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Edward E. Whitacre Jr.
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Computer Science

Design, Development and Validation of Virtual Reality Based Surgery Simulations

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Abstract:
Traditionally, one-to-one apprenticeship is adopted for surgical training. Recent changes in surgical training to a more streamlined approach in conjunction with restriction in working hours have resulted in difficulties in maintaining this apprenticeship model. Learning surgical skills especially for novice surgeons in the operating room with this age-old is time-consuming and might also cause iatrogenic injuries to the patients. Besides, alternative training methods using cadavers and animals are often costly and limited to one-time use only. In contrast, Virtual Reality (VR) based surgical simulators could offer a low-cost, realistic risk-free training and assessment platform. They allow the trainers to repeatedly perform tasks and to receive quantitative feedback on their performance. The aim of creating of such environments is to provide high-fidelity realistic simulation to all level of medical practitioners for training, assessment and surgical planning or development of prospective surgical techniques. The success of virtual surgery systems is evaluated based on how closely they replicate all the modalities of the surgical scenario involved. This requires concrete task analysis of the actual procedure and the comprehensive software development followed by rigorous validation studies with physicians. In this talk, the design, development and validation of several virtual simulations from the top (task analysis)-down (design and development) approach for virtual simulation of arthroscopy, colonoscopy, open simulations such as virtual airway management techniques and other VR based surgical skill trainers will be presented. The problems and solutions to furnish high-fidelity user experience in VR based surgery simulations will be addressed.

Bio:
Dr. Tansel Halic is Associate Professor of Computer Science Department at University of Central Arkansas (UCA). Dr. Tansel Halic holds his B.Sc. and M.Sc. Computer Science degrees. He completed M.Sc. in Applied Science specialized in Applied Computing at the University of Arkansas at Little Rock (UALR). He received his Ph.D. degree from the Department of Mechanical, Aerospace and Nuclear Engineering in Rensselaer Polytechnic Institute (RPI). He is an alumnus of The Center for Modeling, Simulation, and Imaging in Medicine (CeMSIM) in RPI. During his studies, he worked on several VR and augmented reality (AR) based surgical simulations with Neurosurgery Department in University of Arkansas for Medical Sciences (UAMS). He developed Laparoscopic Adjustable Gastric Banding (LAGB) Simulation with his colleagues, which is the first and only virtual simulation of LAGB technique in the world. Dr. Halic's primarily research interests are in the area of VR, mixed and AR, human computer interaction, multimodal interactive simulation environment design and development. Dr. Halic designed, developed and validate several real-time VR based surgical simulations in collaboration with Harvard Medical School, UAMS, Indiana School of Medicine. His research amounted to more than $1.7 Million funded from several federal agencies such as NIH, DoD, state agencies and companies such as Kitware Inc, Vivonics, Intuitive Surgical (makers of Da Vinci Surgical Robot). Dr. Halic published more than 50 papers in reputable international and national journals and conferences. He has been serving editorial board member and reviewer in several technical and medical journals. He is also the recipient of the faculty champion award given by Microsoft