University of Basel
Department of Biomedical Engineering

BIROMED-Lab
Medical Robotics and Mechatronics

Master Thesis: sensor concept, design and implementation for an automated plate handling system inside a robotic incubator

Context: Organoids are "in vitro miniaturized and simplified model systems of organs [which] self-organize into complex structures" [1]. Since 2009, the Organ-on-a-Chip (OoaC) approach to synthesize viable non-vascularized small organoids progressed significantly and is currently the most used approach. Most organoid engineering in academic research is carried out manually and is, therefore, labour-intensive. The successful vascularization of organoids is critical to allow nutriments and drugs transport to the cells. Methods to generate vascularized organoids have been discovered but vasculature creation is still poorly understood. Thus, we are researching on how to automate both non-vascularized and vascularized organoid synthesis.

This Master Thesis is your opportunity to work on this exciting project, which have an impact on research as well as the pharmaceutical industry.

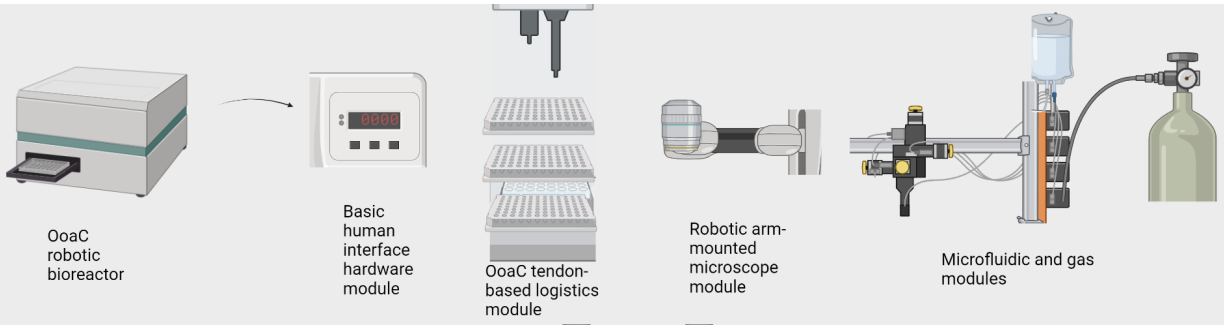

Figure 1: Schematic visualization of the robotic OoaC incubator system's components

Task description: We currently perform research with the aim to build a fully-automated OoaC synthesis robotic system that takes care of organoids 24/7 and gathers information (fig. 1). The system includes a real-time control system to control the robotic-arm-mounted microscope, a tendon-based system to manipulate OoaC plates, and further various actuators and sensors to control the condition inside the incubator.

Your challenge would be to find different sensor concepts to measure the position and orientations of the OoaC plates, to build one or prototypes and to assess prototypes. You would contribute to the integration of your hardware and software with existing tendon-based plate logistics module and other parts of the OoaC synthesis robotic system.
The project suits you if you enjoy physical component modeling (Matlab, Simulink) and you are familiar with biomedical basic concepts. Successful participation in either Basel University's "Applied control"[2] or " Rapid prototyping" or ETH Zurich's "Robot Dynamics" is recommended.

Start: SS 2023 or upon agreement with the student
Duration: 6 months
`https://biromed.dbe.unibas.ch`

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[1] M. Hofer and M. P. Lutolf, "Engineering organoids," Nature Reviews Materials, vol. 6, pp. 402–420, feb 2021
[2] G. Rauter et al. Lecture with practical courses: Applied control, https://vorlesungsverzeichnis.unibas.ch/en/home?