Components

Auto-stereoscopic 3D display, tilted mirror, 2D touchscreen, haptic arm, 3D-printed aspirator, hand motion-capture device, foot pedal, PC

Core Technology

The core technology of HandsOn.surgery is the highly realistically modeled interaction between the tool (milling device) and the personalized patient bone model.
The underlying physics have been handcrafted by an interdisciplinary team of Fraunhofer IIS scientists and an experienced Ear-Nose-Throat (ENT) specialist. Four other ENT-specialists from multiple hospitals have subsequently evaluated and validated the physical simulation.
HandsOn.surgery was developed in the HaptiVisT project, funded by the Federal Ministry of Education and Research (reference number 16SV7559).

HandsOn.surgery is not certified for diagnostics or therapy of diseases. It is not a certified medical product.

Title images:

1 *Haptic Arm with Surgical Tool Attachment*

2 *Cochlear Implantation*

www.iis.fraunhofer.de/HandsOn

Fraunhofer Institute for Integrated Circuits IIS

Management of the institute
Prof. Dr.-Ing. Albert Heuberger (executive)
Dr.-Ing. Bernhard Grill

Am Wolfsmantel 33
91058 Erlangen, Germany

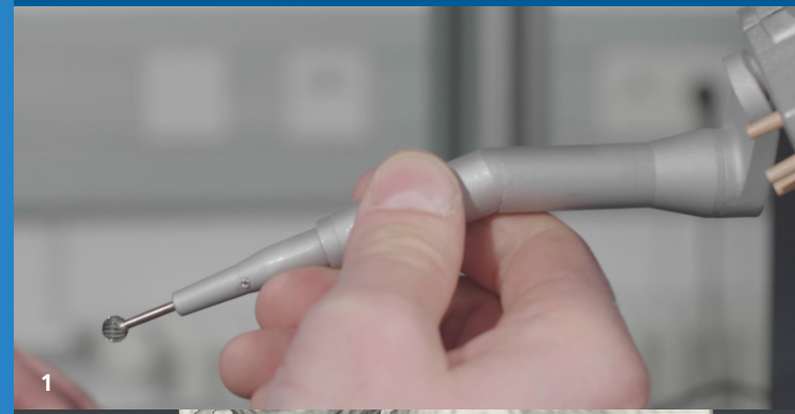
Contact:
Volker Bruns
Phone +49 9131 776-7310
Fax +49 9131 776-7309
volker.bruns@iis.fraunhofer.de

www.iis.fraunhofer.de

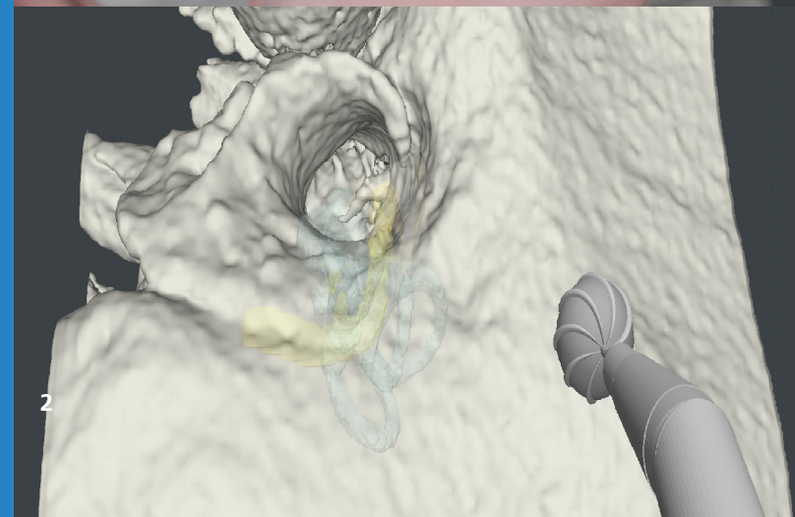
Fraunhofer IIS

FRAUNHOFER INSTITUTE FOR INTEGRATED CIRCUITS IIS

HandsOn.surgery
VIRTUAL IMMERSIVE SURGICAL SIMULATOR



1



2

SEE.FEEL.TRAIN.

HandsOn.surgery is a surgical simulator that addresses all senses. The training is carried out with individualized 3D models from patients segmented from real volumetric image data (e.g. CT, DVT, MRI).

See	3D patient model data extracted from volumetric data displayed on auto-stereoscopic 3D display (no glasses required)
	A rotated mirror achieves a realistic distance between surgeon and surgical site and emulates the view through a surgical microscope
	Tools selection (milling device with diamond or blades bit) and controls displayed on a 2D touchscreen
Hear	Realistic drilling sounds captured during a surgery
Feel	Original surgical milling hand piece controlled by haptic arm with force feedback, vibration and foot pedal
	Motion-captured 3D-printed aspirator

Scenario: Cochlear Implantation

The objective is to drill a hole into the temporal bone behind the ear to access the hearing channel and make space for the cochlear implant (CI) and its electrodes.
It is crucial that the surgeon stays clear of the facial nerve and other sensitive structures.

The inner and middle ear structures (cochlea, nerves, ossicles, vestibularis) have been segmented from a CT/DVT scan and are highlighted in colors in the virtual 3D model.

Advantage of Virtual Training

Low Running Costs

A virtual simulator has very low running costs compared to one-time usable 3D-printed models, human corpses or animal cadavers

Objective Evaluation

Each session is objectively and quantitatively evaluated.
This way

- the trainee's learning curve can be tracked over time
- the trainee's surgical result can be compared against a golden standard created by an experienced expert

Individualizable Set of Training Cases

Training cases of varying difficulty levels, different pathologies and different patients can be loaded

High Availability

The virtual trainer is always available and does not require lengthy preparations beforehand or cleaning up afterwards. It does not require a lab or surgical theater.

Applications

Orthopedic surgery/traumatology

- Hip replacement
- Shoulder and elbow surgery
- Total joint reconstruction (arthroplasty)
- Pediatric orthopedics
- Spine surgery
- Surgical sports medicine
- Orthopedic trauma

Ear Nose Throat (ENT) surgery

- Cochlear implantation
- Mastoidectomy
- Endocrine surgery
- Sinus surgery

Oral and maxillofacial surgery (OMS)

- Cranio-maxillofacial trauma
- Craniofacial surgery
- Pediatric maxillofacial surgery
- Cleft surgery
- Dental applications

Possible future extensions

- Drilling-Simulation
- Interaction with soft tissue