Department of Electrical Engineering

BIDYUT

A Bi-Annual Newsletter (April-October, 2024)

IIEST, Shibpur

From HoD's Desk

Dear All,

I am proud to share the first edition of the newsletter "Bidyut" of the Department of Electrical Engineering. In today's fast-paced digital age, newsletters are more than just a summary of updates. They are powerful tools that help brands connect with their audience, convey their story, and drive engagement.

The Department of Electrical Engineering was established in the year 1912. The department offers an 8-semester undergraduate B. Tech. course, a 10-semester dual degree (B. Tech. and M. Tech.) course and 4-semester postgraduate M. Tech. degree course in Electrical Engineering. The department also offers research programs leading to a Ph.D. degree. It produced its first batch of graduate electrical engineers in 1936. The postgraduate degree was first offered in 1955 and the first Ph.D. Scholar from the department came out in 1959. The major M. Tech. Specialisations are Control System and Instrumentation, Power and Energy Systems and Power Electronics, Machines & Drives.

Post-independence, when the nascent nation had just started building the power plants that have been instrumental in realizing the dreams of modern India, many of the visionaries, planners and implementers were the students of this department. The present focus of the department is to include several modern topics in its UG/PG curricula and to focus on the cutting edge research in line with the need of our mother land.

This version of the Newsletter includes major events and programs, Sponsored research projects, Invited Talks, Research Collaboration, Consultancy Projects, Patents, Journal and Conference publications, and Student activities.

I look forward more and more contribution from all stakeholders and more eventful version of newsletter ahead.

Thanks and regards,

Prof. Anindita Sengupta

Events & Programs

- Recently concluded
  - ✓ First lecture of the series "**Legends & Legacies**" was organized by GAABESU in collaboration with the Department of Electrical Engineering in memory of **Dr. Sankar Kumar Sen** on 23rd August, 2024. Dr. Sen, Ex HoD and alumnus of Electrical Engineering Department, was also the Vice Chancellor of Jadavpur University, Kolkata and the Minister-in-Charge, Power of the Government of West Bengal.

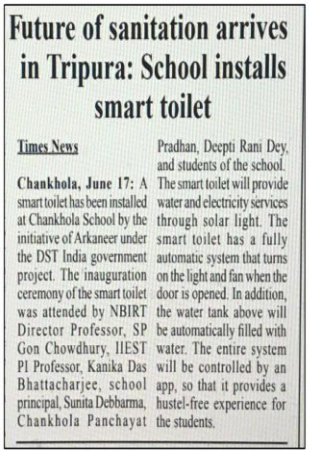



- ✓ National Space Day Program on 23rd Aug, 2024 broadcasted from ISRO

Events & Programs

- Recently concluded
  - ✓ Inaugration of Smart Toilet jointly implemented by Prof. Konika Das (Bhattacharya), Prof. Chandan Kumar Chanda alongwith faculty members of other departments of our institute.

Inauguration of Smart Toilet at Chankhala High School, Tripura under DST Project "Going Remote-Solar Energy for Lighting and Hygienic Sanitation with Smart Exhaust System for Rural Applications" implemented by IIEST, Shibpur and NBIRT, Kolkata Funded by DST, Government of India [Sanction Order: DST/TMD/CERI/RES/2020/23(G)] [Project Code: DRC/DST/CEGESS/KDB/004/21-22]



Future of sanitation arrives in Tripura: School installs smart toilet

Times News

Chankhola, June 17: A smart toilet has been installed at Chankhola School by the initiative of Arkaneer under the DST India government project. The inauguration ceremony of the smart toilet was attended by NBIRT Director Professor, SP Gon Chowdhury, IIEST PI Professor, Kanika Das Bhattacharjee, school principal, Sunita Debbarma, Chankhola Panchayat Pradhan, Deepti Rani Dey, and students of the school. The smart toilet will provide water and electricity services through solar light. The smart toilet has a fully automatic system that turns on the light and fan when the door is opened. In addition, the water tank above will be automatically filled with water. The entire system will be controlled by an app, so that it provides a hustel-free experience for the students.

দেশের মধ্যে প্রথম স্মার্ট টয়লেট ত্রিপুরার ছনখলায়

Features of Smart Toilet:

--Solar Powered Washroom.

-Battery Backup for two days.

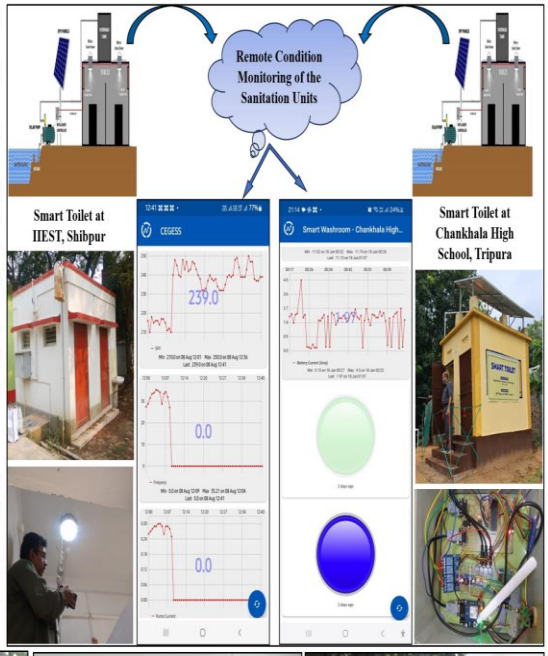
--Condition monitoring of overall system can be assessed through mobile from any part of the country.

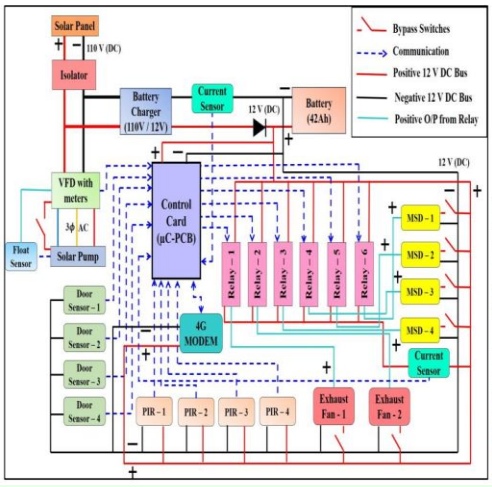
--Availability of water in the tank and condition of pump is also been checked.

--Flow sensor indicator.

-Battery charging discharging monitoring system..

--4G (Fallback) Modem enabled communication system established.





- Upcoming
  - ✓ Lecture on 'Smart Grid' by Mr. Rajib Das (Retd. DGM, CESC and Consultant to the RP-SG Group on integration of renewables in the Smart Grid and Advanced Metering Infrastructure) on 06th Nov, 2024.
  - ✓ National symposium on 'Bridging Academia and Industry for NextGen Technologies in Electrical Engineering (AI-NxtGen-EE 2024)' during 03-07th Dec, 2024. Sponsored by Anusandhan National Research Foundation (ANRF), Govt. of India
  - ✓ International symposium on 'AI-Driven Cyber-Physical Systems - A Hands on course' (in Hybrid mode) during Feb, 2025.

Sponsored Research Projects

- Title: Going Remote – Solar Energy for Lighting and Hygienic Sanitation with Smart Exhaust system for Rural Applications
  - Investigators: Dr. Konika Das (Bhattacharya) & Dr. Chandan K. Chanda
  - Agency: DST-TMD-CERI

- Title: Design and development of magnetic core power inductor (HF-Mag)
  - Investigators: Dr. Mainak Sengupta
  - Agency: MEITY

- Title: Design and development of WBG device based high current converters for industry applications
  - Investigators: Dr. Mainak Sengupta
  - Agency: MEITY

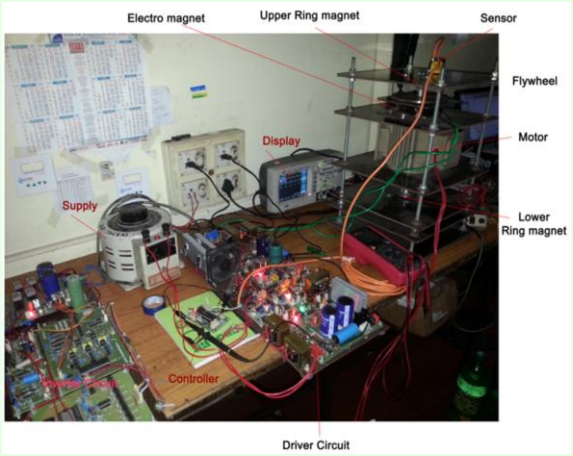
- Title: MEMS for electric machines and drives (MEMS Machines)
  - Investigators: Dr. Mainak Sengupta
  - Agency: MEITY

- Title: Design and development of Multilevel Inverter based Distributed Power Flow Controller(DPFC) FACTS for a grid integrated system with renewable energy sources
  - Investigators: Dr. Atanu Banerjee
  - Agency: CPRI

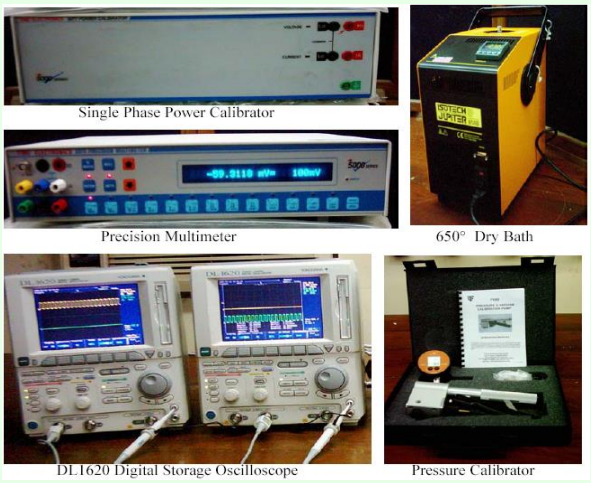
- Title: Data-driven methods in systems and control
  - Investigators: Dr. Mousumi Mukherjee
  - Agency: DST

Ongoing Research Activities

Implementation of a Data Driven Controller on Rotary Servo Flexible Link System interfaced with SIMULINK Real Time Workshop



Experimental Setup of the single-axis controlled repulsive-type magnetic bearing



Experimental Setup of the Magnetostrictive Energy Harvester using Shaker and other accessories

Invited Talks

Ms. Sumita Dutta Nag (Dy. Chief Engineer, DVC) delivered a talk on “Overview of designing a Grid Substation” on 23rd August 2024

Dr. Mousumi Mukherjee delivered an invited talk on "Data-based stability analysis of strongly autonomous nD systems" at the 2024 Tenth Indian Control Conference (ICC-10), Dec 2024

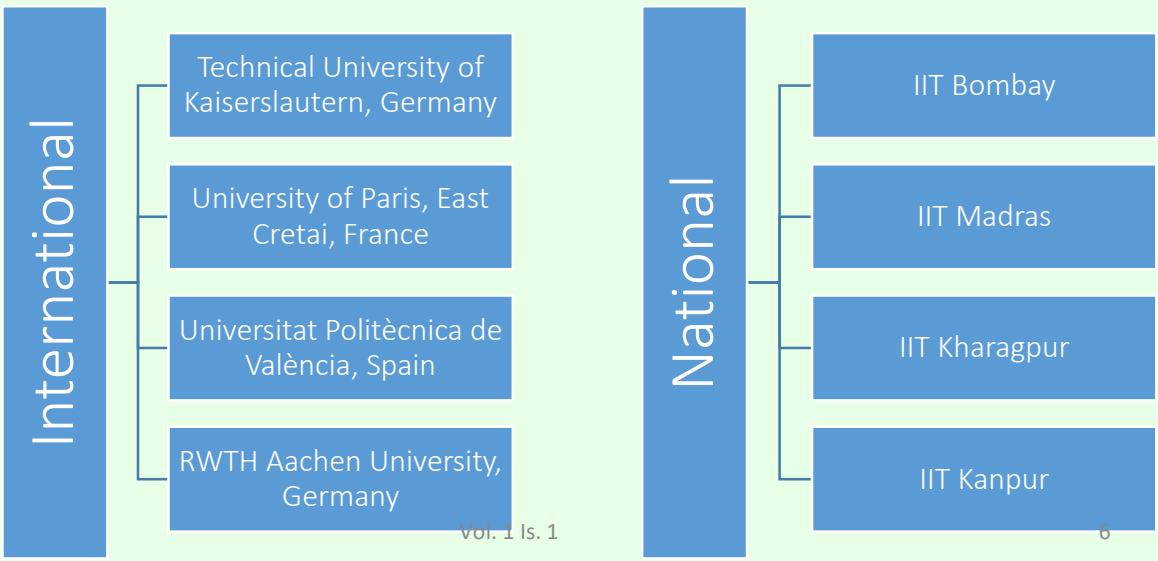
Dr. Roshni Maiti delivered invited talks in MNNIT, Allahabad and G H Raisoni College of Engineering and Management, Pune

Research & Collaborations

PhD Thesis Submitted and Degree Awarded

1. Ms. Saheli Sengupta (Supervisor: Prof. Chandan Kumar Chanda) defended her PhD thesis on 16-04-2024
2. Mr. Tanmoy Mulo (Supervisors: Prof. Prasid Syam & Prof. Amalendu Bikash Choudhury) defended his PhD thesis on 18-04-2024
3. Mr. Subhasish Dey (Supervisor: Prof. Debabrata Roy) defended his PhD thesis on 09-05-2024
4. Mr. Neelbrata Roy (Supervisors: Prof. Ashoke Sutradhar & Prof. Anindita Sengupta) defended his PhD thesis on 09-05-2024
5. Mr. Sandeep Kumar Chawrasia (Supervisor: Prof. Chandan Kumar Chanda) submitted his PhD thesis on 16-07-2024
6. Mr. Manish Kurre (Supervisor: Prof. Atanu Bannerjee) submitted his PhD thesis on 18-07-2024
7. Mr. Dipanjan Bose (Supervisor: Prof. Chandan Kumar Chanda) submitted his PhD thesis on 26-07-2024
8. Mr. Subhasis Bandopadhyay (Supervisor: Prof. Atanu Bannerjee) submitted his PhD thesis on 14-08-2024
9. Mr. Devraj Roy (Supervisor: Prof. Mainak Sengupta) defended his PhD thesis on 09-09-2024
10. Mr. Aranya Bandyopadhaya (Supervisor: Prof. Sukanya Parui) submitted his PhD thesis on 20-09-2024
11. Mr. Snehashis Ghoshal (Supervisor: Prof. Chandan Kumar Chanda) defended his PhD thesis on 04-10-2024
12. Ms. Deblina Nanda (Supervisor: Prof. Prasid Syam) submitted his PhD thesis on 29-10-2024

International/National collaborations



Revenue Generation Avenues

S. No.	Name of the Investigator	Funding Agency	Title of the project and duration (Start and end date)	Amount sanctioned
1.	Dr. Suvarun Dalapati (PI) & Dr. Kaushik Mukherjee	CESC Ltd.	Consultancy Project for Design and Development of HVDC and FACTS based Experimental Dynamic Model Setups, 17th Dec 2022 – 16th Dec 2024	Rs. 5.94720 lakhs
2.	Dr. Abhinandan De	Conveyor & Ropeway Services Pvt. Ltd., Kolkata	Technical Inspection and Certification of Darjeeling Rangeet Valley Ropeway, 2022-2024	Rs. 6.72 lakhs

Patents Granted

S. No.	Description	Year	Faculty Name
1.	A node MCU based overcurrent protection system using Internet of Things	2024	Dr. Abhinandan De
2.	Development of tubular linear induction motor stators from discrete linear stampings	2024	Dr. Mainak Sengupta
3.	Intelligence based system for route planning for optimal electric vehicle charging stations and method thereof	2024	Dr. Chandan Kumar Chanda

Journal Publications

R Maiti, KD Sharma, G Sarkar, "Adaptive Fuzzy Filter-based L1 Adaptive Controller Design for Electromechanical Actuator Containing Uncertainties and Disturbances," IETE Journal of Research, 2024

Shivanshu Kumar, AB Choudhury, HS Bhattacharyya, CK Chanda, “Vital health indicator based state of health estimation of lithium-ion battery by adaptive neuro-fuzzy inference system,” International Journal of Green Energy, May 2024

Reetam Mondal, Jayati Dey, “A General Form of FO PI-PD Controllers for Some Stable Integer and Non-integer Order Plants with Transport Delay,” Springer Proceedings in Physics, Springer Nature, Vol.3, pp. 461-471, 2024

C Dolui, S Dasadhikari, D Roy, CK Chanda, “Galfenol-based Magnetostrictive Sensors: comparative analysis of various structures for efficient energy harvesting,” Microsystem Technologies, 1-13, 2024

C Dolui, D Roy, “Advancement of bridge health monitoring using magnetostrictive sensor with machine learning techniques,” Nondestructive Testing and Evaluation, 1-22, 2024

D Bose, A Alayil, SK Chawrasia, D Roy, CK Chanda, “Resiliency improvement through grid forming inverter,” Microsystem Technologies, 1-9, 2024

AK Mondal, T Santra, D Roy, S Yamada, “An investigation on NGR failure in Indian smart cities while replacing the existing overhead lines by underground cables,” International Journal of Emerging Electric Power Systems, 1-12, 2024

D Chatterjee, C Chakraborty, S Dalapati, “Current Sensor-less Dead Time Distortion Compensation in Single-Phase PWM Inverter,” accepted for publication at IEEE Transactions on Industrial Electronics, 2024

D Dhara, S Das, S Dalapati, “An Improved One Cycle Control Technique for Switching Buck Regulators,” accepted for publication, International Journal of Power Electronics, 2024

Journal Publications

A Nayak, D Chatterjee, S Dalapati, “An Experimental Set-up involving Low-cost Digital Controller to study the Magnetizing Inrush Current in Transformer using Point on Wave Switching Technique,” Vol. 9 (44), pp. 292 - 316, Power Electronics and Drives (Sceindo), 2024

B Barman, M Sengupta, “Parameter Determination of a Multi-layered Induction Heating Coil: Analytical, Simulation and Experimental Studies,” J. Inst. Eng. (India) Ser. B, 1–19, 2024

M Mukherjee, D Pal, "Data-based stability analysis of strongly autonomous discrete nD systems," IFAC-PapersOnLine, Vol. 58, Is. 17, pp. 439-444, 2024

M Mukherjee, VK Mishra, Naim Bajcinca, "Robust data-driven feedback control with pole placement constraints," IFAC-PapersOnLine, Volume 58, Issue 21, pp. 232-237, 2024

Pritam Paral, Saibal Ghosh, Sankar K. Pal, and Amitava Chatterjee, “Adaptive non-homogeneous granulation-aided density-based deep feature clustering for far infrared sign language images”, IEEE Transactions on Emerging Topics in Computational Intelligence, Early Access, 2024

S. Pusti, T. Santra, D. Roy and S. Yamada, Fuzzy gain scheduled adaptive sliding mode
control of a vertical shaft hybrid magnetic bearing under variable rotor speeds, International Journal of Dynamics and Control, June 2024, https://doi.org/10.1007/s40435-024-01463-y

M. Pramanik, U. Roy, M.P. Anjana, et al. Finite element method based performance assessment of existing electrical apparatus in the distribution network in the backdrop of increasing renewable penetration. Microsystem Technologies, Oct, 2024. https://doi.org/10.1007/s00542-024-05779-9

S.B. Pal, R. Ganguly, K. Das Bhattacharya, C.K. Chanda, The Performance of Solar PV Panels and Arrays Affected by Outdoor Parameters. In: Sikander, A., Zurek-Mortka, M., Chanda, C.K., Mondal, P.K. (eds) Advances in Energy and Control Systems. ESDA 2022. Lecture Notes in Electrical Engineering, vol 1148. Springer, Singapore. https://doi.org/10.1007/978-981-97-0154-4_14.

Conference Publications

Jyotika Agarwal, Aniket Karan Chaudhary, Dipayan Guha, Richa Negi, Roshni Maiti, "Finite-time Frequency Control of an Islanded Microgrid System", INDISCON, 2024.

Reetam Mondal and Jayati Dey, ""Compensation of any Stable Plants with a Fractional Order PIλDμ Controller,"" IEEE 3rd International Conference on Control, Instrumentation, Energy & Communication (CIEC), Kolkata, India, 2024, pp. 13-18.

Reetam Mondal and Jayati Dey, ""Different Cascaded Modified Forms of Fractional Order Compensation for Unstable Non-Minimum Phase Systems and Plants with Transport Delay,"" IEEE 3rd International Conference on Control, Instrumentation, Energy & Communication (CIEC), Kolkata, India, 2024, pp. 7-12.

Reetam Mondal and Jayati Dey, ""On Non-Integer Order Internal Model Control of Non-Minimum Phase Systems and Plants with Transport Delay,"" IEEE 3rd International Conference on Control, Instrumentation, Energy & Communication (CIEC), Kolkata, India, 2024, pp. 37-42.

Reetam Mondal and Jayati Dey, “Fractional Order 2-DOF Control for the Non-Integer and Integer Order Plants”, IEEE 3rd International Conference on Smart Technologies for Power, Energy and Control (STPEC), 2023, pp.1-6.

Arindam Chakraborty, Reetam Mondal, Tapas Roy and Jayati Dey, “Robust De-coupled Periodic Compensation for Continuous Time Multi-Input and Multi-Output System”, IEEE 3rd International Conference on Smart Technologies for Power, Energy and Control (STPEC), 2023, pp.1-6.

Surya Narayan Santra, Mousumi Mukherjee, "Data-driven reference tracking of a flexible link rotary servo system," accepted as Experimental Abstract in the Indian Control Conference, 2024

A. Anamika, B. Dutta, R. Dey, A. Nath, T. B. Gavrila and V. E. Balas, "Adaptive Control Design for Blood Glucose Regulation of T1DM patient: An LMI framework," 2024 28th International Conference on System Theory, Control and Computing (ICSTCC), Sinaia, Romania, 2024

Aranya Bandyopadhyay, S Parui, "A Novel Internal Model Principle Based Unified Resonant-Notch Chaos Controller for DC-AC Inverter“, 7th IFAC Conference on Analysis and Control of Nonlinear Dynamics and Chaos at Imperial College, London, UK, 05-07th June, 2024

Shivanshu Kumar, HS Bhattacharyya, AB Choudhury, CK Chanda, “Thermal Analysis of Lithium-Ion Battery Pack for EVs Application,” 2024 IEEE International Conference on Smart Power Control and Renewable Energy (ICSPCRE), July 2024

Achievements

Prof. D Roy - Track Chair in Electrical Engineering of 2024 IEEE Calcutta Conference (CALCON) on December 14-15, 2024

Recent Achievements of Students

S.No.	Name of Student	Course	Organisation
1	Monojit Seal	PhD	R&D Engineer, Kirloskar Brothers Limited
2	Abhishek Kar	PhD	R&D Engineer, Tagore Technology
3	Harshit Kasera	3rd year UG	Secured 3rd place for a remote - controlled hovercraft in Robocon 2.0, IIEST Shibpur (2024)
4	Aranya Bandyopadhyay	PhD	Received Travel Grant Award from GAABESU

RPL 3.0 Cricket Tournament

Students' Corner

AI and ML in Electrical Engineering: A Technical Overview

By: DEBJYOTI SAHA(3rd year EE) - 2022EEB066

Artificial Intelligence (AI) and Machine Learning (ML) are transforming electrical engineering by enabling smarter, more efficient systems. These technologies leverage data and algorithms to solve complex problems, optimize processes, and innovate across various domains.

Applications of AI and ML in Electrical Engineering

1. Power Systems Optimization

AI and ML help optimize power generation, distribution, and consumption. Machine Learning models predict power demand, balance loads, and reduce energy losses. For instance, predictive analytics forecast future system needs, enhancing grid stability and reliability.

Technical Insight: Models like Random Forest, Support Vector Machines (SVM), and Neural Networks analyze historical data to improve system management.

2. Signal Processing

In signal processing, AI and ML enhance signal quality and extract meaningful data from noisy signals. Techniques like Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) are used for real-time signal analysis, useful in smart sensors and IoT applications.

Technical Insight: These models help detect anomalies and improve the accuracy of sensor data processing.

3. Smart Grid Technologies

Smart grids utilize AI and ML to manage dynamic electricity flows. They support fault detection, predictive maintenance, and grid optimization. These systems improve grid resilience and efficiency.

Technical Insight: AI models analyze IoT data to prevent grid failures and ensure smooth operations.

4. Control Systems and Automation

Machine Learning enhances control systems for automation, robotics, and industrial applications. These intelligent systems optimize operations, reduce downtime, and enable predictive maintenance.

Technical Insight: Reinforcement Learning (RL) and Deep Learning are used to train systems for adaptive decision-making, such as in automated power regulation.

Impact on the Next Generation of Engineers

The integration of AI and ML into electrical engineering is shaping the future of education and career paths for upcoming engineers. These technologies require a strong foundation in data analysis, programming, and domain expertise, which are becoming essential skills for aspiring electrical engineers. As AI and ML continue to evolve, engineers need to develop interdisciplinary knowledge to design, implement, and maintain advanced systems. Moreover, the demand for engineers proficient in AI and ML will increase, offering opportunities for innovation and leadership in developing smarter, more efficient electrical systems. Future engineers will play a crucial role in advancing areas such as renewable energy, sustainable grids, and automated control systems.

Challenges and Future Trends

Despite significant advancements, challenges such as data quality, computational complexity, and the need for domain-specific expertise remain. However, ongoing research addresses these issues, leading to more efficient systems. In future, AI and ML will drive innovations in renewable energy, advanced grid management, and sustainable power systems, shaping a smarter and greener electrical engineering landscape.

Conclusion

In the present scenario, as Electrical engineers, it is our foremost duty to bridge the gap between academia and industry, ensuring our developed skillset at university level matches the demanding challenges posed before us by the ever changing era of advanced electrical systems. This propels us to push ourselves to be out of our comfort zone to learn new things on our own beyond curricula so that we can prove ourselves to be worthy engineer of tomorrow.

Students' Activities

1. Harshit Kasera (3rd Year UG) has participated in :

a) CADaBot (Ongoing)
- Timeline: September 2024 – Present
- Objective: Developing a CAD-driven motion control system for humanoid robots, where real-time animations or CAD motions dictate robotic actions, eliminating the need for explicit programming.
- Significance: Innovated a CAD-integrated approach to humanoid motion control.

b) 15-Channel Pressure Scanner Device (Completed)
- Timeline: August 2024 – November 2024
- Under: Prof. Joydeep Bhowmik (IIEST Shibpur)
- Description: Developed a compact device to measure real-time differential pressure for aerodynamic analysis using MPXV7002 sensors and ADS1115 ADC modules.
- Significance: Improved real-time pressure monitoring efficiency for applications like airplane wing airflow measurement.

c) Robotic Manipulator for Patient Feeding (Completed)
- Timeline: May 2024 – July 2024
- Under: Prof. Abhilash Patel (IIT Kanpur)
- Description: Designed and implemented a self-feeding robotic arm to assist patients with limited physical abilities.
- Significance: Advanced healthcare automation for improving the quality of life for patients.

d) Kshitij, IIT Kharagpur (2024)- Presented an RC Plane project.

2. Sumit Kumar (3rd Year UG) participated in prestigious events such as:

a) Smart India Hackathon 2024 (SIH): Our team, Solution Squad, secured the rank in the internal hackathon held at IIEST Shibpur as part of the SIH selection process.
b) Expression Partition Competition: Successfully participated and gained valuable experience in this engaging event Organised by Lesthespians.

3. Keshav Bhagat (2nd Year UG) participated in expression organised by Lesthespians

4. Soham Karar (3rd Year UG) have participated in the Tata Crucible Campus Quiz 2024 organized by the Tata group

5. Aarush Roy & Rupanjan Bhattacharyya (2nd Year UG) completed an internship on Data Science organised by IDEAS-TIH, an organisation of the Indian Statistical Institute, Kolkata.

6. Aranya Bhattacharya (PhD Scholar) delivered an invited talk on "Some Analytical Perspectives on Modeling, Small-Signal Stability Analysis and Chaos Control of Power Electronic Converters", Online Workshop "AI/ML based Controllers Design and their Applications in Real-time Platform", organized by NIT Rourkela on 1st October, 2024.

Group photograph of graduating students (Batch 2024) and Faculty members of the Department

Photo Gallery

Department Visit by the Chairperson, BoG, Director, Dean (Academic)

Visit of Students to Purulia Pumped Storage Station, March 2024

Editorial Team