



SAHARRA

Semi **A**utonomous **H**Air **R**emoval **R**obotic **A**ssistant



Team

prof. MSc. František Duchoň, PhD.

MUDr. František Okál





MSc. Martin Dekan, PhD.



MSc. Ľuboš Chovanec, PhD.



Mgr.art. Daniel Zach



MSc. Martin Lučan



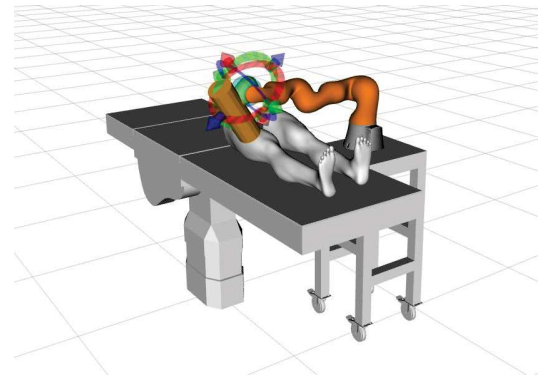
The project motivation

- laser hair removal procedure
- **state of the art – manual procedure**
 - lack of professional staff
 - larger areas are time-consuming
 - necessary to repeat at least 6–8 sessions
 - monotonous
 - inaccurate



The project motivation

- our solution – automatic/robotic procedure
 - relieving monotonous work
 - speeding up the treatment
 - higher accuracy
 - more consistent hair removal result



Key technologies

- KUKA LBR MED
- Roboception - rc_visard 65m
- Laser hair removal device

KUKA

KUKA Innovation Award 2020_Medical Robotics Challenge



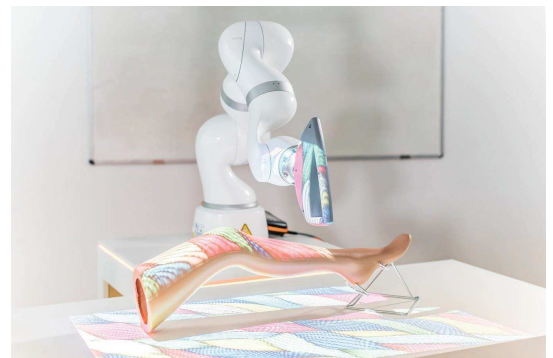
Operational mode A

- support system for guiding the end effector
lower physical load on the operator



Operational mode B

- **semi-autonomous solution**
scan the human skin's surface using a 3D camera
segmentation of the surface
perpendicular to the surface and at a constant distance
selection of areas where to/not to remove the hair



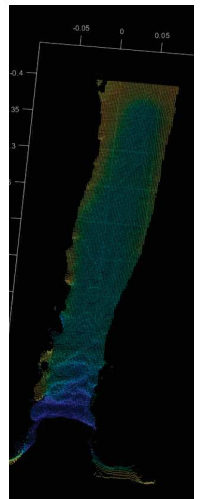
Main features

- Autonomous movement of the robot perpendicular to the surface of the skin at a predefined distance (mode B)
- Application interface allowing to adapt the dermatological procedure (mode B)
- An ergonomic end effector (mode A)



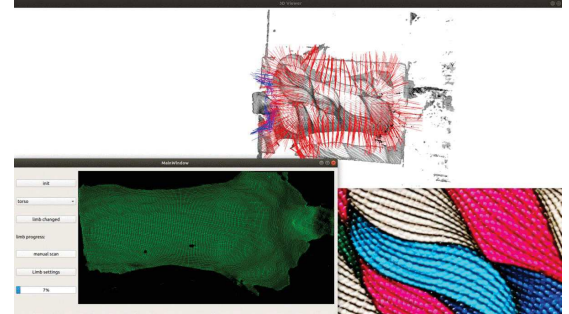
Key innovation

- Analysis of the surface of human skin's and automatic finding of the suitable trajectories
- TRL 6 – prototype verified in relevant environment



Key innovation

1. the optimal projection pattern → reducing noise
2. detection of the body → workspace, ground plane detection, aprilTag detection
3. measurement is repeated several times → minimize the noise
4. normal to important points is calculated
5. data are filtered and validated → the points where the robot should be navigated



Level of integration

- feasibility study
- dermatological head only with a model printed on a 3D printer
- recommended technological abilities - working with a computer (basics), knowledge of robotics (basics)

Market analysis

Hair removal devices market analysis

Market size value in 2019	0.66 billion \$
Market size value in 2020	0.76 billion \$
Revenue forecast in 2026	1.87 billion \$
Growth Rate from 2019 to 2026	CAGR of 15.9%

Source: <https://www.grandviewresearch.com/industry-analysis/laser-hair-removal-market>

Market analysis

US market in 2019	Sessions	Average fee \$	Expenditures \$
Laser hair removal	1,055,456	287	279,736,549
Intense pulsed light	685,755	406	303,074,190
Total	1,741,211		582,810,739

Source: <https://www.plasticsurgery.org/documents/News/Statistics/2019/cosmetic-procedures-average-cost-2019.pdf>

Net Present Value & Payback Period

Assumptions	
SAHARRA price (robotic arm,SW,vision sys)	185,000 \$
Session fee	300 \$
Sessions per day	8
SAHARRA session multiple	50 %
SAHARRA sessions pre day	12
Workdays	261

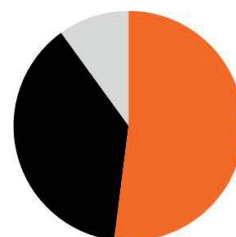
year	1	2	3	4	5
Cash flow	128,200 \$	313,200 \$	313,200 \$	313,200 \$	313,200 \$

Net Present Value (10% discount factor)	1,019,093 \$
Return of Investment (ROI)/ Years	0.59

Target market

- Beauty and dermatology clinics
 1. motivating consumers to adopt the technologically advanced products
 2. a more consistent hair removal result
 3. a relief from monotonous work
 4. increase status and client preference

Germany hair removal devices market share, by end use, 2017

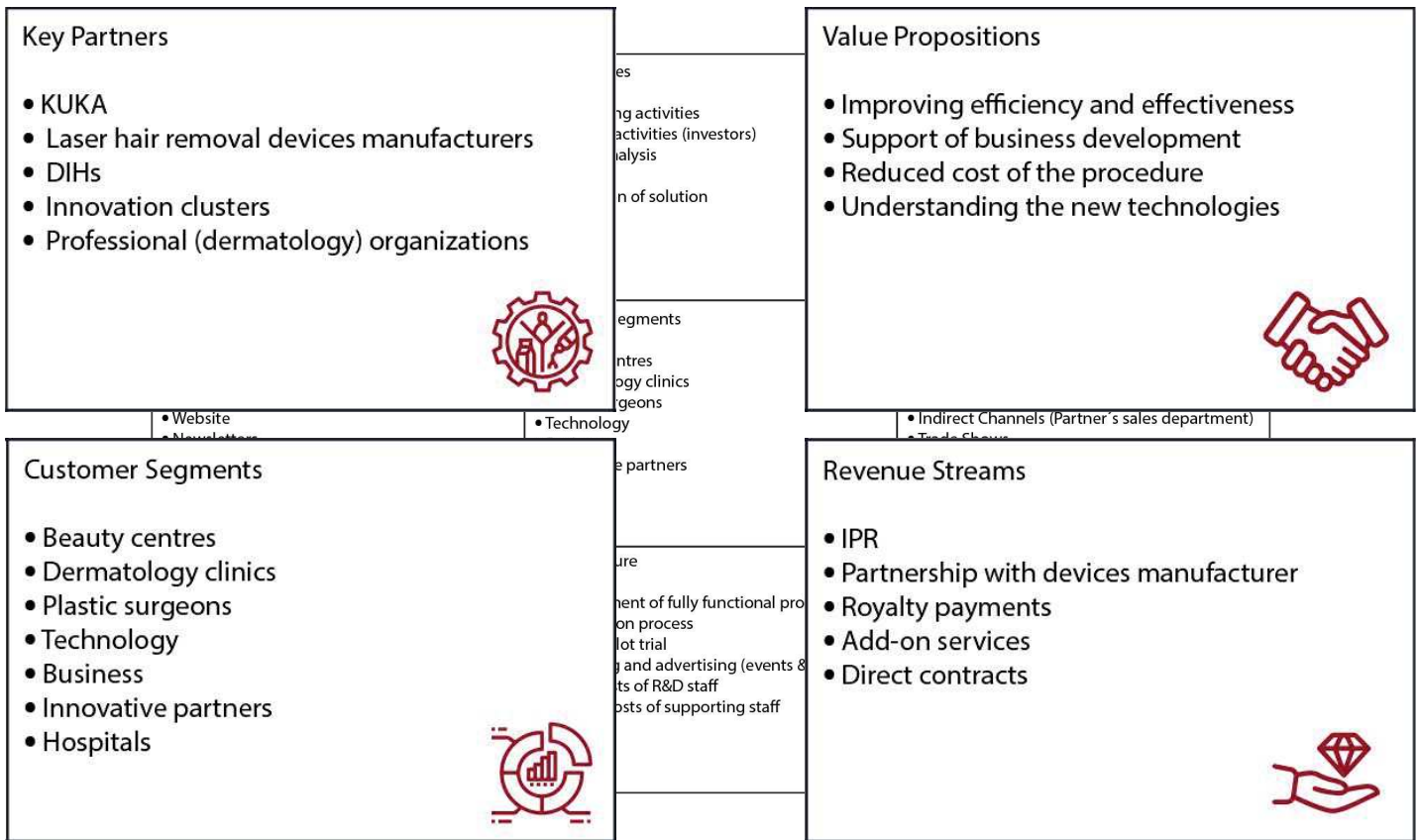


- Beauty clinics
- Dermatology clinics
- Home use

Competitive advantage

- increase the competitive advantage of the seller of the epilator
- early exclusive partnership with laser hair removal manufacturers will provide funding for the further development
- solution is not limited to a particular type of device and manufacturer

Business model canvas





Commercialization – next steps

- IPR protection
- capital increase for the development of a fully functional prototype (1 year)
- a few pilot solutions in Slovakia
- launch in the next year



Thank you for your attention



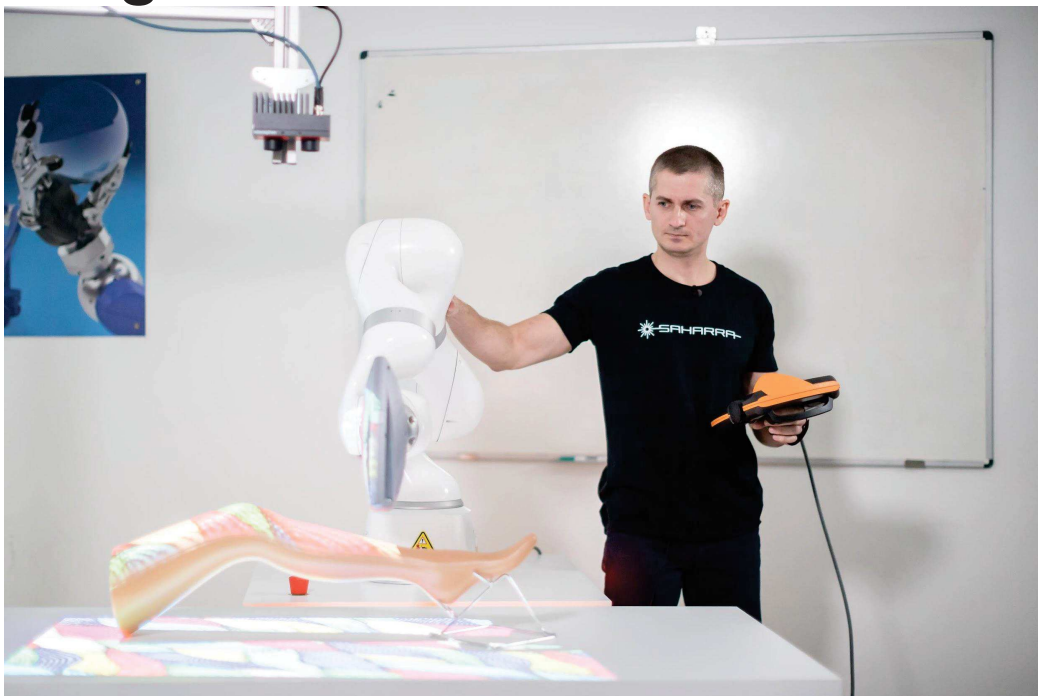
Competition

- 1st round – only 12 teams were selected
- 2nd round – only 5 finalists were selected (Italy – winner, Germany, USA, China, Slovakia)
- Jury
 - Prof. Dr. Oussama Khatib (Stanford USA)
 - Prof. Dr. Alin Albu-Schäffer (DLR Germany)
 - Prof. Dr. Ir. Stefano Stramigioli (University of Twente NL) Prof. Dr. Tobias Ortmaier (University of Hannover Germany)
 - Dr. Rainer Bischoff (Director of Research at KUKA)
 - Erico Guizzo (IEEE Spectrum Magazine)

Recording



Recording



Recording



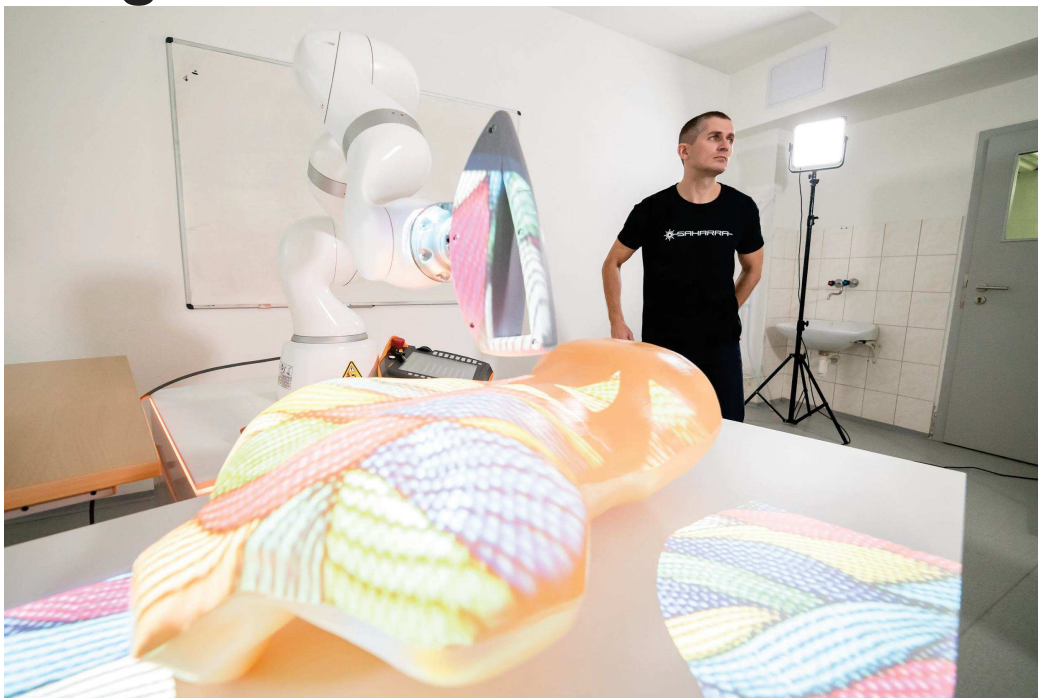
Recording



Recording

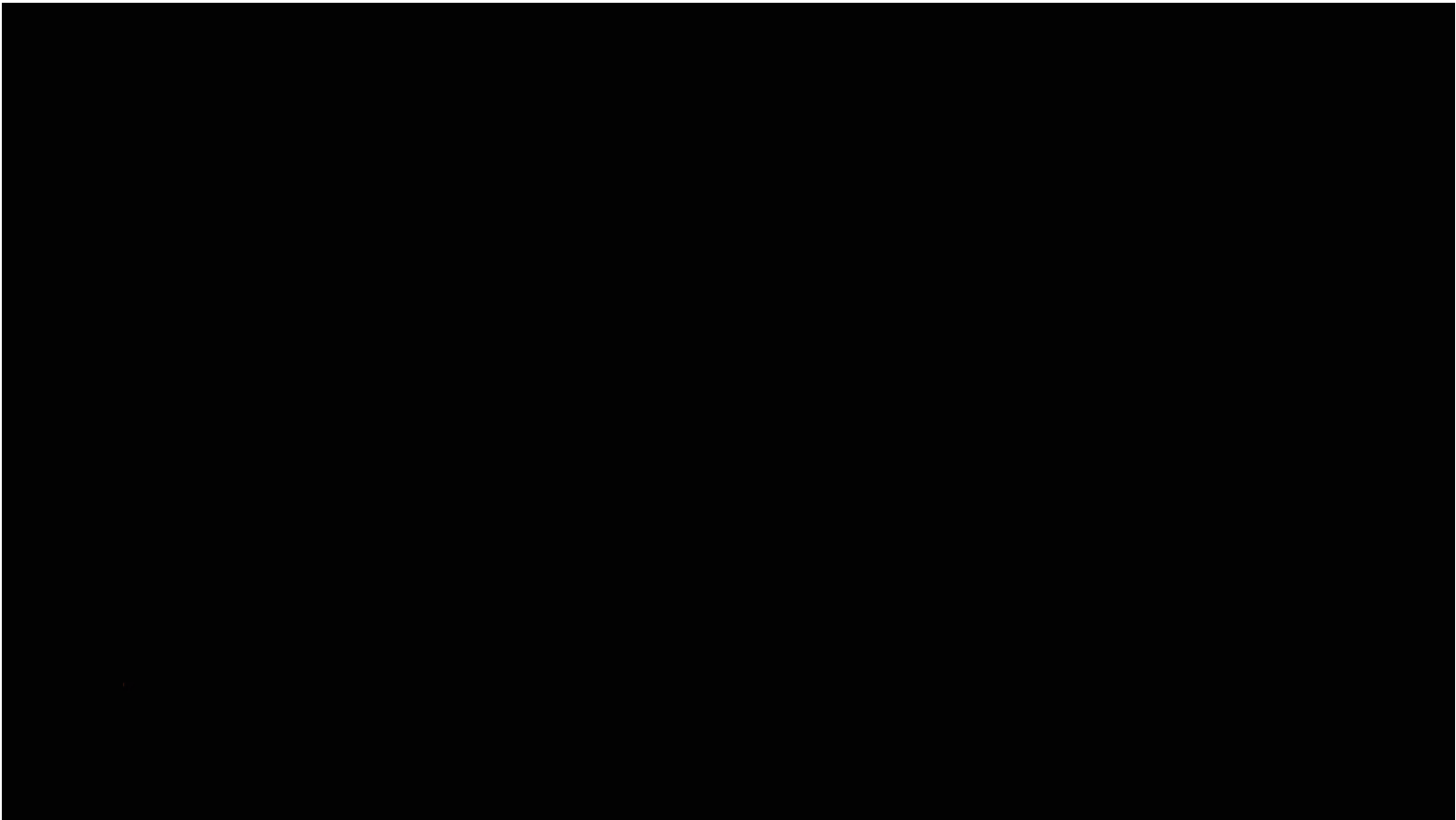


Recording



Video

- <https://youtu.be/WbL1nt7UY8Q>



And the finalists



The price



Thank you for your attention

