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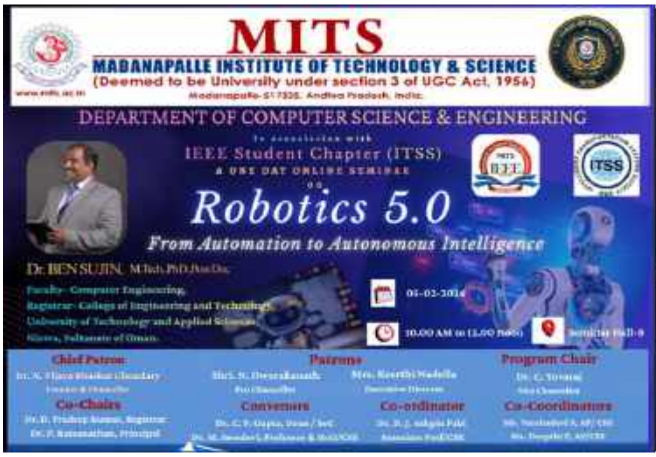
A Report on Seminar on
"Robotics 5.0- From Automation to Autonomous Intelligence"
Organized by Department of Computer Science & Engineering
in Association with IEEE Student Chapter (ITSS)
Date: 05.02.2026



Report Submitted by: Dr. D. J. Ashpin Pabi, Associate Professor, Department of Computer Science & Engineering.
Time: 10.00 AM to 12.00 Noon
Venue: Seminar Hall B
Participants: 104 Students from II CSE
Mode of Conduct: Offline
Report received on 24.02.2026.

The programme was started at 10:00 AM with a welcome address to all the audience by Dr. G. Arun Kumar, Associate Professor, CSE, MITS, Deemed to be University, Madanapalle. The resource person Dr. Ben Sujin, Faculty-Computer Engineering, University of Technology and Applied Sciences, Nizwa, Sultanate of Oman was introduced by Dr. D. J. Ashpin Pabi, Associate Professor, Department of Computer Science & Engineering, MITS, Deemed to be University, Madanapalle.

The resource person started the session by extending his hearty thanks to Our HoD, organizers, participants and Management of MITS, Deemed to be University, Madanapalle for giving the opportunity to share his knowledge and experience in – Robotics 5.0 (from Automation to Autonomous Intelligence). The session covered the following points.
Robotics 5.0 represents the next evolutionary stage in intelligent robotic systems, marking a shift from conventional automation toward fully autonomous, human-centric, and cognitively capable machines. Unlike earlier generations of robots that were primarily designed to execute repetitive and pre-programmed tasks, Robotics 5.0 integrates advanced artificial intelligence, high-speed data processing, connected ecosystems, and adaptive learning mechanisms. This transformation enables robots to perceive their environment, analyze complex data, make informed decisions, and act autonomously in dynamic and uncertain conditions. The concept aligns closely with the principles of Industry 5.0, where technological advancement is combined with human creativity, sustainability, and ethical responsibility.

The development of Robotics 5.0 can be understood through the progression of industrial revolutions. Industry 1.0 introduced mechanization powered by steam engines, which transformed manual labor into machine-assisted production. Industry 2.0 brought electrification and enabled mass production through assembly lines. Industry 3.0 introduced electronics and programmable automation, leading to the widespread adoption of computers and control systems in manufacturing.

Industry 4.0 integrated cyber-physical systems, smart devices, and digital connectivity driven by technologies such as Artificial Intelligence and the Internet of Things, enabling intelligent data-driven operations. Industry 5.0 further expands this vision by emphasizing collaboration between humans and intelligent machines, focusing on customization, resilience, and sustainable production. Robotics 5.0 serves as the technological embodiment of this human-centered industrial transformation.

At the core of Robotics 5.0 lies machine intelligence, which evolves across different levels such as Artificial Narrow Intelligence, Artificial General Intelligence, and Artificial Super Intelligence. Present-day robotic systems primarily operate at the level of task-specific intelligence, but advancements in deep learning, reinforcement learning, and neural architectures are gradually enhancing their reasoning and adaptive capabilities. Modern robots are increasingly capable of learning from environmental data, recognizing patterns, predicting outcomes, and optimizing actions in real time. This transition from rule-based automation to learning-based autonomy defines the essence of Robotics 5.0.

The enabling technologies behind Robotics 5.0 include artificial intelligence, IoT connectivity, quantum-inspired computation, and edge computing platforms. Artificial intelligence provides perception through computer vision, speech processing, and predictive analytics, enabling robots to interpret complex environments. IoT connectivity creates intelligent ecosystems in which robots communicate, share data, and coordinate actions within distributed networks. Emerging computational technologies enhance processing speed and optimization capabilities, supporting real-time decision-making. Edge computing platforms such as Raspberry Pi and Jetson allow deployment of AI models directly on robotic devices, reducing latency and improving autonomy without constant reliance on cloud systems.

Robotics 5.0 systems operate through a fundamental functional framework described as Sense, Think, and Act. In the sensing stage, robots gather environmental information using diverse sensors such as infrared sensors, ultrasonic sensors, gas sensors, light sensors, accelerometers, gyroscopes, magnetic sensors, and pressure sensors. These sensing mechanisms enable spatial awareness, obstacle detection, environmental monitoring, and motion tracking. In the thinking stage, sensor data is processed through machine learning algorithms and decision-making models that analyze patterns and determine optimal responses. In the action stage, actuators convert electrical control signals into mechanical movement. Linear actuators, rotational mechanisms, and advanced drive systems enable robots to interact physically with their environment. The integration of these three stages forms a closed-loop intelligent control system capable of adaptive and autonomous operation.

The architecture of Robotics 5.0 systems typically follows a layered structure consisting of the user interaction layer, cognitive layer, perception layer, decision layer, control layer, and hardware layer. The user interaction layer facilitates communication between humans and robots. The cognitive layer functions as the AI brain, responsible for reasoning and learning. The perception layer processes sensor inputs, while the decision layer generates action strategies. The control layer translates decisions into motor commands, and the hardware layer executes physical operations. This modular architecture ensures scalability, flexibility, and seamless integration of intelligent algorithms with mechanical components.

Robotics 5.0 applications span multiple domains including space exploration, disaster management, drone systems, exoskeleton assistance, humanoid interaction, medical surgery, industrial automation, and underwater research. In each domain, robots demonstrate increasing levels of autonomy, adaptability, and precision. Industrial robots enhance smart manufacturing environments, medical robots improve surgical accuracy, disaster robots operate in hazardous conditions, and humanoid robots facilitate human-robot collaboration. The integration of intelligence across these sectors highlights the transformative impact of Robotics 5.0.

Current research in Robotics 5.0 focuses on human-robot collaboration, explainable AI, sustainable robotic systems, swarm intelligence, neuromorphic computing, and ethical AI governance. The objective is not merely to build smarter machines, but to develop responsible and transparent systems that align with human values and societal needs. Robotics 5.0 ultimately represents a paradigm shift from automation-driven productivity to intelligence-driven collaboration, where humans and machines coexist and cooperate to achieve enhanced innovation, efficiency, and sustainability.The lecture was concluded with a note on the various applications of Robotics 5.0 including space robotics, disaster robotics, drone robotics, exoskeleton robotics, humanoid robotics, medical robotics, industrial robotics, and underwater robotics. It emphasized how Robotics 5.0 integrates sensing, intelligent decision-making, and advanced actuation to enable autonomous and human-centric robotic systems across these domains, marking the transition from automation to autonomous intelligence.

During the interactive session, several students raised thoughtful questions related to cybersecurity in robotics, focusing on data protection, secure communication, and safeguarding autonomous systems from potential cyber threats, indicating strong engagement and critical thinking among participants.
The session was concluded at 12:00 PM followed by vote of thanks, given by the coordinator of the event Dr. D. J. Ashpin Pabi, Associate Professor, Department of CSE, MITS, Deemed to be University, Madanapalle. She extended her thanks to the Management, Principal, HoD, the faculty members and the student participants.

Outcome of the event:

- The participants gained a comprehensive understanding of Robotics 5.0 and its transition from automation to autonomous intelligence.
- Attendees developed clarity on the Sense–Think–Act model, system architecture, sensors, controllers, and actuators used in intelligent robotic systems.
- Participants explored various application domains such as space robotics, disaster robotics, drone robotics, humanoid robotics, medical robotics, industrial robotics, exoskeleton robotics, and underwater robotics.
- The session encouraged awareness of interdisciplinary integration, particularly the role of Artificial Intelligence and connected systems in Robotics 5.0.