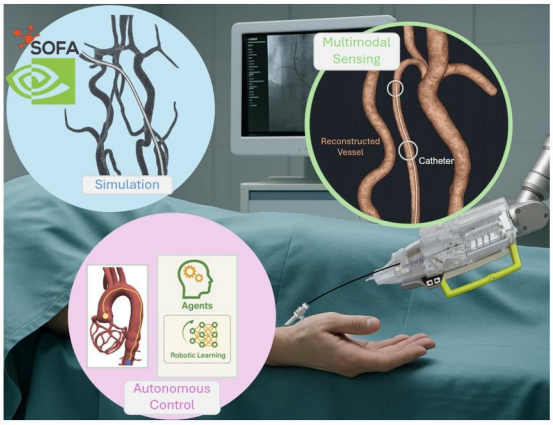
PhD Project Poster

Haolin Jiang • SDU Robotics, The Maersk Mc-Kinney Moller Institute • PhD period: Feb 2026 to Feb 2029

Semi-autonomous and radiation-reduced robotic catheter navigation via simulation, multimodal sensing, and AI-based control

Clinical vision and system concept

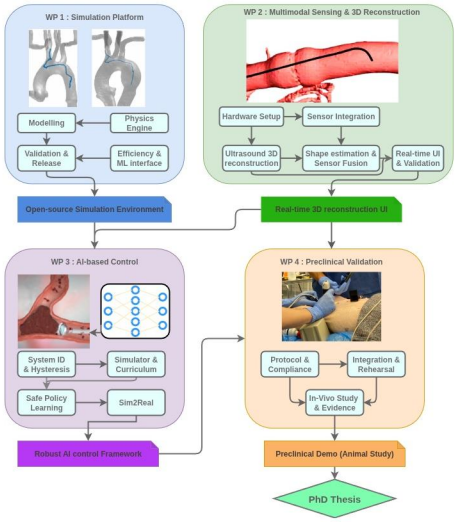
Integrated robotic catheterization with simulation, multimodal sensing, and autonomous support.



The project develops an integrated platform for radiation-reduced catheter navigation. A physics-based digital twin, multimodal sensing, and model-informed AI control are combined to support safer, more reproducible endovascular intervention.

Work-package structure

Four coordinated tracks from simulation and sensing to control and preclinical validation.



Project thrust

- **WP1** Physics-based simulation and digital twin for catheter navigation.
- **WP2** Radiation-free 3D guidance from multimodal sensing and reconstruction.
- **WP3** Model-informed and learning-based catheter steering with Sim2Real transfer.
- **WP4** Integrated phantom and preclinical validation, then thesis consolidation.

Core objectives

- Build a reusable simulation environment for catheter robotics.
- Fuse non-radiative sensing for vessel, tip, and catheter-state estimation.
- Develop robust AI-assisted control for constrained navigation.
- Validate the integrated system in phantom and preclinical settings.

Indicative timeline

Compact A4-friendly overview aligned with the three-year PhD plan.

