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System for Tracking Microsurgical Instrumentation

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Technology description

Novelty:

A device that provides real-time 3D tracking of the eye and surgical instruments relative to each other during surgical procedures.

Value Proposition:

A number of unaddressed problems are regularly encountered in eye surgery, such as poor visualization, lack of force sensing, and hand tremor. Computer- and robot-assisted ocular surgical systems offer solutions to many of these problems; however, many existing systems interfere with existing workflow, obstruct the visual path, and can be inaccurate. Using depth- and position-sensing technologies, this device tracks the location of all surgical instruments and of the surgeons hands relative to various anatomical ocular structures in real-time. This device is an easy-to-use, reusable mask that is attached directly to the patients face, rendering sensors pre-calibrated to anatomical structures and reducing potential workflow changes for both training and clinical use. The following are the main applications the device:

Technical Details:

Johns Hopkins researchers have developed a device to provide real-time tracking of surgical components relative to ocular anatomical features. The device hardware is a mask outfitted with sensor arrays arranged so as not to interfere with typical surgical practice. The mask can be sterilized and placed over the draped patient face. The tracking concept provides depth maps of the environment from which it extracts human skeleton information. This technology has sensors positioned at multiple angles surrounding the eye. Standard image reconstruction methods are, then, used to compile the real-time 3D scene of the surgical field around the eye. Positions of surgical tools, the surgeons hands, and ocular features are processed from the 3D scene, and this information is provided to the software system for further analysis and feedback. A number of sensing technologies can be integrated into the mask to offer feedback in a variety of surgeries; these sensing technologies include, but are not limited to: RGB cameras, IR cameras, optical flow sensors, structured light methods, time-of-flight cameras, LADAR, sonar, ultrasound, and optical coherence tomography. This device can also be adapted to interface with other anatomical structures by changing the patient interface, potentially allowing for use in many other microsurgical surgeries, such as cochlear implantation.

Application area

• Inform the surgeon of unintentional collisions with the anatomy and other instruments
• Archive detailed 3D procedure information for education and general record keeping
• Used as input for surgical skill assessment

Advantages

• Automate tasks such as accurate automatic instrument insertions
• Prevent excessive stress on the sclera by tracking the insertion points and providing feedback to the robot controller
• Prevent unintentional collisions with the anatomy, and other instruments
• Integrates with eye-lid retractor and draping to minimize instrumentation and decrease footprint
• Capable of providing patient-specific interfaces through modular hardware design

Institution

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