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µRALP

Micro-Technologies and Systems for Robot-Assisted Laser Phonomicrosurgery

µRALP is a multidisciplinary project proposing a redesign of laser phonomicrosurgery systems to improve the safety, efficiency, and quality of these surgical procedures. It involves:

- New assistive technologies
- New micro-robotic tools
- Improved surgical site access and visualization
- Augmentation of surgeon's dexterity and manipulation skills
- Improved safety through cognitive supervision

For further information please contact the project coordinator:

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µRALP

Micro-Technologies and Systems for Robot-Assisted Laser Phonomicrosurgery

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Project Summary

Lasers form an increasingly common tool for precision treatment of pathological conditions on delicate and vital human organs such as the vocal folds. However, laser aiming control still relies completely on the dexterity of surgeons who must operate through a microscope and deal with its associated poor ergonomics. This can have a strong impact on the quality of the procedures. Additionally, in laser phonomicrosurgery the laser beam is directed from a comparatively large range (400mm), resulting in accuracy and consistency problems that require extensive surgeon training. In this project a redesign of the surgical setup is proposed to create an advanced micro-surgical system that will allow unprecedented levels of accessibility, controllability, precision and safety during these procedures, resulting in enhanced surgical and patient outcomes. The new technologies developed herein will pave the way towards new and safer minimally invasive laser microsurgeries, leading to a significantly enhanced capacity for cancer treatment in general.

Research Topics

1. Micro-mechatronic systems for minimally invasive surgery

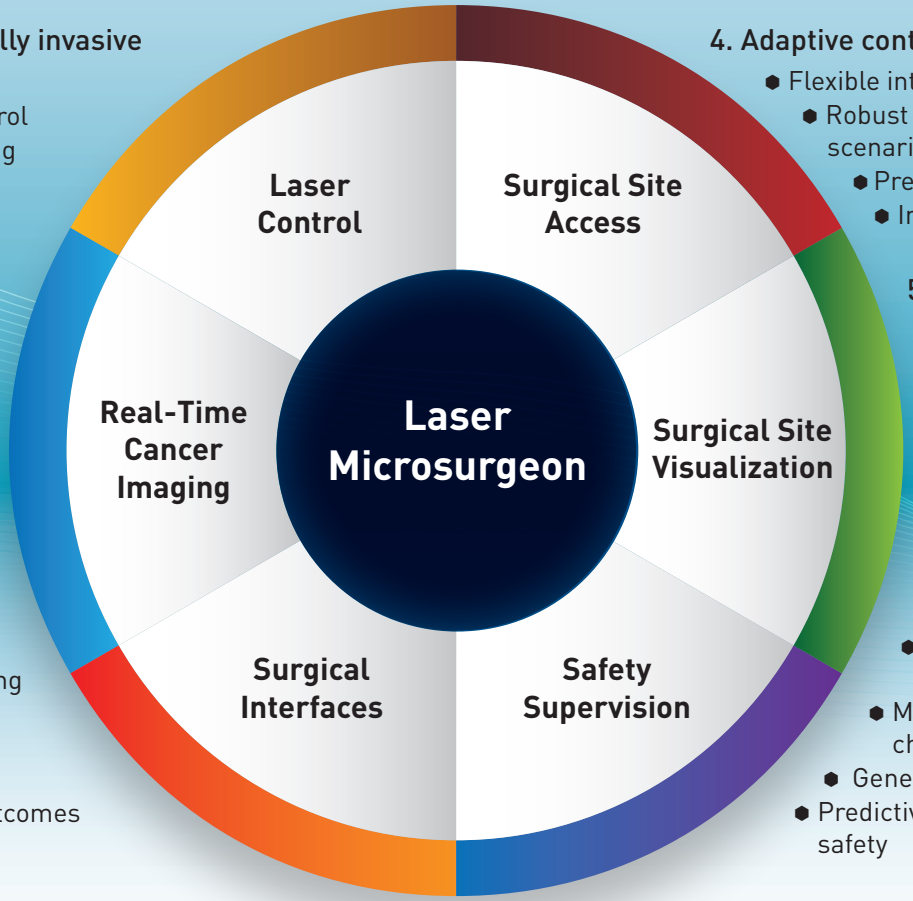
- Surgical MEMS: design, fabrication and control
- Improved laser aiming accuracy and scanning capabilities
- Enable high-level automation and adaptive control

2. Optical micro-technologies for medicine

- Micro-optomechatronic imaging devices
- Multi-functional endoscopic systems
- Real-time cancer tissue imaging
- Enable total tumor removal with minimal collateral damage

3. Surgeon skills augmentation

- Intuitive and ergonomic control
- Augmented reality: information-rich operating environment
- Real-time registration of pre-operative data
- Motion scaling and virtual safety options
- Automatic routines for improved surgical outcomes



4. Adaptive control systems for medical robots

- Flexible intraoperative surgical planning
- Robust control adaptable to the dynamic surgical scenario
- Precise surgical plan execution
- Improved safety and outcomes

5. Computer vision for soft tissue surgery

- Modeling and estimation of soft tissue deformations
- Data fusion from different imaging modalities
- Improved augmented reality surgical environment
- Vision-based automatic laser aiming control

6. Intelligent systems for safety supervision

- Learn and predict the outcome of surgical actions
- Monitor the surgical site's continuous appearance changes
- Generate safety warnings and alarms
- Predictive and reactive controllers for maximum surgical safety