Feasibility of Team Training in Virtual Reality for Robot-Assisted Minimally Invasive Surgery

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The rate of evolution of surgical robotics has continuously increased since its inception. Training and experience with the robots is a key factor to successful operations but these events are costly, as the equipment used is expensive and has a short lifetime, and time-consuming. To explore the possibility of enabling alternative robot assisted surgery training methods, we design and test a virtual reality simulation of team training practiced in certified training institutes.
This study investigates regular training and team training of nurses and surgeons in a user centered design approach to determine key objects and procedures in the context in order to ensure realism and accuracy of the simulation. Objects such as the surgery robot, manual tools, robot instruments, and surgical bed were designed and implemented in a virtual reality scene
using the Proteus template in Unreal Engine 4. Users were able to fit the robot with laparoscopic tools and move the robot's arms. The inverse kinematics of the robot arms were solved using the cyclic coordinate descent algorithm.
We evaluated the simulation in cooperation with Minimal Invasive Education Centre and with Jane Petersson, First Nurse Assistant and Nurse specialist in Robot Surgery, and Johan Poulsen, head surgeon at Aalborg University Hospital. The experts were positive about the system's future, however it was considered too incomprehensive to consider implementation at this stage. More scenarios and features would be required in future implementations to allow for near full training sessions to be performed in VR. This includes a realistic setting, extending from the look of the objects in the scene to the handling of robot arms. Following this, we suggest a usability test and a longitudinal study to ascertain the possibility of implementing such a system at certified institutes such as Minimal Invasive Education Centre and the effects of extending robot assisted minimally invasive surgery team training to virtual reality.