A Note from "Head of Mechanical and Aerospace Engineering"

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As we have been entering into the age of intelligent machines in the field of teaching, sports, defence, entertainment, healthcare, space technologies, socializing with newborn and the elderly, the research and development have been ongoing in the development of robust artificial intelligent algorithms based on cognitive process utilizing different sensory organs found in nature [1] and robotics systems of different types and sizes [2]. The future lies in the development of error free communication systems among such automated systems. Recent articles by Billard et al. [3] cites this roadblock in the selection of appropriate AI models developed based on datasets rather than the physical human model. To develop robots of the future generation, more emphasis needs to be given on the human centric collaborative and lifelong learning mechanisms of the robots for safe and sustainable integration of robots with humans. To accelerate the research in this area, automation and intelligent systems/algorithms have been developed in various research verticals such as robotics, mobility, experimental mechanics, smart manufacturing, aerospace and space technologies, theoretical and applied mechanics, computational mechanics, and biomechanical systems. To name a few intelligent technologies, an automated metal 3D printing system, automatic moment of inertia measurement system, stiffened flexible arm manipulator, piezo actuated complaint micropump, system for incremental sheet forming and hybrid fabrication were developed.

To produce the trained manpower for the futuristic intelligent systems, the Department of Mechanical and Aerospace Engineering took the lead to start minor programs in "Robotics" for undergraduate students in 2024 and subsequently starting a postgraduate MTech program in "Robotics and Intelligent Systems (RIS)" in 2025 [4]. The foundation of the RIS program is based on multi domain robots comprising the Soft, Marine, Aerial, Recreational and Transport (SMART) systems.

The important courses such as probability and optimization, machine learning and its applications, control systems designs, robotics kinematics and dynamics supported specialized labs such as sensors and actuators, robotics vision, robotics and automation, advanced robotics lab. Furthermore, specialized elective courses like soft robotics, underactuated robots, marine robotics, autonomous robotics systems, vehicle dynamics.

The current research focus comprises the development of humanoid robotic systems for adaptive locomotion and interaction, engineering and design of aerial-aquatic multirole drones with tiltable thrusters for cross-medium mobility, development of unmanned surface vehicles (USVs) for water quality monitoring and sludge mapping, design of a remotely operated vehicle (ROV) for underwater close-range inspection, creation of GNSS-denied indoor drones for inspection in complex industrial environments, fabrication of a soft, pneumatically actuated autonomous underwater vehicle (AUV) for aquaculture, design and development of AUV for tunnel inspection, TO-SoFiT: topology optimization of soft fish tail design, TO-SoCrawl: topology optimization of soft crawling insect, TO-BiSoGrab: topology optimization of bidirectional soft grippers, design of flexible devices for medical device applications, design of soft grippers and tires for space applications, and human centric control strategy for driver. Apart from these areas, there is immense potential for interdisciplinary research across the disciplines such as artificial intelligence, computer science, electrical engineering, biotechnology, industrial engineering. I am sure the reader will benefit from the contents of the current issues to explore further the interesting field of robotics and automation.

[1] Amos Matsiko, taking inspiration from nature is a no-brainer.Sci. Robot.8,eadi 2720(2023). DOI:10.1126/scirobotics.adi2720

[2] https://www.nature.com/immersive/robotics-ai/index.html#group-section-Features-jS2s0IQWaq

[3] Billard, A., Albu-Schaeffer, A., Beetz, M. et al. A roadmap for AI in robotics. Nat Mach Intell 7, 818–824 (2025). https://doi.org/10.1038/s42256-025-01050-6

[4] https://mae.iith.ac.in/files/2025/MTechRIS-Flyerv3.pdf

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