SMC Society Distinguished Lecturer Programme

DLP Talk and Visit by Professor Saeid Nahavandi

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On June 28, 2023, Professor Saeid Nahavandi delivered an exceptional talk under the IEEE SMC Distinguished Lecture Programme on "Emerging Haptically-Enabled Systems for Immersive Simulation-Based Training: Design, Development, and Deployment." Hosted by the IEEE Systems, Man, and Cybernetics Singapore Chapter at the Singapore University of Technology and Design, the seminar drew an audience of 50 researchers, students as well as representatives from companies such as Matlab and Tektronic. Professor Nahavandi, the Associate Deputy Vice-Chancellor Research and Chief of Defence Innovation at Swinburne University of Technology, presented his insights on the integration of haptic technology into virtual and mixed reality (VR/MR) systems to enhance the immersion and efficacy of simulation-based training (SBT) tools across multiple sectors.

Simulation-based training (SBT) has emerged as a cost-effective and safe approach to delivering realistic training experiences in a virtual environment. However, the efficacy of skill learning depends heavily on the level of immersion provided by these training tools. Professor Nahavandi emphasized that while emerging technologies like VR/MR and artificial intelligence (AI) have significantly improved the visual and auditory aspects of SBT, they often fall short in providing realistic tactile sensations during interactions with virtual objects.

To address the limitations of current VR/MR systems, Professor Nahavandi highlighted the integration of haptic (force feedback) technology. By enabling users to "touch-and-feel" virtual and remote objects, haptically-enabled VR/MR systems offer a truly immersive environment for skill acquisition. These systems allow trainees to perceive object properties such as texture, hardness/softness, and other attributes crucial for performing dexterous tasks in SBT.

During the seminar, Professor Nahavandi presented a series of haptically-enabled systems developed by his team. These systems included haptically enabled motion simulators, firefighting trainers, and tele-healthcare robotic systems, all designed to provide high-fidelity training experiences. For example, the developed robotic-based platform integrated haptic chairs and control devices to offer realistic flying/driving experiences, complete with air turbulence or rough terrain, thus ensuring an immersive training environment. Similarly, haptically-enabled hot-fire trainers provided trainees with realistic jet reaction forces and immersive interactions with fire and smoke particles, based on accurate physics modelling through VR/MR tools. Another exemplified application was a haptically-enabled ultrasound scanning system for tele-healthcare purposes, enabling accurate remote diagnosis by allowing sonographers to "touch-and-feel" the anatomical structure of a patient.

Professor Nahavandi highlighted the successful deployment of several haptically-enabled systems developed by his team in real-world environments through start-up companies. The impact of these systems was showcased across sectors such as aviation, automotive, healthcare, and emergency services. This deployment demonstrated the potential of haptically-enabled systems to revolutionize training by providing personalized, immersive, and highly effective skill acquisition experiences.

In addition to presenting his team's developments, Professor Nahavandi shared his candid evaluation of commercially available haptic devices. This evaluation offered valuable insights into the current state of haptic technology and its potential for further advancements and R&D applications.

Overall, the seminar stimulated thought-provoking discussions and demonstrated the immense potential of haptically-enabled systems for the next generation of simulation-based training. With continued advancements in haptic technology, we can expect to witness even more immersive and effective training experiences that enhance skill acquisition and improve overall training outcomes across various industries.