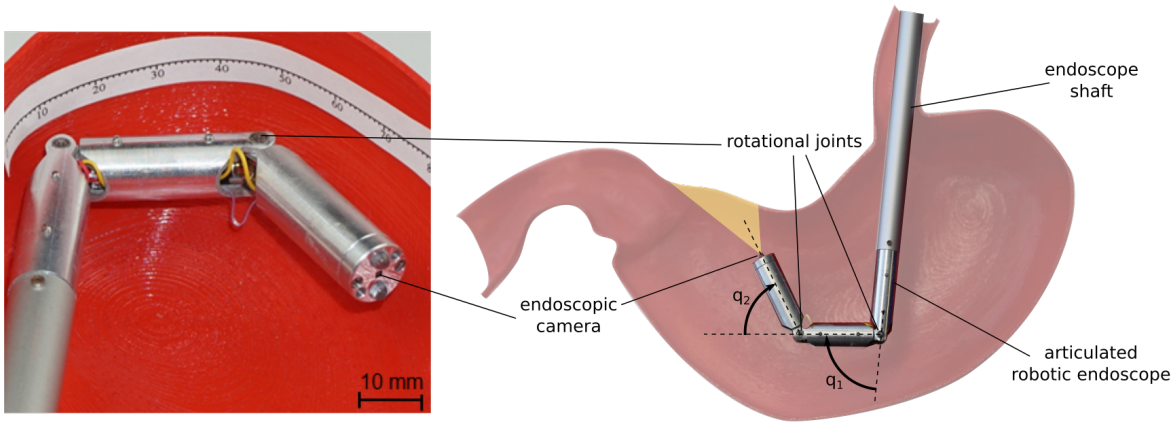
University of Basel
Department of Biomedical Engineering

BIROMED-Lab
Medical Robotics and Mechatronics

Master Thesis:
Design of a Rotational Endoscope Joint with Integrated Joint Position Sensor

Context: In recent years, more and more robots have found their way into operating rooms and enabled or improved minimally invasive surgical procedures, where the size and number of skin incisions are kept to a minimum. Advantages of minimally invasive surgeries include the reduction of tissue stress, postoperative pain and a faster healing process. However, for the surgeon, manual handling of instruments through a small incision is difficult and robots can help to perform these interventions faster and with greater precision. Within the MIRACLE project, we are working on equipping a surgical robot with an articulated endoscope, which enables to automate certain surgical tasks inside the body. Naturally, the surgical tools need precise positioning, and a major challenge is to provide reliable position feedback of the endoscope to close the control loop. This challenge could be overcome by installing joint position sensors directly at the rotational joints of the endoscope, but to our best knowledge, no suitable sensors exist on the market or in the literature.



Task description: In this project, you will develop a rotational endoscope joint with an integrated joint position sensor. This includes the following work packages:

- Basic research: Literature research is conducted on existing principles of joint position sensors and available hardware with a special regard to accuracy and size.
- Concept development: Based on the literature research and own ideas, different concepts are developed to implement joint position sensors in the joints. These concepts are evaluated with respect to criteria such as miniaturization potential, accuracy, reliability, real-time capabilities, and autoclavability.
- Implementation: The most promising concept is designed and manufactured. The sensor is then included in the existing prototype and its control architecture, which is based on TwinCAT3 and MATLAB Simulink.
- Testing, evaluation and characterization of the system with respect to its requirements.

Student: Saverio Drews
Start: July 2020
Duration: 6 months

Supervision:
Lorin Fasel
Manuela Eugster
Dr. Nicolas Gerig
Professor: Prof. Dr. Georg Rauter

Contact:
Lorin Fasel (lorin.fasel@unibas.ch)
T: +41 61 207 54 72
https://biromed.dbe.unibas.ch