



MECHAZINE

**JULY 2024
EDITION**



DEPARTMENT OF
MECHANICAL ENGINEERING



**VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)**

“

*Strive for perfection in everything
you do.*

*Take the best that exist and
make it better*

When it does not exist, design it.

”

- Sir Henry Royce

GOVERNMENT INDUSTRIAL TRAINING INSTITUTE



During their semester leave holidays, second-year engineering students from Velammal College of Engineering and Technology in Madurai are seizing the opportunity to gain valuable hands-on experience by participating in a government-sponsored internship at the Government Industrial Training Institute (ITI) in Madurai. This intensive program focuses on industrial robot welding, a crucial skill in modern manufacturing. The students are immersed in various aspects of robotic welding, including programming, operation, maintenance, and adherence to safety protocols, giving them a well-rounded understanding of the technology and its applications.

Furthermore, the program emphasizes the importance of industrial automation and robotics in contemporary engineering practices. By working directly with state-of-the-art equipment, the students are not only learning about the latest technological advancements but also about the practical challenges and solutions involved in industrial welding processes. This experience is proving invaluable for students as it prepares them for future career opportunities in the rapidly evolving field of industrial automation and robotics, ensuring they are well-equipped to meet the demands of the industry.





The third-year engineering students from Velammal College of Engineering and Technology in Madurai also participated in the government-sponsored internship at the Government Industrial Training Institute (ITI) in Madurai. This program focuses on additive manufacturing and 3D printing, offering students hands-on experience with cutting-edge technologies that are revolutionizing the manufacturing industry. The third-year students delve into the principles of additive manufacturing, exploring various 3D printing techniques, material properties, and the design and prototyping processes. This training equips them with the skills needed to create complex designs and prototypes quickly and efficiently.

The course also covers advanced topics such as optimizing print settings for different materials, troubleshooting common issues, and integrating 3D printing with other manufacturing processes. By working directly with state-of-the-art equipment, the students gain practical knowledge and problem-solving skills that are invaluable for their future careers. This internship not only enhances their technical abilities but also prepares them for the rapidly evolving field of industrial automation and advanced manufacturing technologies, ensuring they are well-equipped to meet the demands of the industry.





During their semester leave holidays, fourth-year engineering students from Velammal College of Engineering and Technology in Madurai are enhancing their skills by participating in a government-sponsored internship at the Government Industrial Training Institute (ITI) in Madurai.



This intensive program focuses on industrial robot welding, providing students with hands-on experience in one of the most advanced and critical areas of modern manufacturing. The fourth-year students are engaged in comprehensive training that covers various aspects of robotic welding, including programming, operation, maintenance, and safety protocols. This real-world experience allows them to apply their theoretical knowledge to practical scenarios, significantly boosting their technical skills and industry readiness.



Moreover, the program highlights the importance of safety in industrial environments, teaching students about the necessary precautions and protocols to prevent accidents and ensure a safe working space. This holistic training approach makes the internship a crucial step in preparing the students for their future careers, equipping them with the skills and knowledge needed to excel in the rapidly evolving field of industrial automation and robotics.

Through this internship, the fourth-year students from Velammal College of Engineering and Technology are gaining a competitive edge in the job market. The exposure to advanced technologies and real-world applications is proving to be an invaluable addition to their academic learning, making them highly sought-after by employers in the engineering and manufacturing sectors.



INDUSTRIAL VISIT

20
24

Industrial Visit to IIITDM Kancheepuram, Chennai Institute Of Technology, Sri Venkateswara college of engineering, BGR NEO - Chennai, JTEKT India Limited Manager HR and Admin, Mitsubishi Factory Automation Learning Setup, Mitsubishi Electric ROBOTS, Robot (MELFA) Programming, Mitsubishi Factory Automation, Altair AI-powered Engineering conference, Advance Mechanical Services Pvt. Ltd, Andrew Additive



In an effort to stay at the forefront of technological advancements and enhance their teaching methodologies, the faculty from the Department of Mechanical Engineering at Velammal College of Engineering and Technology recently embarked on an industrial visit to the Indian Institute of Information Technology, Design and Manufacturing (IIITDM) in Kancheepuram.

The visit began with an exploration of the Additive Manufacturing Lab, where faculty members were introduced to the latest developments in 3D printing and additive manufacturing technologies. These advancements are revolutionizing the manufacturing industry by enabling the production of complex geometries and reducing material waste. The faculty observed demonstrations of various 3D printing techniques and materials, which are pivotal in the transition from traditional manufacturing to more sustainable and efficient practices.

IIITDM Kancheepuram



The journey continued to the Robotics and Automation Lab, where the faculty witnessed state-of-the-art robotics applications in action. The lab showcased a range of robotic systems designed for industrial automation, highlighting their capabilities in improving productivity and precision. This visit underscored the importance of integrating robotics into the mechanical engineering curriculum to prepare students for the rapidly evolving job market.

Further into the visit, the faculty explored the Robotics Mechanism Lab. Here, they were introduced to the intricacies of robot design and operation. The lab's focus on the kinematics and dynamics of robotic systems provided the faculty with a deeper understanding of the theoretical and practical aspects of robotics. This knowledge is essential for developing coursework that bridges the gap between classroom learning and real-world applications.

The final stop was the Design for Manufacturing Automation Lab, where the faculty learned about the latest techniques in design automation. This lab emphasized the importance of designing products with manufacturing processes in mind, ensuring efficiency and cost-effectiveness. The faculty were particularly impressed by the integration of advanced software tools that streamline the design process,





SRI VENKATESWARA COLLEGE OF ENGINEERING

In a significant step towards enhancing their academic and practical knowledge, the faculty from the Department of Mechanical Engineering at Velammal College of Engineering and Technology embarked on an enriching visit to Sri Venkateswara College of Engineering (SVCE). This visit aimed to explore the state-of-the-art facilities at SVCE, providing an invaluable opportunity for the faculty to gain insights into advanced engineering technologies and research practices.

The visit commenced with a tour of the Advanced Manufacturing Lab. This facility is equipped with cutting-edge machinery and tools that exemplify the future of manufacturing. The faculty were introduced to various advanced manufacturing processes, including computer-aided manufacturing (CAM)

and high-precision machining. Observing these technologies in action provided a clear understanding of how modern manufacturing techniques are pushing the boundaries of efficiency and precision.

Next on the itinerary was the Additive Manufacturing Lab, where the faculty witnessed the revolutionary impact of 3D printing technologies. This lab showcased a range of additive manufacturing processes, from rapid prototyping to the creation of complex, functional components. The faculty learned about the diverse materials used in additive manufacturing and the potential applications in various industries, highlighting the transformative power of this technology.



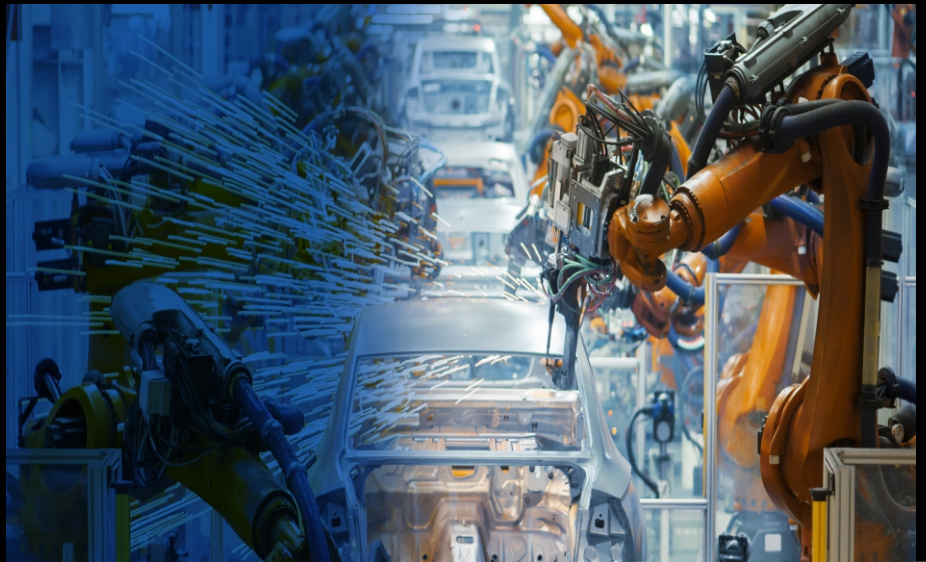
The final destination was the Welding Research Lab, a facility dedicated to advancing welding technologies and techniques. The faculty observed cutting-edge research in welding processes, materials, and quality control methods. This lab's focus on innovation in welding technology underscored its significance in various sectors, including automotive, aerospace, and construction.

The Robotics & Automation Lab was another highlight of the visit. Here, the faculty observed the integration of robotics in automation systems, emphasizing their role in enhancing productivity and precision in industrial operations. The lab demonstrated various robotic applications, from automated assembly lines to intelligent robotic systems, underscoring the importance of robotics in the future of manufacturing and engineering.

The Automation and Control Lab provided a deeper understanding of the systems that form the backbone of modern industrial operations. The faculty explored advanced control systems, sensors, and automation technologies that ensure optimal performance and efficiency in manufacturing processes. This lab visit highlighted the critical role of automation and control in maintaining the competitiveness and sustainability of manufacturing industries.

This visit to SVCE's advanced labs provided the faculty of Velammal College of Engineering and Technology with a comprehensive overview of the latest advancements in engineering technology. The insights gained from this visit will be instrumental in enriching their teaching methodologies and curricula, ensuring that students are well-equipped with the knowledge and skills required in the ever-evolving engineering landscape.

BGR NEO CHENNAI



In an effort to align academic programs with industry needs and enhance student employability, representatives from Velammal College of Engineering and Technology visited BGR NEO in Ambattur, Chennai. The visit was focused on discussing recruitment requirements, gathering feedback on alumni performance, and exploring internship and employment opportunities for current and future students.

During the visit, BGR NEO's HR team outlined the specific skillsets and attributes they look for in potential recruits. Emphasizing the importance of strong technical expertise, problem-solving capabilities, and effective communication skills, BGR NEO highlighted the need for graduates who are not only proficient in their technical domains but also adaptable and ready to tackle real-world challenges. This feedback is essential for Velammal College to fine-tune its curriculum and training programs, ensuring that students are well-

prepared to meet industry expectations.

A key part of the discussion was the performance review of RM Prabhakar, a 2023 alumnus of Velammal College. BGR NEO praised Prabhakar's technical skills, dedication, and ability to contribute effectively to their projects. This positive feedback underscores the quality of education at Velammal College and highlights the successful transition of their graduates into the professional world. Such feedback is invaluable for the college to understand the strengths and areas for improvement in their training programs.



BGR NEO expressed a strong interest in offering paid internships to final year students from Velammal College. These internships are designed not only to provide hands-on experience but also to serve as a potential pathway to full-time employment. This initiative will allow students to apply their theoretical knowledge in practical settings, gain industry insights, and develop professional skills that are crucial for their career advancement. The placement scope associated with these internships further adds to their attractiveness and value for the students.

BGR NEO also discussed opportunities for Graduate Engineer Trainee (GET) positions for the 2024 batch. They specifically mentioned the need for graduates with strong CAD and design knowledge. This requirement emphasizes the importance of proficiency in computer-aided design software,

which is fundamental for various engineering roles. Velammal College can leverage this information to emphasize CAD and design training in their curriculum, ensuring that their graduates are well-equipped to meet these technical demands.

The visit to BGR NEO has provided Velammal College of Engineering and Technology with valuable insights into the current and future needs of the engineering industry. By understanding these requirements and integrating them into their educational programs, the college can better prepare its students for successful careers. The positive feedback on alumni performance and the establishment of internship and GET opportunities underscore the importance of maintaining strong industry connections.

A photograph of a modern, multi-story office building with a white facade and blue accents. The building has large windows and a prominent 'JTEKT' logo on the top left. A flag is visible on a pole in front of the building. The image is partially obscured by a large, dark blue triangular graphic on the left and a yellow triangular graphic on the right.

JTEKT

FUJIKKO

JTEKT India Limited

In a significant step to provide practical exposure and industry-relevant experience to its students, Velammal College of Engineering and Technology's faculty and placement coordinators recently visited JTEKT India Limited. This visit focused on exploring opportunities for internships and final year projects, providing a comprehensive understanding of how students can gain hands-on experience in a leading industry setting.

JTEKT India Limited expressed a strong interest in collaborating with Velammal College to offer internships and final year project opportunities to their students. These programs are designed to give students practical experience in a real-world industrial environment, allowing them to apply their academic knowledge to practical problems and projects. Such experiences are invaluable in helping students develop the skills and insights needed to succeed in their future careers.



It was noted during the visit that JTEKT India Limited currently does not offer Graduate Engineer Trainee (GET) or trainee positions for BE graduates. While this might be a consideration for some students, the availability of internships and project opportunities still provides substantial value. These programs can serve as a stepping stone, offering practical experience that is highly regarded in the industry and can significantly improve employability.

The visit to JTEKT India Limited has opened up valuable opportunities for Velammal College of Engineering and Technology students. By facilitating internships and final year projects, the collaboration allows students to gain crucial industry experience, develop professional skills, and enhance their readiness for the job market. Despite the absence of GET or trainee positions, the hands-on experience provided through these programs is a significant advantage for students aiming to build successful engineering careers.



MITSUBISHI ELECTRIC ROBOTS

In a bid to bridge the gap between academic knowledge and industrial applications, the faculty from the Department of Mechanical Engineering at Velammal College of Engineering and Technology embarked on an enlightening industrial visit to Mitsubishi Electric's robotics division. This visit provided the faculty with in-depth exposure to the basics of robot programming, simulation, and hands-on experience with industry-standard robots using RT Toolbox 3.

The visit commenced with an introduction to Mitsubishi Electric ROBOTS, where the faculty learned about the core components and functionalities of these advanced robotic systems. The session covered the robot's anatomy, including the base, arm, end-effector, control system, and sensors. Understanding these basics is essential for comprehending how these robots are designed to perform complex tasks with high precision and reliability.

Mitsubishi Electric ROBOTS are renowned for their:

- *High Precision

- *Flexibility
- *Efficiency
- *Durability
- *Ease of Integration

A significant portion of the visit was dedicated to robot programming and simulation. The faculty were introduced to the fundamental principles of robot programming, which involve defining tasks and writing code to control the robot's movements and actions. They explored various programming languages and tools used in Mitsubishi robots, gaining insights into how to create and optimize robot programs for different applications.

One of the highlights of the visit was the hands-on training session using RT Toolbox 3, Mitsubishi Electric's advanced robot programming software. This session provided the faculty with practical experience in:

- *Creating Projects
- *Programming
- *Simulation
- *Backup and Recovery
- *Troubleshooting



these advanced technologies into their curriculum. This knowledge will enable them to prepare students for the demands of the modern engineering industry, ensuring they have the skills and expertise required to excel in their careers.

The visit also included demonstrations of various real-world applications of Mitsubishi Electric ROBOTS. The faculty observed how these robots are utilized in industries such as manufacturing, logistics, healthcare, and automotive. These demonstrations provided valuable insights into the versatility and efficiency of Mitsubishi robots in performing tasks such as assembly, welding, material handling, and quality inspection.

The industrial visit to Mitsubishi Electric's robotics division was a significant learning experience for the faculty of Velammal College of Engineering and Technology. By gaining a comprehensive understanding of robot basics, programming, simulation, and hands-on operations, the faculty are now better equipped to incorporate





MITSUBISHI FACTORY AUTOMATION

In a continued effort to enhance practical learning and stay abreast of industry advancements, faculty members from the Department of Mechanical Engineering at Velammal College of Engineering and Technology recently visited Mitsubishi's Factory Automation Learning Setup. This visit focused on gaining expertise in various key components of factory automation, including iQR PLC Training, HMI - GOT2000, Inverter – A800, and Servo Systems.

The visit started with an in-depth session on iQR PLC (Programmable Logic Controller) training. Mitsubishi's iQR PLC is known for its high performance, flexibility, and ease of integration into various automation systems. The training covered:

- *Basic Concepts: Understanding the architecture and functionalities of PLCs.
- *Programming: Learning to write and troubleshoot ladder logic programs.
- *Integration: How to integrate PLCs with other automation components.
- *Advanced Features: Exploring the advanced capabilities of the iQR series, including high-speed processing and enhanced security features.

Next, the faculty were introduced to the GOT2000 series of HMIs (Human-Machine Interfaces). The session provided hands-on experience with:

- *Interface Design: Creating intuitive and user-friendly interfaces for operators.
- *Functionality: Utilizing the advanced features of GOT2000, such as multi-touch screens and gesture operations.
- *Connectivity: Integrating HMIs with PLCs and other automation systems to streamline operations.
- *Diagnostics: Using HMI tools for monitoring and diagnosing system performance and issues.



The training on the A800 series inverter was particularly insightful for understanding motor control and energy efficiency. Key topics included:

- *Basic Operation: Understanding how inverters control the speed and torque of electric motors.
- *Programming: Learning to program the A800 inverter for various industrial applications.
- *Energy Efficiency: Strategies to enhance energy savings and optimize motor performance.
- *Advanced Features: Exploring the advanced control functions and network compatibility of the A800 series.

The final segment of the visit focused on Mitsubishi's Servo Systems, which are crucial for precision control in automation. The faculty gained knowledge in:

- *Servo Basics: Understanding the components and operation of servo motors and drives.
- *Configuration and Tuning: Learning to configure and fine-tune servo systems for optimal performance.
- *Applications: Exploring various industrial applications of servo systems, such as robotics, CNC machines, and automated manufacturing lines.
- *Integration: How to integrate servo systems with PLCs and HMIs for cohesive automation solutions.

The industrial visit to Mitsubishi's Factory Automation Learning Setup provided the faculty with hands-on experience and a deeper understanding of advanced automation technologies. By mastering the iQR PLC, GOT2000 HMI, A800 Inverter, and Servo Systems, the faculty are now better equipped to impart this knowledge to their students. This ensures that students are not only theoretically proficient but also practically skilled in the latest automation technologies.

ALTAIR AI - POWERED ENGINEERING



In an effort to stay at the forefront of technological advancements and integrate cutting-edge tools into their curriculum, faculty members from Velammal College of Engineering and Technology recently attended the Altair AI-Powered Engineering Conference. The conference provided valuable insights into the latest developments in computer-aided engineering (CAE), artificial intelligence (AI) tools, data analytics platforms, and digital twinning, showcasing their applications in industrial settings.

The conference highlighted significant advancements in CAE, particularly the integration of AI tools like physicsAI. These tools are transforming the way engineers conduct testing and simulations by:

- ***Enhanced Accuracy:** AI algorithms improve the precision of simulations, reducing the margin of error.
- ***Efficiency:** AI-driven simulations significantly cut down the time required for testing, enabling faster project turnarounds.
- ***Cost-Effectiveness:** Reduced need for physical prototypes leads to cost savings in the development process.

One of the key sessions at the conference focused on the application of RapidMiner, a powerful data analytics and AI platform, in industrial settings. The faculty learned how RapidMiner is used for:

- ***Predictive Maintenance:** Analyzing data from machinery to predict failures and schedule maintenance, thereby reducing downtime.
- ***Quality Control:** Utilizing AI to monitor and enhance product quality throughout the manufacturing process.
- ***Process Optimization:** Leveraging data analytics to streamline operations and improve efficiency.

Dr. Karthik Ramanathan, Engineering Director at Applied Materials in Bengaluru, delivered an enlightening session on the significance of digital twinning. He discussed how digital twins are revolutionizing the semiconductor industry through:

***Real-Time Monitoring:**

Digital twins provide real-time data and insights, allowing for immediate adjustments and improvements.

***Testing and Simulation:**

Virtual models of physical assets enable extensive testing and simulation without interrupting actual operations.

***Predictive Analytics:** By analyzing data from digital twins, companies can predict future performance and identify potential issues before they arise.

Dr. Ramanathan presented several test cases from the semiconductor industry, illustrating the practical applications and benefits of digital twinning. These case studies showcased:

***Increased Efficiency:**

Enhanced monitoring and predictive capabilities leading to more efficient manufacturing processes.

***Reduced Downtime:** Early detection of potential issues and proactive maintenance, minimizing downtime.

***Improved Quality:**

Continuous monitoring and adjustments ensure higher quality products and reduced defect rates.

The insights gained from the Altair AI-Powered Engineering Conference are invaluable for Velammal College of Engineering and Technology. By understanding and integrating these advanced technologies into their curriculum, the faculty can better prepare students for the evolving demands of the engineering industry.



ADVANCE MECHANICAL SERVICES PVT. Ltd.

In a proactive initiative to bolster student employability and industry readiness, Velammal College of Engineering and Technology has engaged in fruitful discussions with Advance Mechanical Services Pvt. Ltd. The focus of these discussions centered around placement opportunities for students with robotic welding skills, enhancing the CFAWR curriculum, and establishing a collaborative framework for industry-supported training and credit courses.

Advance Mechanical Services Pvt. Ltd. highlighted the critical demand for skilled professionals in robotic welding, specifically targeting students trained under the Certified First Assistant in Welding and Robotics (CFAWR) program. This collaboration is set to open numerous placement opportunities for students, ensuring they are well-prepared for the demands of modern manufacturing environments where robotic welding plays a pivotal role.

Recognizing the need for a holistic and future-ready curriculum, discussions included a proposal to augment the CFAWR program with advanced modules such as integrating IIOT concepts to enable seamless connectivity and smart manufacturing processes, utilizing AI and ML to enhance welding process optimization, quality control, and predictive maintenance, introducing students to the latest additive manufacturing techniques to expand their competencies and adaptability in advanced manufacturing scenarios.

ANDREW ADDITIVE



In a significant move to advance educational opportunities and industry engagement, Velammal College of Engineering and Technology has entered into a promising collaboration with Andrew Additive. This partnership focuses on offering industry-supported training and credit courses, as well as establishing an Additive Manufacturing Center of Excellence (COE) on campus.

Andrew Additive has expressed its commitment to collaborate with Velammal College in offering specialized training and credit courses. These programs are designed to provide students with:

***Hands-On Experience:** Practical training in additive manufacturing techniques and technologies, ensuring students are industry-ready upon graduation.

***Industry Insights:** Direct exposure to the latest industry trends and practices, facilitated by experts from Andrew Additive.

***Academic Credits:** Structured courses that contribute to the students' academic achievements while enhancing their practical skills.



In a groundbreaking development, Andrew Additive has shown interest in establishing an Additive Manufacturing Center of Excellence (COE) on the Velammal College campus. Notably, this initiative will be set up at no cost to the institution. Key features of the COE include:

***State-of-the-Art Facilities:** The COE will be equipped with the latest additive manufacturing technologies, providing students and faculty access to cutting-edge equipment and tools.

***On-Campus Presence:** Andrew Additive will have a permanent presence on campus, fostering close interaction and collaboration between industry professionals and the academic community.

***Research and Development:** The COE will serve as a hub for innovation, allowing students and faculty to engage in research and development projects in collaboration with Andrew Additive.

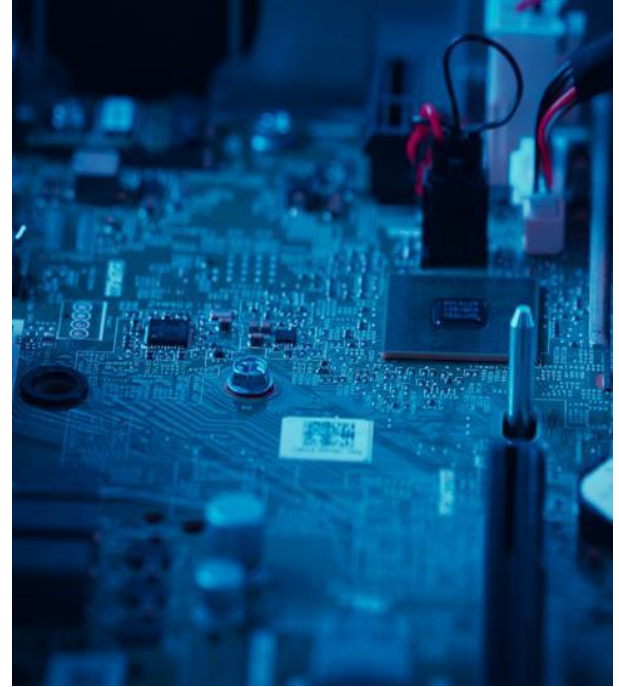
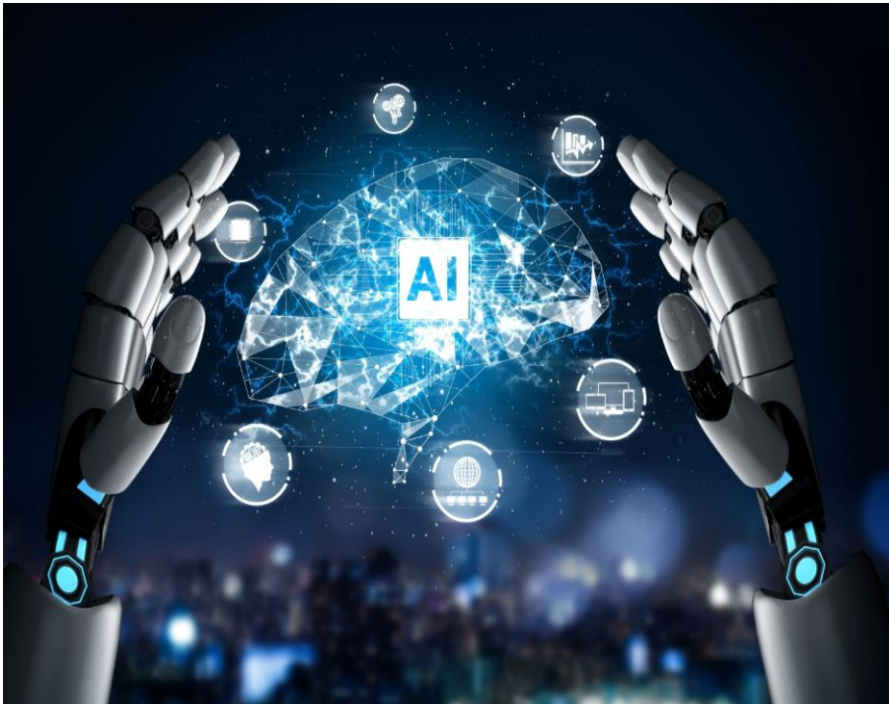
The partnership between Velammal College and Andrew Additive is poised to deliver numerous benefits, including:

***Enhanced Learning Opportunities:** Students will gain invaluable hands-on experience and practical knowledge, making them more competitive in the job market.

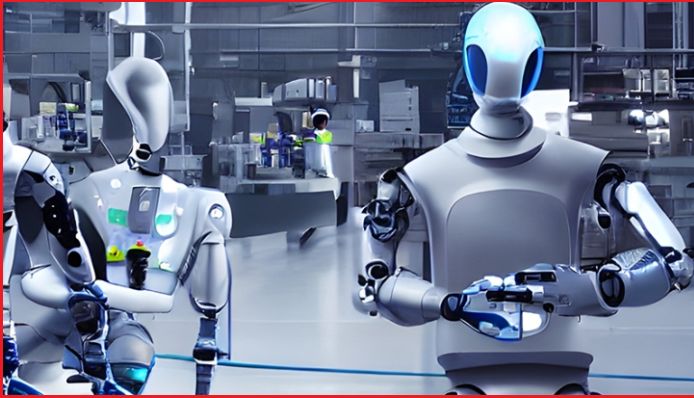
***Industry-Academia Synergy:** The close collaboration between Andrew Additive and the college will bridge the gap between academic theory and industrial practice, driving innovation and excellence.

***Research Advancements:** The COE will provide a platform for pioneering research in additive manufacturing, contributing to advancements in the field and offering students unique opportunities to participate in cutting-edge projects.

Newsletter



AI IN ENGINEERING



AI in engineering – existential threat,
or huge opportunity?

By this point, nearly everyone is familiar with the AI tools that started trickling out late last year (2022), and seem to gain new capabilities each week. ChatGPT, which launched on 30 November, is the best known.

“I don't even think the most hardened tech journalists were quite expecting something as profoundly different as ChatGPT,” says King. “It really is like stepping five or 10 years into the future almost overnight, and its capability – without being too hyperbolic – will drive an absolute explosion in terms of what we're going to see.”

Applications of such chatbots, based on large language models (LLM), can seem practically unlimited. From the relatively mundane – writing shopping lists and travel itineraries – to the more radical – formulating entire business plans and executing them, writing scripts in the style of specific authors, even instructing other AIs on complex tasks – ChatGPT and equivalents such as Microsoft's Bing and Google's Bard are revolutionising the production of text, and other types of content.

Chatbots can produce software code, for example, while text-to-image and text-to-video programs are capable of producing photorealistic images of imagined situations. ‘Balenciaga Pope’, published online last month, showed how unprepared society is for the approaching tsunami of AI-generated social media content.

In short, we seem to be standing on a precipice. Before us lies a very different future to the one that might have been forecast less than a year ago, and countless ways of life and industries will be forced to adapt. From data entry to creative artistic expression, it seems that most activities will be threatened, streamlined, or otherwise changed in one way or another.

3 key messages from Advanced Manufacturing 2024

Manufacturing has a significant carbon footprint, and this is not compatible with our net zero aspirations,” said Dr Becky Bolton, knowledge transfer manager at Innovate UK Business Connect. “We also need to keep up with the technological advancements that are ever-prevalent in a digital world – but it's not always easy for traditional manufacturers to adopt a new technology.”



AI could play a significant role in decarbonising manufacturing, claimed Şahin Çağlayan, co-founder and CEO of Faradai. “We need a dynamic, continuous decarbonisation intelligence,” he said. “Large language models, generative AI are popular in a lot of different verticals, but still in manufacturing, there are gaps and there are trust issues.”

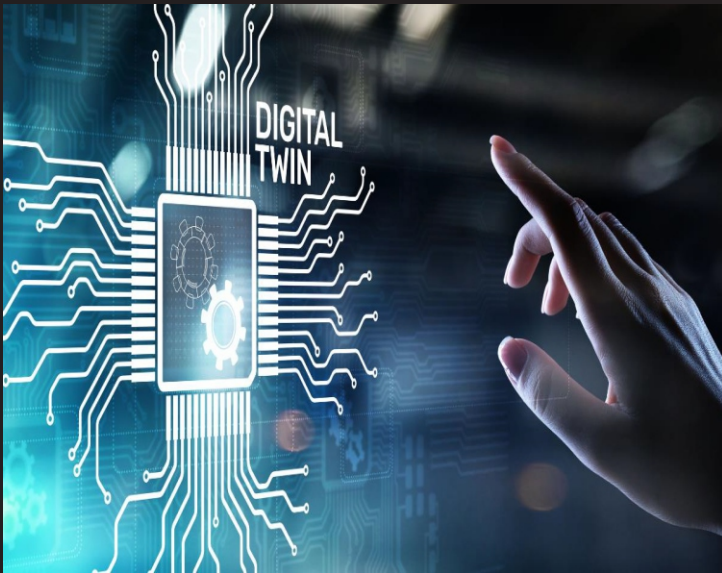
There is a “missing link between carbon, energy, ESG (environmental, social and governance) and finance, data, operation, so it needs to be aligned all together and with a wider, comprehensive approach.”

Faradai aims to solve those challenges with its integrated intelligence platform, which it claims can cut carbon footprints by 20%. Approaches include “multi-

objective optimisation”, which looks at the inputs and outputs of an entire production line to produce ‘heat maps’ of energy use and consumption of other resources. Results from the platform can then point out potential optimisations or changes to reduce consumption.

Extensive use of AI can result in increased emissions, however, so any deployment will need to be carefully considered to ensure it does not undermine its own purpose.

SEMICONDUCTOR EQUIPMENT AND PROCESSES NEEDS DIGITAL TWINS



Since they were first described in 2002[1], there has been remarkable interest in developing and deploying digital twins to enable and accelerate smart manufacturing across many industries.

While we have seen growing excitement in the technology within the semiconductor equipment industry, we are still in the very early innings of creating and capturing value from digital twins.

Applied Materials plays an enabling role in driving the advances in computing power needed to accurately model and simulate the physical world. Today, we are taking advantage of this same technology to help address the growing complexity of chip process technology, which is driving up R&D costs and increasing the time it takes to bring new technologies to high-volume production.

We must use every tool in our toolbox to help manage this increasing cost and complexity. Digital twins give us opportunities to advance the roadmap in novel ways, accelerating concept creation, process exploration, prototyping, testing, knowledge sharing and talent development. Recent trends in the integration of sensors and metrology, along with advances in modeling and algorithms including artificial intelligence, bring us to the point where we can overcome the cost and complexity challenges.

As previewed in our 2021 blog, "Taking a Second Look at 'AI'," a digital strategy has many applications across the process node lifecycle, from R&D to process transfer, ramp and high-volume manufacturing. Examples include system and chamber matching, performance and productivity improvement, diagnostics, predictive maintenance and accelerating "green to green" times between tool maintenance and recovery.

At Applied, our vision is a holistic digital twin architecture representing the entire semiconductor process flow. We are developing digital twins of materials, process equipment, metrology, on-chip structures and electrical performance. In addition, with the growing focus on sustainable semiconductor industry growth, our digital twin strategy includes modeling the carbon emissions of alternative semiconductor materials, recipes and manufacturing techniques.

MECHAZINE EDITORS

STUDENT EDITORS

*** Sameer Ahamed -
II year/MECH, VCET**

***Ansari Naina Mohamed Sait - II
year/MECH, VCET**

FACULTY ADVISORS

***Dr. M. Vivek Prabu - AP/MECH, VCET**

***Dr. B. Varun Kumar - AP/MECH, VCET**

MECHANICAL DEPARTMENT, VCET