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VREDmed, ein Werkzeug für die 3D-Visualisierung von Erweiterter und Virtueller Realität in der Chirurgie

VREDmed, a tool for 3D-visualization of Augmented and Virtual Reality in surgery

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Purpose

Today.s medical imaging is able to deliver 3-dimensional information in high-resolution about patients anatomy. To access this information for orientation and guidance purposes would be useful during surgical procedures. Unfortunately there is a lack of visualization software that can take advantage of an appropriate display technology and use an interface that respects the special circumstances within an OR.

Material

We developed VREDmed, a rendering engine for 3D-visualization of patient.s data from CT and MRI as well as surface models gained from preoperative planning. Our software is based on the open-source rendering engine of the OpenSG and OpenSGplus project. It can be used for preoperative planning supported by stereo viewing as well as for guidance purposes during the surgical procedures themselves.
Various visualization methods offer 2D and different stereo modes. Combined with an auto-stereoscopic display from SeeReal Technologies, it prevents the surgeon from the need to wear eyeglasses during the procedures.

Interfaces for several commercial tracking devices are implemented in VREDmed. In the OR, the surgeon can interact with the software by mouse and keyboard or via speech recognition.

Methods

At first stage, VREDmed was used in preoperative planning to offer better 3D-overview of preoperative gained imaging data to the surgeon. Different modalities like CT, MRI and Ultrasound were imported in
VREDmed and integrated in a coordinate system by commercial tracking systems if not already provided by the modality itself.

Surgical planning and further information was gained through post-processing of the data with segmentation methods and different CAD-software. If specific functionality was not provided by VREDmed, it was done with other software and re-imported.

The obtained information was visualized in combination with the original imaging data on computer monitors, auto-stereoscopic displays and Head-Mounted-Displays. Results were evaluated to find out the best and fastest information content for the surgeon.

In an upcoming step, the software will be tested in the operating theatre where it should serve as a (stereo-)3D map during interventions and later, when it tracks the surgeons position as well, by wearing a head mounted display (HMD) serving as an augmenting information system in the field of view of the physician.

Results

VREDmed can present various imaging data for preoperative planning and allows the user intuitively inspect and interact with it also during surgical procedures. Interfaces for tracking and haptic devices as well as stereoscopic displays make it a powerful tool for surgeons.
The possibility to gain snapshots and movies makes it easy to use VREDmed for documentation and presentation purposes in clinical workflow. Clusterization enables collaborative consulting over the network with the aid of 3D-visualization of medical imaging data.

Conclusion

Augmented and Virtual Reality can be a powerful instrument for surgeons to obtain better orientation during preoperative planning and surgical interventions. Software in the OR has to be extendable to get customized to specific needs and situations. Therefore it must have documented interfaces to allow fast adaptations to devices like tracking instruments, medical imaging and force-feedback-devices.