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Haptic-Enabled Simulations for Cognitive Training

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Patent pending

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Background

Development and refinement of surgical skills of novice surgeons is critical and time consuming processes. Demand for better performance and accountability has resulted in shifting the focus of training from subjective to objective evaluation. Modern surgeon training techniques are moving towards a 'hands-on' approach and eliminating the process of 'learning on patients'. Current training systems use metrics such as time, kinematics of laparoscopic tools, and smoothness of movements as a measure of surgical proficiency. Some systems use Markov models to model processes such as Minimally Invasive Surgeries (MIS). Specially designed tools and sensors used to measure and model hand-tool and tool-tissue interactions, surgical gestures and performed movements using complex pattern recognition tools. These models do not involve any haptic feedback and require a significant amount of human input. They do not model the interpersonal differences in surgical performance accurately. Also, these techniques are oriented towards performance measurement rather than training. This creates a need for a technique that can quantify the effects of surgical simulation and develop efficient and reliable protocols for training and evaluating proficiency and psycho-motor performance of novice surgeons.

Invention Description

Researchers at Arizona State University have developed a technique for simulating and quantifying the surgical performance and impart training in psycho-motor skills, sensory acuity and cognitive planning. This involves visual and visio-haptic behavioral measurements such as hand and wrist movements and neural recording (electroencephalography). The collected data is then measured in comparison to baseline skill measures of expert surgeons. The technique provides a real time feedback and adaptive simulation for training processes such as the MIS. The system has the capability to impart psycho-motor training, surgical dexterity and improves team work and communication.

Potential Applications

- Impart training on surgical skills for novice surgeons
- Efficient quantification and evaluation of surgical performance
- Advanced training in aviation and aerospace applications

Benefits and Advantages

- Provides real-time feedback and facilitates development of surgical psycho-motor skills and dexterity
- Simulates complex situations and expose the trainee to unexpected complications
- Quantifies surgical performance in a reliable way
- Eliminates chances of clinical errors and improves patient safety
- Minimizes precious operating room time
- Promotes communication and team work