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A SOFT TISSUE SURGICAL SIMULATOR USING AR MARKERS AND PHYSICS ENGINE

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[Purpose] To ensure the safe and problem-free endoscopic surgery, improvements in surgical training are indispensable. VR (Virtual Reality) based surgical training systems are superior to surgical training models, such as being able to evaluate training results quantitatively. However, they are expensive and have not yet achieved widespread use. This paper presents a simple and low-priced surgical training system that combines technologies of augmented reality (AR) markers and physics engine.
[Method] Instead of a laparoscope, a web camera is installed in a training box. We applied ARToolKit, a software library for AR applications, to track forceps with an AR marker. Virtual organ models are overlaid on the camera view. To simulate the deformation of the soft tissue, we used NVIDIA PhysX® physics engine and NVIDIA GeForce® GPU.
[Results] Our initial target of simulation is a liver deformation with a forceps. A 'virtual' liver is overlaid inside a training box. An AR marker is attached to a forceps to detect its position and orientation. Collision between the virtual liver and the real forceps results in the deformation of the liver. Using GeForce GPU greatly contributes to the real-time deformation. A comparative study of deformation of real and virtual livers suggests that the physics engine can mimic the overall deformation.
[Conclusion] Improving the marker recognition and deformation quality, our study will lead to the widespread use of the surgical simulator.