was in the semi-autonomous mode.

All the autonomous cars are judged and rated on the basis on disengagements suffered, this may not seem to be the most perfect way of judging but for comparing the decisions made with a human driver, this would suffice. A disengagement is when the human driver monitoring the car is not exactly sure of how the car would behave and these are generally calculated in disengagements per 1000 miles. No major forerunner in the autonomous car industry has a 0 disengagement number yet, the least being google (WAYMO) at 0.2. They have had 124 disengagements from 635868 miles driven. The number has reduced from 0.8 in the previous year to 0.2 but considering the magnitude of the disengagements, security researchers say it is still not safe to be on road. Road vehicle density of USA is approximately twenty times that of India, but our poor road quality makes up for this factor. The rate of an autonomous car getting disengaged in India will almost be the same as a car in USA.

-Rengadeva Rajasekaran

FAME-INDIA

The Present World Trend

"I think a lot about electric cars. Do you think about electric cars?" – Elon Musk at a party in his college years. Even as a college student, Musk was already hooked on electric cars. Years later, he never gave up on his dream and co-founded Tesla Inc. in 2003. Since then, its growth has been straight out of a movie. Tesla grew leaps and bounds and has established itself as the numero uno in the electric vehicle industry. It is estimated that around 2 million electric cars are currently running around the world. However, a majority of this number is restricted to some European countries, China and the United States. It is quite appalling to know that India despite its extreme population has fewer than 10 thousand electric cars (including hybrids) in circulation. With a market share of less than 1 percent, the electric vehicle industry is at a nascent stage in the country. However, there is cause for optimism. There has been a steady increase in electric car sales with the government expecting a double digit growth rate. The government has also set an ambitious target of having 100 per cent electric vehicles for public transport and 40 per cent electric for personal use. For this cause, the Indian government has launched FAME: Faster Adoption and Manufacturing of (Hybrid and) Electric Vehicles in India.

FAME Phase I

The Indian Government implemented FAME Phase I in 2015. Phase I envisages Rs. 795 crores in the first two fiscals, with around 500 of it dedicated to on-demand incentives. Initially, Phase I was supposed to end by March 2017, with an updated Phase II to be launched after. However, Phase I has already seen three 6-month extensions pushing Phase II to September 2018. A preliminary proposal for Phase II has already been made but the Union Government is yet to look into it for approval.

FAME Phase II

The proposal for Phase II entails financial support of Rs. 9831 crores over a five-year duration. FAME Phase II has seen several notable changes from Phase I, the most prominent of which is the scrapping of cash incentives currently offered to buyers of electric cars. The new phase is being restricted to new energy vehicles used for public transport, commercial purposes and high speed two wheelers. Large EV components not covered under modified special incentive package scheme (MSIPS) of the Ministry of Electronics and Information Technology have also been proposed to be given capital investment subsidy at a rate of 20-25 per cent. Additionally there is also the proposal to establish a venture capital fund under FAME II to extend credit facilities to promising start-ups in the EV industry. These high risk start-ups fail to get funding by reluctant finance institutions and often fail to see the light of the day. Hence, to support them, a sizeable amount of Rs. 500 crore is to be set up for funding.

Benefits to public transport

Despite the positive changes, there has been a certain amount of backlash over its decision to scrap cash incentives for private buyers. The government has, however, countered this by announcing that they were giving subsidies for aggregators instead. Cash subsidies are now given for ride sharing aggregators such as Ola and Uber if they adopt a fleet of electric cars. Although it appears that the number of private electric vehicles won't increase much, this move has cause for optimism. It is quite apparent that these vehicles will see more light than their private counterparts. Hence, it makes sense to incentivise these rather than private vehicles that may not make much of a difference in the overall carbon footprint of the country. Agencies such as Energy Efficiency Services Limited and Association of State Road Transport Undertakings are also being considered as potential aggregators to come under the scheme since the maximum utility of a majority of the population will be through public transport. Even though the estimates seem rather quixotic, it is quite refreshing to know that steps are being taken for sustainability and longevity of the environment. With time, it is quite possible that India also can hope to reach the levels of China and the US in the EV industry.

TOTAL NO. OF VEHICLES SOLD: 220815 (as of 31-07-2018, 23:00 pm)

30568578	48695	121030	76471813
Saved fuel (In Litres)	Fuel saving per day (In Litres)	CO_2 Reduction per day (In Kg.)	CO_2 Reduction (In Kg.)

-Sathya Naarayanan T

ARE WE READY FOR AUTONOMOUS VEHICLES?

VEHICLES AND THE REVOLUTION

Transportation of things and people has been mankind's priority since time immemorial. While there was a stark difference in the ways this was achieved but the underlying factors remained the same:

#convenience
#safety
#speed.

Fast-forward to the 19th century and we are greeted by the first gasoline powered automobile. The automobile 'industry', as it soon became, was in the constant pursuit of mobilizing goods and people in the most efficient way possible. Two centuries later, automobiles are no longer a novelty, but the pursuit is still on. With rapid advancements in the field of mobile and communications technology, we now have synergised the automobile and tech industries. However, a series of questions begged to be asked: Has technology become too fast for us to keep up with? Is it crossing our fathomable limits?
Most importantly, are we even ready for this?

If the automobile industry saw the same growth like the tech or communicarions industry, we could all afford Rolls Royces by now!

COMPUTERIZATION OF VEHICLES AND CRUISE CONTROL

DAWN OF SECURTITY FEATURES

One of the major driving forces behind the integration of technology in the automobile industry was safety. As vehicles became more powerful, the damages caused by them became more grave. To mitigate this, a host of safety and security features were made mandatory in modern day vehicles. Seat-belts became an industry standard in 1958, with the Swedish manufacturer, Saab, making it a feature in all its models. Airbags were also among the first safety features to find its way into vehicles. The initial models were not computerized and relied on an array of pressure, velocity and impact sensors to determine when these needed to be deployed. As safety standards kept improving, manufacturers found ways to integrate computerization and the sensor data to achieve better situation-specific response. Soon, more and more parts of vehicles were being centrally monitored by a computer and this allowed for new safety features like Anti-lock Braking System (ABS), Traction Control, Stability Control and many others. Vehicles are equipped with a multitude of sensors in the form of lasers, lidars (a detection technique which uses pulsed laser) and/or radars. The data from these sensors is sent to a central on-board computer where it is processed and control signals are given to the required components of the vehicle to execute the control action. Control can occur in the form of lighting up the dashboard or braking of the wheels when the driver is unable to respond to sudden changes in the surroundings. The last few years have also seen diversification in ways we fuel our automobiles.

Another popular feature that has become a staple in most middle and upper-tier cars, is Cruise Control. While this is not a safety or security feature, Cruise Control is aimed at reducing driver fatigue by maintaining the car at a constant speed when driving on roads that are fairly monotonous in nature.

HYBRIDS AND THE ELECTRIC CARS

ROAD TO AUTONOMOUS CONTROL

With global warming having gripped the world, all countries are increasingly working towards an environment of sustainable development. Reducing greenhouse gas emissions and the usage of fossil fuels are one of the first few steps that can be taken towards making the world a much greener place. This initially involved finding alternative solutions for fuels and thinking about a design that will help us better utilise the available resources. This is exactly where the hybrid vehicles come in. They typically use two or more distinct types of power. The purpose of using different sources of power is to improve the energy efficiency of the vehicle by switching to different power sources at different speeds. Hybrid vehicles have made their mark in the automobile industry and have made a significant progress. Another technological advance in the automobile industry which is gaining popularity is the Adaptive Cruise Control. ACC as it is abbreviated, is an optional cruise control system for vehicles on road that helps to maintain a safe distance from adjacent vehicles. Using ACC doesn't mean that the cars are autonomous, they just assist the drivers. In other words, the cars are semi-autonomous. From the way the ACC system has been growing through the years, we can clearly see the industry moving towards a future where we do not have the requirement of human drivers. This forms the basis of what is called as the autonomous cars. This transition to autonomous vehicles would help to reduce the usage of fossil fuels and hence the greenhouse gas emission.

Mitsubishi was the first to use a lidar based distance detection system, which they offered in their Japanese market. This one was a very simple system which just warns the driver, without involving the gear shifting or brakes. This happened way back in 1992. From then to 2015, when Honda introduced the European CRV - 2015 with predictive cruise control, ACC has come a long way.

How AV's work?

By definition, AVs are vehicles that need little to no human control to safely operate the vehicle. Autonomy is split into 6 layers ranked from 0 to 5, with 0 being completely manual and 5th layer vehicles having the ability to self-drive at any given situation. This autonomy is achieved using a host of lasers, radars and specialized cameras placed around the car. They create an internal mapping of the place around them and use these inputs to plot the best possible path for the AV to follow. Hard-coded rules, obstacle avoidance algorithms, predictive modeling, and "smart" object discrimination help the software follow traffic rules and navigate obstacles. Accelerating, braking and steering (among many others) are the key functions that are driven by actuators. The optimized path, in conjunction with the sensor data sends instructions in the form of control signals to these actuators and the desired actions are carried out.

Cars have become moving nodes, connected to the internet of things around us. This enables manufacturers to utilize the advantages of the internet to the fullest and greatly simplify the automation process. The powers of cloud computing are harnessed to the fullest, to offer a seamless experience across all connected vehicles. Map updates, optimal cruising velocity for battery optimization and actuator-specific information form a small chunk of the huge amounts of data that is updated to the database on the cloud. These updates and information get pushed to every other AV connected to this cloud server and consequently, AVs grow smarter as time progresses.

In August 1961, Popular Science reported on the Aeromobile 35B, an air-cushion vehicle(ACV) that was invented by William Bertelsen and was envisioned to revolutionize the transportation system, with personal self-driving hovering cars that could speed up to 1,500 MPH.

SO WHAT'S THERE IN AN AV?

SOME HEADLINING FEATURES

The struggle of keeping a good eye on the traffic and taking care of parking the vehicle, are some of the many woes that we face when we drive cars. Some of the most exciting features of the autonomous vehicles include :

Automatic forward-collision braking - these systems detect chances for an imminent frontal collision. They then alert the driver and apply the brakes so that, the vehicle stops at a safe distance and can thus avoid a fatal accident. This reduces the dependency on the driver's reaction time.

Automatic parking - This technology helps in deciding if the parking slot is of the appropriate size and after it carries out this assessment, it automatically controls the steering and parks the vehicle in the decided slot.

Autopilot - Discussion about Autopilot in vehicles is incomplete without the discussion of Tesla's Autopilot, which has line centering, Adaptive Cruise Control, collision control being some of its features. Tesla's autopilot is said to be almost as close as we can get to autonomous vehicles at the moment.

Sign recognition - They help in identifying the signs on the road and relaying the right information to the control in the vehicle so that the vehicle is also safe. Right interpretation of the signs on the road can increase the safety and easy moving traffic as more number of people will abide by the traffic rules.

General Motors filed a safety petition with the department of transportation for its ourth-generation self driving Cruise AV, the first production-ready vehicle built from the start to operate safely on its own, with no driver, steering wheel, pedals or manual controls.

USER STATS ABOUT AV

Semi-autonomous cars are as close to AVs as we can get in the commercial space. Many manufacturers have designed concept cars that are fully autonomous but most of them never made it past that stage and hence it is impossible to get real world statistics for those models. Ergo, the statistics will be a combination of numbers for the current semi-autonomous market as well as future projections for AVs. Tesla's Model S, Model X, and Model 3 are the three major offerings by the Californian giant. Cadillac's CT6 equipped with GM's SuperCruise feature is the only real competition that Tesla faces in the semi-autonomous vehicle industry. According to Tesla and General Motors' official sales numbers, Tesla's vehicles have been around since 2014, while the CT6 is just two years old. In 2014, Tesla sold a combined total of 16,689 models and had 0.11% of the market share. These numbers saw an uphill trend in the following years as their market share grew from 0.11 to 0.29% in 2017 and production numbers jumped to 50,145. The CT6 also saw an increase in sales from 2016 to 2017 as numbers jumped from 9,169 to 10,542. This can be credited to both, the increase in popularity of semi-autonomous vehicles and the concurrent release of the lower priced Model 3, which attracted more consumers.

A study conducted by Kantar TNS across multiple nations and nearly 8500 'connected' car owners, revealed some shocking numbers. Nearly half the users just 'do not get' the relevance behind the connectivity features in their vehicles. While making a purchase decision, 'connectivity' was the least priority in the minds of the customers, with only 11% of the people taking it into consideration. 'Safety' topped the list with nearly half the customers being on the lookout for new and improved safety features. Hence, customers in the market for cars, should be educated on the correlation between the connectivity features and overall safety. It is also found that people who are exposed to the host of security and safety features are willing to shell out the price premium for the same, while the uninitiated are reluctant. Again, this goes to show that manufacturers and/or dealerships have an added responsibility of giving their potential customers a hands-on with their safety and security enhancements.

Future projections by Intel tell us that AVs are truly the next biggest thing in the automobile industry. Intel predicts that the AV market will scale from $800 Billion in 2035 to $7 Trillion in 2050. These predictions cannot be validated at this point in time, but it does seem possible that AVs penetrate deep into the automobile market. With this advancement, AVs will spearhead a dearly-welcomed change in the automobile industry.

Cons about AV

Like any new product in a market, AVs too have their downsides. That, along with the growing pains of new technology, means that AVs are scrutinized with a fine-toothed comb in a way that has seldom been done before. While the safety standards are much improved, drivers are still skeptical about handing over complete control of their vehicles to a computer. The fact that computers have to be trained to react to situations, makes them wary about any unforeseen exceptions that may creep in. The technology behind AVs is still very much at its infancy. As a result, it is associated with a hefty price tag, discouraging many people from making the leap towards autonomy. As seen from the user statistics, many people fail to understand the connectivity features in their cars. AVs kick this up a notch and have lots more connectivity. For the buyers to take full advantage of the price premium, they need to be educated on the assortment of attributes by the car dealership. This directly leads to a rather steep learning curve. Moreover, the cloud connected nature of AVs thrives on the number of connected cars. More cars equates to frequent updates on the cloud database which eventually translates to better autonomy of the vehicles itself. Hence, for AVs to perform, there needs to be more AVs out on the road. As one can observe, this gives way to a complicated circle. On the topic of connectivity, every node that's connected to the internet is an invitation for notorious hackers to make their way through. Unlike data losses and/or thefts that occur with traditional attacks, a hacked AV can single-handedly consume lives of both, the people inside and outside the vehicle. Quite naturally, there is skepticism surrounding the security of these AVs and manufacturers are looking to prevent malicious attacks by pushing security updates every so often. In conclusion, it is quite easy to spot a trend here; there is an underlying fear in handing over complete control to a computer, especially one that is prone to hacking and other malicious attacks. This, when paired with a hefty price tag and a steep learning curve leaves a lot to be desired from current-gen AVs.

WHAT DOES THE FUTURE LOOK LIKE? HOW IT CAN BE IMPROVED?

It is a very common notion that automation of vehicles will help in cutting back the total usage of fuel. Living in a world where sustainable development has become of prime importance, this seems to be like a great advantage that the automation industry is having. But, according to the transportation experts, it is yet to be confirmed as to whether the introduction of this automation will help in decongesting the roads or with reducing the greenhouse gas emission or for that matter reducing the consumption of fuel.

"The impact can be dramatic, but there remains a lot of uncertainty about it," said Jeffrey Gonder, a researcher at the National Renewable Energy Laboratory in Colorado. "There needs to be further research to try to more intelligently understand where are the key tipping points in the evolution of the technology, so we can help encourage the beneficial impacts and mitigate the negative impacts."

The transportation experts have modelled several hypothetical models, where vehicles can 'talk' to each other to avoid accidents and also prevent the stopping and restarting of vehicles which usually leads to a huge loss of fuel. They have also worked on vehicles which go exactly one behind the other, in a phenomenon called 'platooning'. This reduces the air resistance and helps with fuel economy

Jeffery Greenblatt, a co-author of the study and an energy researcher at the Lawrence Berkeley National Laboratory, said that with the advent of autonomous vehicles there will be greater use of electricity.

Conclusion

The automobile industry, once a great feat of mechanics, has now slowly transitioned into a great feat of electronics. The future of cars lies in their complete automation and having vehicles which will ultimately not require any driver. The future of such a seismic shift leads us to a multitude of questions like - what are we going to do with the time that we had earlier invested in driving? Will some other technology be developed to swoop away that time? Will completely autonomous vehicles also mean that the vehicles, as we know them today, would seize to exist?

Apart from these, questions like customization of cars will move from just choosing the right colour and audio systems to a second generation of lightweight technology driven by 3D printing. Another question that occurs is that of ownership, now that humans are no longer in charge of their vehicle, will this mean that there is no need to actually own the vehicle? And if no one owns the vehicle, what about the case when an accident occurs? Who shall be held responsible, then?

With so many questions at the end of this, perhaps we are not yet ready for complete automation of our vehicles. This automation will rake and impact our society at several levels. Even more so in places where many people who earn a living by driving cars and working in the taxi service industry, it is very important that we analyze the consequences of the same and push for sustainable automation!

-Kiran Krishnan & Nandita Sreekumar

COMPANY INTERNSHIP

CISCO

I did my summer internship at CISCO Systems. I was put into Data Center BU. During my internship, the whole BU was busy because of the Cupertino release for N7K series. It was all chaotic for the first 2-3 weeks. The team I was into develops the software for the switch and also fixes any issue.Keeping things simple, when a customer has an issue with the switch and the company can't fix that in time, as per the policies, company should be paying them back. (By customer, I mean other companies which use Nexus for data centers etc.) Coming to the point, when there is any issue, all we get from customer or the testing team is logs obtained from the switch. Each log has around 50 million lines or more. And we have many such logs. They usually search for error messages in the event history from the logs and that takes a lot of time, since they have to go through a lot of lines. Now, my project was to develop an engine which parses those logs efficiently and gives out a .csv file which contains contains all details of interfaces like status, Tx Rate, Rx Rate etc. on switch. Along with another intern, I developed two tools to help them in debugging the info from the logs. The other tool generates sequence diagrams for the event history details from the logs. These tools now greatly reduce their trouble of going through all those huge logs. In other words, we developed debugging tools for NX-OS. Python and Bash are primarily used to develop these tools. And they can now do the same work in half a day which should have taken 3 days otherwise. Everyone around me was very friendly and helped me a lot. Working hours are flexible and it is a beautiful campus. Simply, I can't ask for more.

-Vamsi Kiran

CITI INSIGHT

In my two-month long internship at Citicorp Services India Private Limited, I worked in a division called Enterprise Technology Solutions (ETS). ETS is a unit responsible for modelling financial risk, running financial stress tests and reporting the results. I worked on a project that focused on adding excel-sheet-like formatting capabilities to an online management reporting system called 'Citi Insight'. The project was based on Angular 6.0. I got to interact with senior managers and team leaders, who gave me an idea of where my project would fit in the big picture. Overall, it was a great learning experience.

-Nandan Bhaskaran

SIEMENS

I interned at Siemens, a major player in the electronics industry. My intern was mainly focussed on automation which is becoming the norm in several industries these days. Siemens is known for its PLCs, and DC and AC drives. Faults in field instruments are identified in the control center either by HMI on a screen which includes graphical interpretation of instruments' current status or by input cords. Then, in the PLC, as per written logic, commands are carried out back via a junction box to the instruments. The logic is written mostly as per ladder logic, and the inputs and outputs are linked to the screen of the operator in the control room using tags so as to enable the screen to operate as a touch panel. This entire concept of HMI and fault diagnosis can be classified under one heading as SCADA. We worked on the control system design of a water reservoir being built by Siemens in Qatar.

-Teja

I got the opportunity to intern at Seimens. It was a nice learning experience for me. On day one, my guide made a month long plan on how my internship was going to happen. Initially,I was required to know the basics of drives and PLCs . So, the initial days mostly involved theoretical study from reference books and company user guides, along with some help from the colleagues. Later, we dived into the application part. We used the company software for simulation of ladder logic programs.The Company Mentor gave n no. of problems on a daily basis, which were needed to be simulated on a software. After completing the software part, we moved on to the real kit. Understanding how to commission a machine, and write or upload a program on to it were the major part of our learning. In the end, we made a detailed report on the work we did during the internship.

-Alok

SIEMENS
Ingenuity for life

It was a three phase internship.

1)First phase:The first phase was during second year summer vacation. I was posted in Chennai for a period of one month in the Energy Management department. The Chennai office is a sales office and hence it was more of a study project. We learnt about their products and in detail about the latest technologies involved in protection and switchgear. We got an opportunity to visit the Chennai Metro Rail Project near Koyembedu. Siemens had got the contract for electrification, lightning and signalling of CMRL. It was a one day visit where we got to see the OCC room and the substation.

2)Second Phase : It was a 20 days classroom training - SITRAIN. We were given training on three courses - PLC, Electrical Drives and Switchgear. It was a very good learning experience.

3)Third Phase : Third year summer I was posted in GOA, EMTS - Energy Management Transmission Solutions in a factory. They assembled HVDC PLUS converters in the factory and were working on Pugular Kerala power transmission project which was based on VSC based HVDC technology. This technology is being implemented in India for the first time and it was really exciting to learn about it. My work was to study the whole project - the design, the technology behind HVDC plus, the construction and working of the converters and to conduct training sessions for the employees in the factory.

-Vinitha Palani

LARSEN & TOURBO

I did my summer internship in LNT Electrical and automation department, Mumbai. The duration of the internship was 2 months long. I have worked on the topic "The Internet of things". In my project, I had monitored the health of all the transformers in a region by sending the information of the oil level temperature, load voltage and load current to a centrally hosted network and then use the obtained data to predict the next servicing period of the transformers by using machine learning. Working with all the hardware and the latest of technologies gave me a very good insight into the field of IOT. The work culture was balanced with flexible timings. My mentor was very helpful and supportive, he sat me down and explained the concepts with such ease that were new to me. Also, being surrounded by like-minded people encouraged me to learn. The weekend also provided a perfect opportunity to explore the beautiful city of Mumbai. Overall the whole experience was splendid.

-Challa Praveen Kumar

PEPSICO

I got the opportunity to do an intern at PepsiCo and the location given to me was Nelamangala, Karnataka. The intern selection process began with a psychometric test, after which we had a GD and finally PI.During my stint, the project given to me was to perform a quantitative electrical safety audit of the entire plant at Nelamangala. Being a very non-technical person I was very skeptical of whether I'd be able to do the project, however, because of the friendly and helpful work culture within the plant I had a great time doing it. Apart from working on my project I also got to learn and work for the different verticals within the plant (Finance, Manufacturing, HR, EHS, Maintenance). Overall, it was a wonderful learning experience.

-Roshan Joseph

NVIDIA

I did my 2-month summer internship at NVIDIA, Bangalore. On the first day, we had a formal introduction to NVIDIA by the HR team, after which we were allocated to our respective mentors and managers. For the first few weeks, we had training sessions on UNIX, PERFORCE and overview of chip design. I was into the formal verification of GPU ASIC team. My task was to verify a module in their Ampere GPU using formal verification methods. I had to report to my manager about my progress on a weekly basis and we had sync-ups with the GPU ASIC team director once in 2 weeks. The timings were really flexible and there was no particular dress code. We were taken to team lunches and team outings. It was also a good opportunity to know about interns from other colleges. People here are very supportive. In a nutshell, it was a wonderful learning experience.

-Harini K

MORGAN STANLEY

I interned at the office of Morgan Stanley in Bangalore from May to July 2018. It was a good experience interning at such a reputed corporation. I learned about the businesses of Morgan Stanley, their operation and internal affairs. I was a part of the Wealth Management Team, a field in which Morgan Stanley is the industry leader. My project was based on a stream processing system called Kafka. Kafka is used for building real-time data pipelines and streaming apps. It is horizontally scalable, fault-tolerant, fast, and finds use in many mainstream companies. I was given extensive training in Java, Generic Algorithms, and Big Data. The work-life balance was also pretty good, allowing people to dedicate quality time to their hobbies and other fun activities as well. In conclusion, it was an amazing experience working at Morgan Stanley.

-Sudharsan S T

TEXAS INSTRUMENTS

Securing an internship in one of the top semiconductor companies is the dream of almost everyone involved and interested in the field. Not just for the corporate experience and the opportunity to work with some of the brilliant minds in the industry but for us as about to be college graduates to convert the internship opportunity into a placement offer.

My journey with Texas Instruments began last year on July'18, when TI came to campus for recruiting interns. The selection procedure was pretty technical, which involved an online test and a couple of technical interviews. The online test was based on hardware and software domains. Students were selected for interviews in the domains they performed well in the online test. I had my interview in the digital domain. The important thing to understand is that out of the world projects are not expected from a 2nd year B. Tech student. However, one should be crystal clear on the concepts required in the project and should have a detailed understanding of the project. Finally, after all the interviews and the HR round, I was selected as an intern.

Interns in TI are allotted mentors who will be the ones handling the project and guiding you throughout the two months of internship. They reach out to you a month prior to the commencement of the internship and give you an idea of the project you will be undertaking and the technical skills required of you for completing the project in a short span of two months. Truth is two months is a bit on the shorter side to complete the projects allotted, and so one needs to put in that extra effort to do a commendable job which can be appreciated by the people you are working with. My project was no different and I faced many challenges and failures during these two months which were enough to get me frustrate and demotivate me. But if there is a will, there is a way. I had to approach numerous people which expanded my contacts, had to work extra hours to get things done on time. And finally, the work paid off. I am not trying to scare anyone but remember securing an internship is not the end of your work. It is just the beginning and you will have to prove that you're better than the other extremely talented interns in order to receive that pre-placement offer. All the best to all of you for your internship endeavours.

-Subhadeep Aich

QUALCOMM

I did my internship at Qualcomm India Private Limited. The organisation was in the campus by the first week of August. Our batch had a CGPA cut-off of 8.0 which is the general trend. The online test gave us a choice between hardware, software and communication profiles, hardware being the only profile considered for students of EEE department. The online test consisted of aptitude section, questions on electronics and questions on C. Shortlisted candidates had an interview which involved questions pertaining to only the resume.

I chose to intern for nine weeks and I was mapped on to the 'Wi-Fi Verification' team in Qualcomm, Chennai. The first four weeks of the intern involved learning all the necessary concepts and languages which were all pretty much new to me. The next five weeks involved a project which was in line with the work being done by the team. Since the project was a part of the main project being executed by the team, the experience was wholesome and gave a fairly good insight into how the industry works. The mentor and manager allocated were of extreme intellect and a great help too. They phased out the tasks in a very rational manner to help the intern ramp up gradually and steadily. My project involved scripting in PERL and programming in System Verilog. On the whole, the internship was really good and resourceful.

-Aravindh Balaji

I had the opportunity to do an an internship at Qualcomm (Chennai). We were a total of around 10 interns hailing from different colleges, accommodated in a service apartment. On the first day we had an orientation program and mentors were assigned. I assume most of the interns were assigned teams based on their resumes and the projects they had done, so they were all assigned to their desired teams. In my case it was the Design Verification team. My mentor and I had an informal chat over lunch, and I was briefly introduced to the project that I was about to undertake. Later, my manager also arranged a meeting wherein I got to meet all the other team members. My work focused on writing checker files to validate the RTL of Power IP cores.

I must stress the fact that work culture in Qualcomm is excellent. Even if you do not know someone or other team members, you can just ping them and ask your doubts irrespective of their position. There is also no fixed schedule, even for the interns, though it'd be better if you adjust your timetable according to your team.

The best part of the internship was 'Ideaquest'. It's the flagship event for the interns where teams of 4 to 5 interns work on their own ideas. Combined voting by the employees and judges decided the winner. We got to learn many new things during this week-long event. It was like a mini-entrepreneurship project where we thought of an idea, developed a prototype and marketed it for fetching votes. On judgment day we showcased our prototypes to the employees of Qualcomm, Chennai.

All in all, it was a great and enriching experience.

-Shruthi Ravishankar

RBS

I did my intern at RBS, Chennai in the Customer Relationship Management (CRM) team under the business unit of Corporate & Private Banking (CPB). The selection process for the intern initiated with an online test on Mettl platform which consisted of Quantitative Aptitude, Verbal Reasoning, Technical MCQs and two coding questions. Shortlisted students were called for the interview before which another written test consisting of just two coding/tech questions was conducted. Interview was mostly HR where they asked us on what we know about RBS, our strengths, our projects mentioned in the resume, etc. The interview wasn't much technical because they already filtered us twice through two tests.

During the course of my intern I was trained in various fields:

-worked with the tools and technologies like SQL Server, Informatica and Microsoft Dynamics CRM. Using the ETL tool (Informatica), I got the exposure of transforming the data and loading it back into the CRM. The CRM applications play a significant role in almost every company's sales, service and marketing lifecycles.

-Implemented a custom visual in Microsoft Power BI to display the geo map-flow of Relationship Manager meetings.

Beyond the normal day job, I got to volunteer at conducting a digital literacy session on modern payment technologies like UPI, e-wallets etc. for the housekeeping staff. In addition to that, we had fundraising events such as selling bookmarks, biscotti, hot chocolate, etc. The team was very friendly and helpful. The ambience of the place was great and I thoroughly enjoyed my internship this summer.

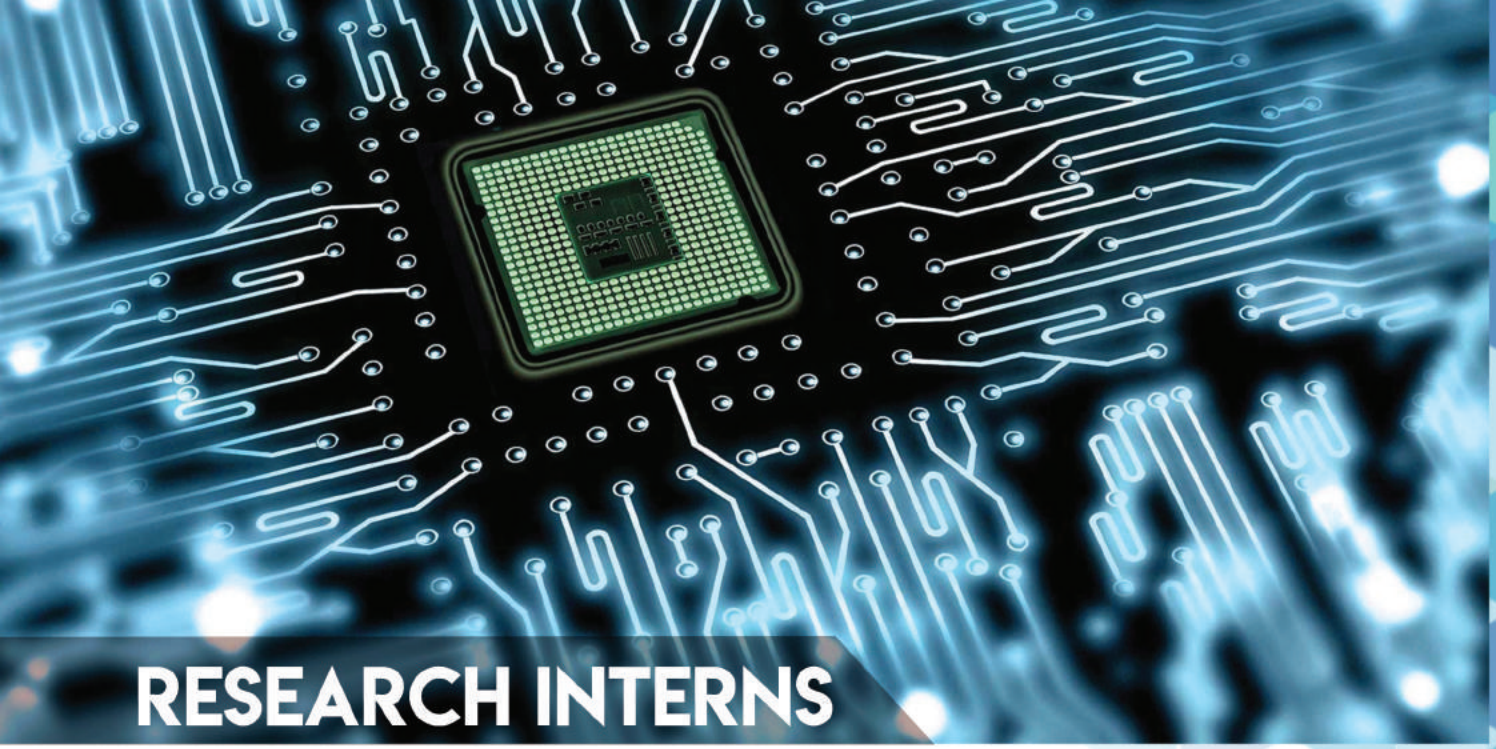
-Ayodhya Mukund

RELIANCE

We did our internship in Reliance. The internship process contained only an online test which was used to filter out the applicants. The posting was up in Northern India, which took a while to adjust to for us, being from the southern side.

The internship was a good learning experience. We came to know about the practically implemented electrical equipments and other gadgets. The degree of appreciation for a project varies from one project to the other. The people in the plant were always easy to approach and friendly, clearing our doubts and letting us be part of any project. The food and accommodation made by the company were good. We were allowed to use the amenities given for the employees like swimming pool, gym, table tennis and transportation. Overall we had a good experience.

- Giri Shankar, Bhavya Sri Pochu and Bharath Thanikachalam



RESEARCH INTERNS

Max Planck Institute for Intelligent Systems, Germany.

I spent my last summer vacations doing a two and a half months internship in the Autonomous Learning Group at the Max Planck Institute for Intelligent Systems, Tuebingen as a DAAD-WISE Scholar. For those who don't know, it means my travel and stay in Germany was sponsored by DAAD. My project was based on a deep learning architecture that was developed by the group that aims at identifying underlying equations governing a dynamic system from its time series data. The model is known as the Automatic Equation Learner and has wonderful applications in perceiving systems, robotics and in situations where knowing an underlying equation of the system leads to an exponential decrease in workload and computational expense. My work mainly involved developing a Tensorflow (Google's Deep learning library) implementation of the same, while optimizing it for performance and collecting and testing the model with real world robotic datasets. I worked along with a postdoc on the project.

During the internship, I got myself acquainted with my fellow group members, who were from different corners of the world. It gave me the opportunity of working in a culturally diverse atmosphere. To be fair, the working environment is nothing that you get back in the country. Flexible working hours, hierarchy being just another noun, getting treated with equal respect and dignity as everybody else and being surrounded with motivated people passionately doing what they love to do - is indeed a whole lot of differences. Many-a-times you will find yourself explaining things to the postdocs and group leaders, contradicting them and you'll find them respecting your views and ideas like never before. And last but not the least, you have got the full freedom of being STUPID.Of course, being in Germany means one can go around a major part of europe without much of a hassle. I wisely exploited my weekends and travelled to eight countries. So for anyone, irrespective of whether you're interested in research, I would recommend that you avail these opportunities and make a go for it. You never know what life has for you around the corner. Cheers!

-Arnab Bhattacharjee

Max Planck Institute for Plasma Physics, Germany.

I was given an opportunity to do a 49-day summer research internship at the Max Planck Institute for Plasma Physics, Garching bei München, Germany. The objective of my project was to design and construct radio-frequency compensated Retarding Field Energy Analyser (RFEA) to measure the Ion Energy Distribution Function (IEDF) for helicon plasma, produced in a test facility called Ion Sheath Test Arrangement (IShTAR). I was provided partial financial support from Max Planck Institute. The dynamism, vision, sincerity and motivation given by my supervisor and PhD students have deeply inspired me. They taught me the methodology to carry out the project properly. The fully flexible work culture and ambience of the workspace helped me in thinking out of the box. The unique and innovative scheme of RF compensation gave exceptional results and was widely appreciated.

I was impressed with the concept of individual rooms for every person working in the Institute, even for interns who visited for a short duration. The dimensions and facilities in the room were the same for everyone irrespective of their designation. Every room was provided with a telephone and a workstation connected with the central supercomputer. I did not face any language problem during my entire stay in Germany. In big cities like Munich, almost everyone is fluent in English. I had the perfect balance between work and fun. Being in Munich, I had the opportunity to visit a lot of places in both south Germany and Austria during weekends. I admired the efficient and punctual public transport facilities. It was a wonderful experience to indulge with cutting edge technology after completion of my second semester, which made me develop the RFEA at Max Planck Institute.

I would like to urge the freshers to try to find the internship of your choice without fear about the lack of knowledge of core department subjects. There are many challenging projects which only need a thorough knowledge of the high school. All the best!

-Shubhabroto Mukherjee, 2nd Year

International Institute of Information Technology, Bangalore.

I did my research internship in International Institute of Information Technology, Bangalore on Computer Architecture. The selection process involved a rigorous spamming of emails to the faculty in my preferred stream until they responded. The email consisted of my resume and Statement of Purpose (SOP).

My project titled "Design space exploration of an out of order processor to improve performance" gave me a wide scope of learning during the course of the project. I got to learn and implement the software "Simple Scalar" which was used to test the various performance parameters at different configurations. It was a wonderful learning experience where I received in-depth knowledge on Computer Architecture, a topic not dealt with as a core course in B.Tech EEE. The accommodation and food were completely free and to make things better, you get a stipend and attend the team's treats! I had a brilliant experience with a relaxed work life and a wonderful set of fellow interns and senior Researchers.

-Ajay Krishnan

National University of Singapore.

Landing a good research internship in a reputed lab is a great opportunity for students who aspire to pursue research in the future. It is no doubt that some of the best opportunities for research are available abroad, in countries like USA, UK, Germany and Singapore. One of the best ways to get an internship offer abroad is to apply through a scholarship program, like DAAD-WISE (Germany) and Mitacs (Canada). However, such scholarship programs are highly competitive with a very low acceptance rate. You can also get some of the best opportunities by mailing directly to the professor under whom you want to work. To get a positive reply from a reputed professor, you need to have a resume of proper format, and a cover letter attached to the body of the mail. The cover letter should be crafted skillfully, making sure that it is crisp and upto the point, at the same time highlighting some of your most apt skills and experiences that can convince the prof to accept you as a prospective intern. After getting a positive reply, you may proceed to ask for financial assistance for your internship. Do not stress a lot on financial assistance if the professor refuses to offer it in the beginning.

Also, if the professor does not respond to your first e-mail, you could resend the same e-mail or go for follow ups. But it is recommended that you ensure a minimum gap of 2 weeks before you follow up.

I am Ravikiran. I was an intern in NUS under Prof. Hongliang Ren, principle investigator of Medical Mechatronics lab, under the department of Biomedical engineering. The reason why I chose this particular lab, is because I am interested in pursuing research in deep learning, and extensive research was going on in this lab where they applied deep learning techniques to biomedical data. During my first few days, I made myself familiar with several deep learning frameworks like caffe, keras and tensorflow. I implemented several deep learning models, and compared the performance and architecture of different state of the art techniques. The project that was assigned to me was 'real time semantic segmentation and instrument tracking of robotic surgery video data', which was a very interesting topic for me. In the end, I was able to publish my results at a good conference. As a part of this internship, apart from deep learning, I also learnt a lot about how to read, write and cite research papers and be an active part of the scientific community.

Hi guys. This is Sidhaarth. I did my internship in Power Systems Research Laboratory, NUS under Prof. Jimmy Peng. The completion of third year in EEE marks the finishing of all core department courses. Doing a research intern in Power Systems Research Laboratory helped me put to use many of the core electrical engineering concepts that I had learnt. The first part of my project dealt with building reduced models that help to adequately and accurately represent droop controlled inverters and power system dynamics. The second part of the project involved testing the same on the RTDS- Real time digital simulator which is used extensively in educational institutions and research facilities throughout the world. In this process, I learnt a new software named the RSCAD which is used for operation on the RTDS. The project was very integrated and involved drawing on concepts from courses like Networks & Linear Systems, Control Systems, Power System Analysis and Power Electronics. I also got to meet lots of new people from different colleges and different fields doing internship in the same lab as mine. It was an enriching experience interacting with them.

-Ravikiran Ramesh and Sidhaarth Venkatachari

Inria in Rennes, France.

I did my summer internship in INRIA-Rennes campus in CIDRE Research team. CIDRE (standing for "Confidentiality, Integrity, Availability, repartition") is a joint research group between Inria, University Rennes 1, CNRS and CentraleSupélec, focusing on the security of distributed information systems. I was under the supervision of Dr Emmanuelle Anceaume and Dr Romaric Ludinard, and we were working on the development of a Blockchain environment. I reached up to them, enquiring about the vacancy of an internship position and I was informed back that a position was present and it dealt with Blockchain. The Lab provided me a monthly stipend. Initially I was confused over this offer and the SRFP offered to intern in IIT Kharagpur. However, I understood that the research happening in INRIA was more specific and much advanced in the area I liked to work in. The main work was on switching from a sequence of blocks to a graph of blocks, which would be highly beneficial for the Blockchain. In simple terms, blockchain is a cryptographically protected distributed database, which provide immutability to the data stored. In addition, this is the underlying principle of cryptocurrencies like Bitcoin, Ethreum, Litecoin and a lot more.

The best part of the internship is that you learn to do something right form the scratch and you will be surprised by the help and assistance they provide you. The lunch sessions and coffee sessions were the best; we used to talk about topics that range from the effect of the latest technology to the performance of the national team of France in FIFA world cup. Brittany, the region of France where I stayed is one of the most beautiful places in the planet and places like Mont St Michel and the fashion capital of the world are few hours away. You are free to work when you like and the work culture is quite casual. However, this has increased the quality of research that is happening here in INRIA. France is the most visited country by tourists, and this is by no surprise. They are extremely hospitable and kind. Also, the French Cuisine is one of the best in the world. So to conclude, this experience made it the best summer I ever had, as I was introduced to the ultra-fast developing technology which made me more independent than I ever was.

-Raj Krishnan

Indian Institute of Science, Bangalore.

I interned in the Department of Aerospace Engineering at the Indian Institute of Science, Bangalore during the Summer of 2018. The specific area of my work was involving the application of Non-Linear and Adaptive Control Theories on Electrical Systems. The major part of my work was oriented towards mathematics, and I had to spend a good chunk of my time understanding the equations involved. The best part of my stay there was getting to know about unpublished theories developed by the researchers in the lab itself, which were waiting to get published. The climate of Bangalore and the greenery of the campus was a perfect combination to survive the Summer. The researchers in the laboratory were very much jovial and were kind enough to help me whenever I faced a roadblock. The internship was also challenging in several ways which included weekly reviews; I had to present the results of the tasks assigned to me by my professor. The working hours were flexible and was around 8

hours a day on an average. Overall, it was a very good learning experience and an opportunity to explore new avenues of research in the field of Control Systems.

-Veejay Karthik

I did my intern in Indian Institute of Science, Bengaluru in the field of electron devices and VLSI fabrication technology under the guidance of Dr. Mayank Srivastava, Assistant Professor, IISC Bengaluru. The internship process involved repeated mailing to the professor which finally gave fruit after three months by his acceptance. The mail consisted of the resume, transcript and the Statement of Purpose (SOP). The acceptance of the email was followed by an on-call interview which eventually lead to my project under him.I worked on the Unification of Physics of Quasi-Saturation of Laterally Diffused and Vertically Diffused MOS for devices of different voltage ranges. While studying the device setup using Sentaurus Technology CAD, I worked towards explaining the reason behind a phenomenon that is posing a challenge to companies using these ultra-high voltage devices in their chips.

With numerous brainstorming sessions, meetings, day-long simulations, long lunch breaks, treats and chai sessions, MSD lab had a competitive and friendly environment to work in. My mentor had a perfect schedule planned for all the interns, enabling us to contribute significantly towards the research project at the lab at our own pace. Overall the research internship proved to be an excellent learning experience with a lot of practical application!

-Sandhya Krishnakumar

INDUSTRIAL VISIT

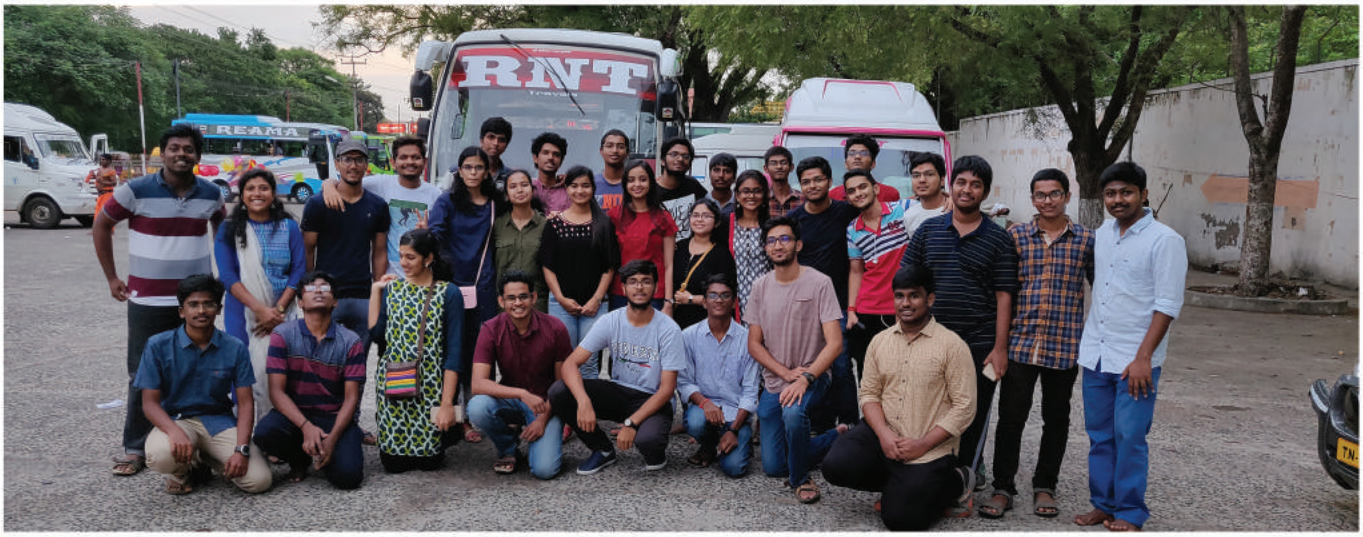
Dr. P. Raja

Power system protection and switchgear, a subject that can be considered as one of the main courses in electrical engineering. Like any engineering course, this course isn't for the normal chalk and board system. It requires actual physical contact with the systems and observing their function in the real world. This became the foundation for the planning of the visit to Neyveli Lignite Corporation (NLC), a thermal powerplant. After covering the necessary topics to equip the students for the Industrial Visit, I began penning down the range of dates on which we could go. After a few arrangements of moving classes up and down for the present final years of EEE, the trip was scheduled to be on 13th April 2018, a Friday. With the completion of the paperwork, we booked the bus for 4:00 am on 13th April and got the visit to NLC approved by the department and NLC.

After some hiccups in the arriving to the start point, we started out from the campus at 4:45am. The groggy youth, sat in their seats slowly waking up to their energetic selves as the sun rose up the sky. Once fully awake the group of 40 started off playing music and games in the bus. The bright nature of the young minds filled the bus with a warm and vibrant mood. We had a pitstop at 7:15 am at Hotel Aariya in Vriddhachalam. After finishing our breakfast, the students went about for a short photo session. We took a bunch of group pictures before climbing back into the bus and departing at 8:45 am to our destination, Neyveli Lignite Corporation. At 9:20 am the first view of the thermal power plant came to view as we approached it, the students pumped up for the new adventure. We reached the entrance of the plant at 9:40 am. After securely depositing our phones in the bus due to restrictions, we moved into the plant. The students stood in awe at the huge expanse of land which includes lush vegetation to absorb and trap any emissions along with the plant. We visited three major sections of the power plant after a briefing by the training section of NLC. First we were taken to the turbine and generator section, then we went to the main section of switch yard. In the switch yard we observed various major apparatus like CT, CVT, Isolator and Circuit breaker with help of an engineer in charge of the yard. Then we had the opportunity to visit the Relay section, where we had seen a variety of relays starting from disc type to numerical.

After a thorough tour inside the powerplant with our guide we boarded back into the bus at 1:50 pm. We then set out for lunch and arrived at 2:30 pm at Blue Diamond restaurant. After finishing our lunch, we set out to try for the mines. However, due to certain restrictions, we were not able to. We then set out for our return journey to the campus. We had a small stop for a tea break on the way at 5:50 pm. With another session of photos and some small transformations to our formal attire, we continued our journey back with a lot of dancing and partying. Being with the students gave me the sense of my former youth slowly returning to me as I joined in with them in their games and discussions. After dropping a few who head out midway to the Currents'18 treat, we arrived to campus at 8:20 pm. The heartful thanks of the students gave me great satisfaction in the trip. Hope the students learnt a lot from the experience as well!!

WELCOME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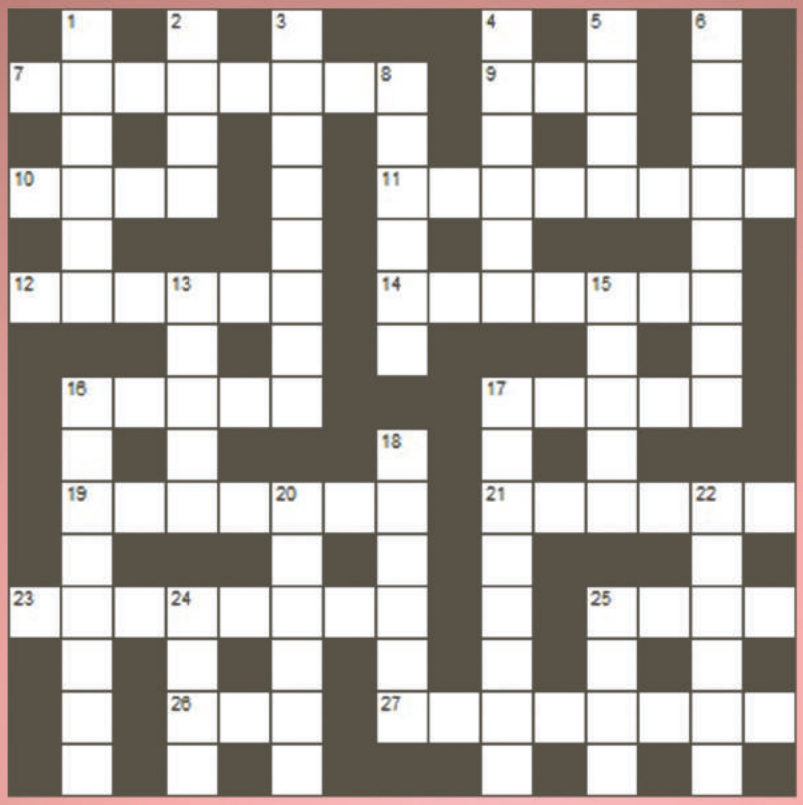

ACROSS:

7 - They disconnect drug-consuming retards, including Radiohead. (8)

9 - Hammer's butt and hoe : endless resistive symbol. (3)

10 - Gold replaced with nothing in safe unit. (4)

11 - Ground soil on a mountain is what separates two parts. (8)

12 - Restart defective robot having extreme sentience. (6)

14 - I hire tailless dogs up front. (7)

16 - Empty possession of Uncle Arnold. (5)

17 - Make fun of eccentric star with love. (5)

19 - Iran destroyed in ugly, unnecessary misunderstanding, primarily, for nuclear material. (7)

21 - Hard retest for me. (6)

23 - Frequently, swear rudely about Windows, for one. (8)

25 - Carbon source. (4)

26 - Hawk/eagle's nest to ruin odd take-off. (3)

27 - Tangled: Doppelganger caught in climax with drug. (8)

DOWN:

1 - Thermionic valve essentially controls input/output before discharging outermost electron. (6)

2 - Stupid twat is a scientist. (4)

3 - ...is in slumber/it's against change. (8)

4 - Limb belonging to us is a shield. (6)

5 - Without head-start, extempore turned around climax. (4)

6 - Rotating stator has helium for resistance control. (8)

8 - Change offer, maybe. (6)

13 - Ohm seen in home game. (5)

15 - Demand former spouse to play. (5)

16 - Charges on US and Colombo set in motion. Nothing came off. (8)

17 - Creepy one stares endlessly to evoke emotions. (8)

18 - Say: A retarded mother and French father. (6)

20 - Dumber and crazier to lose penalties, at last. (6)

22 - Student lost out to winner. (6)

24 - Data structure: It has roots and branches. (4)

25 - Wind tube. (4)

Answers:

Across: 7. breakers, 9. rho, 10. volt, 11. isolator, 12. reboot, 14. current, 16. clear, 17. roast, 19. uranium, 21. setter, 23. software, 25. core, 26. eye, 27. entwined.

Down: 1. triode, 2. watt, 3. resistor, 4. armour, 5. coda, 6. rheostat, 8. switch, 13. omega, 15. exact, 16. coulombs, 17. resonate, 18. ampere, 20. inaner, 22. earner, 24. tree, 25. coil.

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