

# STIFF-FLOP

STIFFness controllable Flexible and Learnable Manipulator for  
surgical Operations



**Team at University of Siegen**

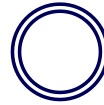
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- STIFFness controllable Flexible and Learnable Manipulator for surgical Operations

- Create a Flexible and controllable manipulator
  - bend & apply force

- Stiffness controllable
  - Stiffen and hold a position

- Learnable



- Sensors to be integrated:

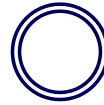
- tactile sensors
- force sensors
- bending sensors
- stiffening sensors
- the vision system



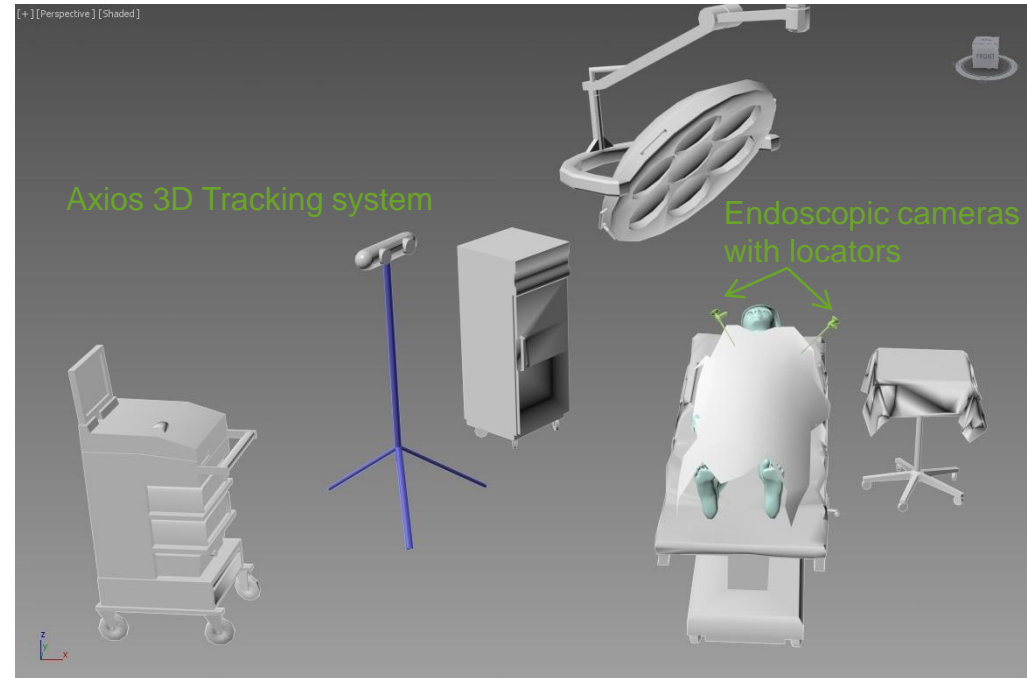


- Aim of the Vision System:
  - Vision for the surgeon
  - Tracking of the STIFF-FLOP manipulator movement
    - Feedback to control loop
    - Monitor and improve accuracy
  - Safety

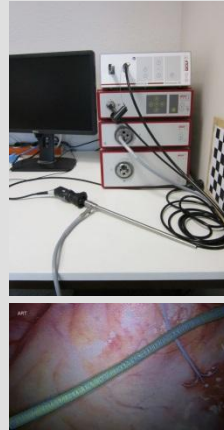




- The STIFF-FLOP arm is monitored by endoscopic camera
- Position and orientation of the endoscopic camera is tracked with a 3D-Tracking System



- Filtering
- Feature detection
- Detection of the manipulator Position within the image

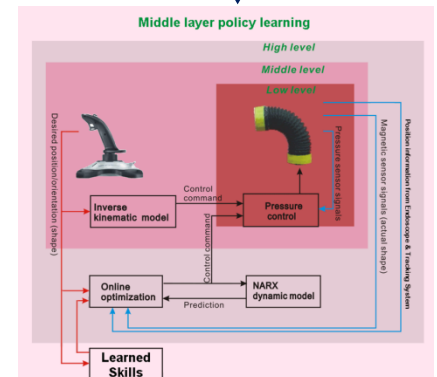
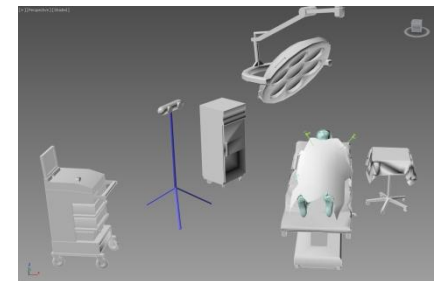


The vision system

- Infrared tracking of endoscopic camera
- Position and orientation are published to ROS



- Calculation of global STIFF-FLOP arm position
- Integration into the control loop to reach the desired pose of the tool with a high accuracy





- Challenges:
  - Evaluation of suitable filters
  - Detection of pose and orientation of a moving manipulator:
    - Due to configuration only parts of the manipulator will be visible  
(Fusion of sensor data necessary to reconstruct the pose & orientation)
    - Diameter changes due to pneumatic actuation
      - Calibration of the vision system

