Implementation of a clinical test-bench for middle ear surgery

Laboratory: Femto-ST institute, AS2M department
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Level: Bac +4/+5
Formation: informatics, mechatronics, automatic control
Duration : 5/6 months
Name of contact person:

- Bassem Dahroug : bassem.dahroug@femto-st.fr (main supervisor)
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AS2M Department

The AS2M is one of the seven FEMTO-ST institute departments (UMR CNRS). Within AS2M, the internship will work in the micro-nanorobotics for medical applications (MiNaRoB) team.

Context

Surgical robots are gaining more popularity for research and development due to their advantages for both the patient and the surgeon. The internship is indeed dedicated to middle ear surgery in order to remove exhaustively pathological tissues that grow within the middle ear cavity. This application has its challenges due to the tiny workspace of middle ear cavity (millimetric scale) and the presence of anatomical obstacles, such as ossicles and facial nerve. A disease named cholesteatoma affects the middle ear, if left untreated, it leads to serious complications. The only treatment in the current medical practice is a surgical procedure. The incidences of residual or recurrent cholesteatoma are high and the patient could have more than one surgery. Therefore, the project objective is to implement a surgical robotic system dedicated to middle ear surgery [1]. In fact, such a system aims i) to reduce the incidence of second-look cholesteatoma surgery, ii) to secure the surgery using a robotic process, and iii) to become a minimal invasive surgery.

Mission

The main objective of this internship is to implement a clinical test-bench which will be used for validating the different controllers proposed by the MiNaRoB team (e.g., [2]). The candidate will begin by implementing a software that i) communicates either with a universal robot (UR) [1] or a numerical simulator, ii) performs the registration process [3, 4] between the robot and the patient (i.e., in-vitro model as a first step), and iii) tracks and estimates the end-effector pose and that of the patient. Besides that, the software should integrate the proposed controller in [2]. The candidate will also propose a detailed protocol for testing the new test-bench.

Profile

A student in the third year of engineering school or master 2 that has a good background in programming (C/C++, Javascript, Qt), mechatronics, automatic control or related field. He/she is motivated in the research and innovation and he has good capacity in analyzing and solving problems.

Application

Please send you application (CV, cover letter and academic transcripts) to `bassem.dahroug@femto-st.fr`.

References

[1] Bassem Dahroug, Brahim Tamadazte, Weber Stefan, Laurent Tavernier, Nicolas Andreff. *Review on Otological Robotic Systems: Toward Micro-Robot Assisted Cholesteatoma Surgery.* IEEE Reviews in biomedical Engineering, 2018.

[2] Bassem Dahroug, Brahim Tamadazte, Nicolas Andreff. *Visual Servoing Controller for Time-Invariant 3D Path Following with Remote Centre of Motion Constraint.* ICRA, 2017.

[3] Terry M. Peters. *Image-guidance for surgical procedures.* PMB, 2006.

[4] Kevin Cleary and Terry M. Peters. *Image-Guided Interventions: Technology Review and Clinical Applications.* ARBE, 2010.

[1] Universal robot UR3 specifications are available at `https://www.universal-robots.com/media/240787/ur3_us.pdf`