

Training and Skills Assessment System for Minimally Invasive Surgery

Published date: Sept. 5, 2008

Technology description

Description

A sensorized laparoscopic instrument and a software based tracking system has been designed and developed at The University of Western Ontario. This hand-held instrument has been designed to non-invasively measure the interaction of the instrument with tissue in the form of forces or torques acting in all five degrees of freedom (DOFs) available during MIS. Additional capabilities include the ability to capture instrument tip position and orientation in 6 DOFs. This allows the software to capture the force/torque and position profiles of surgeons performing conventional MIS tasks. The force and position profiles can be used to model the learning curves and assess the skill levels of residents and surgeons in an MIS training environment. Typical surgical procedures such as suturing and knot tying can be methodologically divided into steps with quantifiable parameters and well-defined intermediate goals.

Background

Compared to open surgery, minimally invasive surgery (MIS) significantly reduces tissue trauma, post-operative pain and recovery time. Unfortunately, the “fulcrum effect” generated at the entry site, causes a significant reduction in dexterity and reversal of hand motion, requires higher manipulation forces to overcome the drag on the instruments, and considerably degrades haptic feedback (the sense of touch). These limitations result in new perceptual-motor relationships which are unfamiliar to the user and require training. The widespread application of MIS is hindered by the lack of appropriate educational and training tools. During conventional surgical training, a trainee first watches a skilled professional doing an operation and then tries the operation under the guidance of the mentor. This mode of training is inefficient and poses a challenge to surgeons interested in acquiring these skills. A possible solution is to develop training exercises that can be used to develop the skills necessary, while providing immediate feedback to the user on their achieved performance.

A mechanism for providing position feedback is required in order to properly assess the performance of the user. This can be accomplished through the use of commercially available tracking systems. The most popular tracking systems used in modern interventions are optical and electromagnetic.

Although these tracking systems are easy to integrate and provide good tracking accuracy, a significant limitation in their use is that they are very expensive.

Application area

A package that permits a computer based analysis of the surgeon' s skills based on the force, position and velocity profiles of the laparoscopic instruments during the performance of various MIS tasks.
A package that uses laparoscopic instruments having force sensors which could be used in surgical procedures.

Institution

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