Friedrich-Alexander-Universität
Technische Fakultät

SPARC
Surgical Planning and Robotic Cognition

The **Laboratory for Surgical Planning and Robotic Cognition (SPARC)** offers a

Position as Research Assistant (m/f/d) with the perspective of a doctorate

for a research project with the tentative title

AI-Driven Robotic Catheter Navigation Systems for Endovascular Interventions

The Project:
We invite applications for a doctoral research position as part of the TED-MeD project, an initiative aimed at the development and approval processes for medical technology products. The TED-MeD project focuses on creating automated safety and compliance testing methodologies, enabling faster and more reliable regulatory approval for complex medical devices including AI components. Central to the project is the development of an AI-supported assistance system, which will guide developers in identifying safety and regulatory risks early in the design process and evaluating the impact of design changes on compliance. As a concrete application within TED-MeD, this project focuses on the development of an robotic catheter manipulator.

The focus of **this doctoral position** is the development and implementation of the catheter navigation robot for endovascular interventions. This position involves addressing challenges at the intersection of medical robotics, regulatory requirements, and user-centric design. The candidate will play a crucial role in the design, implementation, and evaluation of the robotic system, advancing precision and safety in endovascular procedures.
As part of this role, the researcher will conduct an in-depth analysis of application scenarios to determine the specific requirements for the system, including technical and regulatory aspects. Based on these requirements, the candidate will design and construct a catheter manipulator that prioritizes usability, modularity, flexibility, safety, and sterilizability. The development process will include creating operational and path-planning strategies to enable precise catheter navigation through vascular structures to target locations.
A key focus of the project will be the development and testing of control strategies, including telemanipulation, shared control, and autonomous navigation modes, based on previos work at SPARC. The candidate will also work on designing intuitive user interfaces to ensure seamless interaction between the robotic system and its users. Ultimately, the developed components will be integrated into a complete robotic system and rigorously evaluated to ensure compliance with safety standards and optimal performance.

Qualifications:

- Above-average university degree (Master's or Diploma) in computer science or engineering sciences, or relevant adjacent fields
- Relevant disciplines regarding the university degree: Computer Science, Electrical Engineering, Mechanical Engineering, Mechatronics
- Ability and willingness to work both independently and collaboratively with a diverse team in a goal and solution-oriented manner; especially working with industry partners

- Good knowledge in the fields of Hardware design, Robotic control, Software, Machine Learning, Computer Vision
- Experience in hardware development and implementation in CAD and manufacturing
- Experience in software development and implementation in Python or C/C++
- Very good English language skills, both written and spoken; German language skills are advantageous
- Positive attitude, strong social and communication skills, initiative, commitment, high sense of responsibility, and creativity.
- Having peer-reviewed publications or conference papers can be a strong advantage.

Additional Descriptions:

- Aim for doctorate (Dr.-Ing.) at FAU
- A fully funded position (100%, TVL-E13) in a young, dedicated, and innovative team that addresses significant medical and technical challenges using scientific methods
- A creative and inspiring work environment where you collaborate with renowned partners from research, medicine, and industry to develop, implement, and analyze innovative projects
- Interdisciplinary project work and a top-tier national and international network
- An excellent starting position for an academic career or a career in leading industrial companies
- Development and experience in teaching, taking on leadership roles in student projects
- Possibility for (part-time) remote work (home office)

The SPARC Lab:

The laboratory for Surgical Planning and Robotic Cognition (SPARC) at FAU Erlangen-Nürnberg investigates cognition guided robots for surgical assistance in minimally invasive procedures, intelligent and flexible surgical instruments, and intuitive interfaces between humans and robots in the operating room. The SPARC laboratory conducts interdisciplinary research in close collaboration with national and international partners. We aim to contribute to building a healthcare system that enables optimal and personalized treatment of patients through targeted interactions between surgical experts and the next generation of minimally invasive surgical robots and assistance systems.
You can find more information about the lab and our research on our website: www.sparc.tf.fau.de

FAU promotes equal opportunities. Female candidates are specifically encouraged to apply. The position is open to start on 1. April 2025. Please send your application (until 22.1.2025) including cover letter with interests and background (max. 1 page), plus full CV and transcripts, as one PDF document via e-mail to Prof. Dr. Franziska Mathis-Ullrich (franziska.mathis-ullrich@fau.de), chair of the Laboratory for Surgical Planning and Robotic Cognition at FAU Erlangen-Nürnberg.
Please note that the candidate evaluation involves one or more scientific-technical presentations and interview appointments to be held in person or via teleconferencing. Applications sent via e-mail will be confirmed within a week. Furthermore, please note that applications not complying with the above requirements may neither be confirmed nor considered.

Relevant Literature:

1. Lennart Karstensen et al. *„Learning-based autonomous vascular guidewire navigation without human demonstration in the venous system of a porcine liver“.* In: International Journal of Computer Assisted Radiology and Surgery 17.11 (2022), S. 2033–2040
2. Lennart Karstensen et al. *„Recurrent neural networks for generalization towards the vessel geometry in autonomous endovascular guidewire navigation in the aortic arch“.* In: InternationalJournal of Computer Assisted Radiology and Surgery (2023), S. 1–10
3. Steffen Peikert et al. *„Automated linear and non-linear path planning for neurosurgical interventions*“. In: 2022 International Conference on Robotics and Automation (ICRA). IEEE. 2022, S. 7731–7737