**Title: How VR-based simulation could revolutionize next generation surgical training**

The traditional apprenticeship methods of hands-on surgical training are adapting to the increasing complexity of surgical procedures and advances in surgical technology. A steep learning curve exists for operations in surgical specialties such as Otolaryngology (Ear, Nose and Throat) and there is a critical need to enhance the training of surgery while minimizing risks to patients.

This need has sparked collaborative innovation in academic medical centers such as the University of Arizona (UA). Saurabh Jain, a doctoral student, Seunghan Lee, a former doctoral student and currently teaching professor at University at Buffalo, and Dr. Young-Jun Son, PhD, department head of Systems and Industrial Engineering at the UA have extensive experience with simulation and applications of Virtual Reality (VR) technology. They were approached by Dr. Samuel Barber, MD, an otolaryngology resident with a research background in VR and Augmented Reality (AR), and Dr. Eugene Chang, MD, an otolaryngologist with a special focus on sinus surgery. Together, the team created a novel VR-based simulator to teach fundamentals of Endoscopic Sinus Surgery. This work focused on merging consumer VR technology with high-fidelity 3D printing to create a virtual immersive operating room environment navigated using interactive 3D-printed surgical tools. The team has proposed a hybrid simulation technique in their article “Virtual reality-based hybrid simulation for functional endoscopic sinus surgery” elaborating the modules incorporating virtual and physical elements, with additional guided cues to enhance education for novice surgeons. Validation studies revealed that the system provided accurate registration of virtual and physical objects, positionally tracked 3D printed surgical tools provided realistic haptic feedback, and faster identification of critical structures. Moreover, the engineers developed a system that can track real-time surgical tool movements and implemented IE techniques to estimate proficiency using a classification algorithm to provide personalized feedback.

The functional prototype can additionally be utilized as a tool for virtual surgical planning using patient-specific anatomy prior to entering the operating room. Wide adoption of this technology to enhance education would change how fundamental skills are acquired and could lead to more optimal surgical outcomes.

Contact information:

Dr. Young-Jun Son

Professor and Department Head

Department of Systems and Industrial Engineering

University of Arizona

Tucson, AZ 85721-0020

Email: son@sie.arizona.edu

Phone: 520-626-9530