Medical Laparoscopic Phantom with Embedded Performance Feedback
Design and Fabrication of a Medical Phantom with Embedded Feedback Mechanisms for Robotic Laparoscopic Surgery

Context
In order to enhance the possibilities of researching robotic laparoscopic surgery a medical phantom shall be developed. The phantom will be used in the Project RomEo - Robotik mit Emotionsbasiertem Reinforcement Learning - to perform telemanipulated laparoscopic surgery tasks while the brain activity of the operator is measured. The goal is to measure task performance by interpreting the operators subjective feelings visible in the brain activity (frustration, anger, happiness, ...).

The phantom shall give feedback about the task performance. In one scenario the feedback will be used to compare objective measurements to brain activity measurements and in another scenario it should induce brain activity by giving feedback to the operator.

Objective
For this position the goal is to build a torso phantom that allows the manipulation of one laparoscopic device by a Franka Emika Panda. The basic design should be similar to Fig. 1.

The laparoscopic device should be manipulated to reach certain targets and applying force to them while avoiding tender organs. Feedback should be given for reaching the target, the correct amount of force applied to the target and touching organs that should be avoided.

The feedback should have the ability to be computer readable, optical and acoustic.

Task Summary
- Design, build up and testing of the feedback mechanisms.
- Programming of the computer readable interface (probably microcontroller)
- Engineering and prototyping of the phantom.
- Testing of the complete setup.

Tasks are open for discussion and can be adapted.

Figure 1: Laparoscopic phantom with an endoscope attached to a Franka Emika Panda for robotic manipulation.

Requirements
Qualified candidates shall have knowledge and be interested in:
- CAD
- Python
- Using Sensors with Microcontrollers/Raspberry Pi

Contact
Lennart Karstensen, M.Sc.
lennart.karstensen@partner.kit.edu