Interactive 3D simulation planning
Project Management and Software Development for Medical Applications

General Info
Contact Person: Mario Herzog, Gloria Zoernack, Bence Rochlitz
Contact Email: herzog@virtonomy.io, zoernack@virtonomy.io, rochlitz@virtonomy.io

Project Abstract
This project aims at developing an expandable integration of our 3D, VR-enabled and multi-user visualization with a browser-based physical simulation engine. The exciting challenge is to enable patient/statistics based, simulation-driven development of medical implants, while acknowledging all the complexities this interdisciplinary application brings with it. Successful outcome of the project will be used in Virtonomy's simulation and visualization process.

Background and Motivation
Virtonomy GmbH is developing the first web platform for conducting fully data driven clinical trials of medical devices with the use of virtual patients. Our system is based on clinical scans (CT, MRI), pathology data and data about the medical devices. The 3D anatomy model is used to do simulations of body/implant interactions; in real-time where useful.

Our existing 3D visualization presents static models and enables planning of device positioning. These studies will be enhanced by including the results of physical simulations.

Student’s Tasks Description
- Analysis of the data model to share simulation engine inputs/outputs with
- Generation of tool integration code to:
  - Get the current state of the model and the parameter in the viewer
  - Send a simulation call
  - Process the simulation results
  - Trigger UI changes in the frontend
  - Show the simulation results in the frontend viewer
- Help adapt the frontend architecture design to enable the simulations workflow
- Further automatization of the process should be evaluated (like batch-simulations, real-time mode)

At the end of the project, the student shall have the following outcome: A full simulation workflow loop. This covers setting up the simulations in the viewer, triggering the simulation, having the results show up in the viewer to invite investigation and iterative studies. The student will learn how to structure and take care of the complete cycle of visualization/simulation projects. Virtonomy provides supervision with medical industrial simulation and software development experience.

Technical Prerequisites
Software development and 3D visualization knowledge. Basic understanding of simulations. Experience with webapp development. JS/NodeJS/three.js/A-frame. C++ knowledge is a plus. Basic understanding of GIT.

Why you should choose us
- Opportunity to work in a vibrant environment with many other start-ups (Werk1) or from home
- Participation in the exciting development and growth of a start-up
- The opportunity to introduce the simulation framework in user validation calls
- Contributing to an exciting real-life medical data solution with a huge impact

References
Virtonomy’s references for 3D anatomical models: https://virtonomy.io/services/references
Physical Simulation engine: https://xiangyu-hu.github.io/SPHinXsys/
Visualization Toolkit (VTK), for manipulating and displaying scientific data: https://vtk.org/
3D visualization framework: https://threejs.org/