Embodied Robotics for Construction

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Abstract: Robot teleoperation, i.e., human operators manipulating and/or commanding a remote robotic system at a distance, is particularly suited to converge the advantages of robotic systems and human agents in construction tasks. However, existing human-robot interaction (HRI) designs for teleoperation tasks are challenged by the complexity and variability of operational needs such as the evolving work environment, unpredictable workflows, and precision requirements in dexterous tasks. The gap between the robotic perception and human sensory processes makes it challenging for human operators to acquire embodied cognition, such as estimating the force needed for an action in construction workplaces. This presentation introduces an innovative embodied robot teleoperation interaction approach called human-robot sensory transfer for the next-gen construction operations. Based on virtual telepresence and sensory augmentation, human-robot sensory transfer can convert robot sensor data into human-perceivable sensations. It includes simulating sensor data that can be considered novel and alien to humans, such as hydrodynamic, thermal, radiative and pressure changes as haptic and visual feedback. This presentation will cover several on-going projects to explain how the proposed approach can help lower mental and motor barriers in complex teleoperation tasks. Additionally, the latest developments in ChatGPT-driven robotic controls will also be discussed.

Bio: *Dr. Eric Jing Du is a professor in the Department of Civil Engineering, the Dept. of Mechanical and Aerospace Engineering (affiliate), and the Dept. of Industrial and System Engineering (affiliate) in the Herbert Wertheim College of Engineering, University of Florida. Before joining UF in 2019, he was a faculty member at Texas A&M, and a senior production analyst at Zachry Industrial. His primary area of research is human-robot collaboration for the next-gen construction industry. His ongoing projects involve the use of Mixed Reality and haptic stimulation to enhance physical embodiment in construction robot teleoperation. With colleagues, Du has secured more than $12M in funding from NSF, NASA, NIST, and Airforce Office of Scientific Research, with more than $5M directly attributed to him. Dr. Du has published more than 130 referred journal and conference papers, including several best paper awards from high impact journals. Du is the elected Vice Chair of the ASCE Visualization, Information Modeling and Simulation committee, and serves on the editorial board of three journals. Du received his PhD in construction engineering from Michigan State ('12), MS in Enterprise Management ('07) and bachelor degree in Civil Engineering ('04), both from Tianjin University.*