University of Basel

Department of Biomedical Engineering

Development of a mechanical quick-coupling for a tendon-driven robotic endoscope

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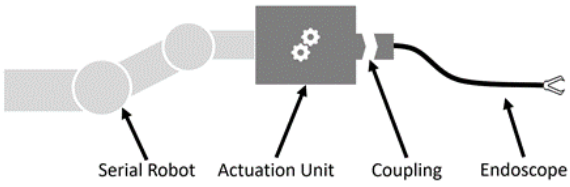
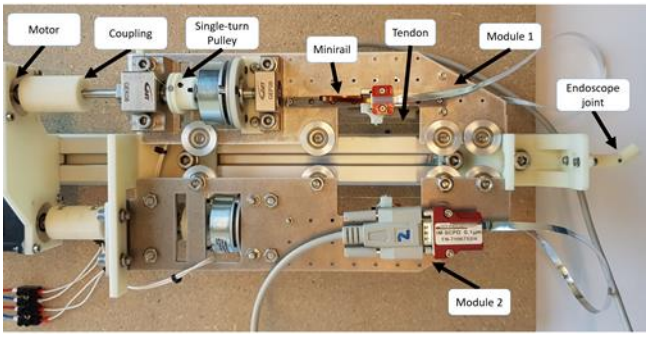
One of the key features of many successful robotic surgical platforms, like the DaVinci System, by Intuitive Surgical Inc., is the ability to switch to a new surgical tool without exchanging the entire platform. This makes quick changes of tools during surgery possible and thus reduces the number of required robot arms. Furthermore, it also eases processes between surgeries as the detachable tools can be sterilized in an autoclave. The possibility to decouple the surgical tool also adds to the safety of the system: in case of emergency, the surgeon can remove the surgical tool from the patient's body manually. The goal of this project was to develop a coupling for a tendon-driven robotic endoscope. Coupling mechanisms that are implemented in current surgical robotic systems are not able to couple many individual tendons at once. The proposed concept features modules, which enable individual control of tendons and provide information on the tendon dislocation with a position sensor. These tendon modules also include a brake to avoid slack when the endoscope is decoupled. Two prototypes of the tendon module design were manufactured, and experiments were conducted to evaluate the positioning accuracy and efficiency of the power transmission. The results of the experiment show that tendon modules with sufficient performance are possible but require further research.



Schematic of a robotic endoscopy platform with an endoscope that is detachable from the actuation unit. (Picture: Philipp Butschle)



Two manufactured prototypes of the developed tendon module controlling a tendon-driven endoscope with one rotary joint. (Picture: Philipp Butschle)

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