Textile-Based Sensors and Actuators for use in the Sports and Healthcare Sectors

Smart-Tech-Textiles – Functional Textiles in Sports, 02.07.2022, Tobias Lauwigi
### Staff and Machinery

- 400 scientists, technicians and research assistants
- 250 machines for textile processing

### International Network

![Map of International Network]

### Budget

- **15m €**
  - Basic Research
  - Collaborative Research
  - Confidential Research

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Institut für Textiltechnik of RWTH Aachen University

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Our competencies

- Fiber Spinning
- Textile Processing
- (Bio-) Functionalization
- Lab Testing
- Preclinical Trials
Embroidery Technology

Features
- Functionalization of textiles by applying e.g. silver coated fibers
- Embroidery of textile electrodes and sensors
- Local reinforcement and material combination

Machinery and Equipment
- Multi Head Embroidery Machine
- Tailored Fibre Placement (TFP) Machine
- Roll to Roll Printing System

Applications
- Wearable Monitoring of Vital-Parameters
  - Biopotential Measurements (ECG, EMG, EEG, …)
  - Optical Measurements (HR, SPO2)
  - Electrical Measurements (Respiratory rate)
- Wearable Therapy Systems
  - LED-Integration for Light- Treatment (Wound, Skin, Nerves, …)

Our experts:

Akram Idrissi
- Embroidery of Flexible Electronics
- Textile Electrode Design and Testing

Tobias Lauwigi
- Fiber Based Monitoring Systems
- 4D Textiles
- Embroidery of Smart Textiles
- Functional Printing

RWTH AACHEN UNIVERSITY
“Smart materials and structures can be defined as the materials and structures that sense and react to environmental conditions or stimuli”

Tao, Smart Fibres, Fabrics and Clothing, 2001
Medical Smart Textiles

Possible functions of Smart Textiles

- Sensor
- Energy
- Actuator
- Processing
- Wiring
- Communication
CAST - Cardiac Measuring Shirt for Telemedicine
Smart Textiles – Textile Antenna
Smart Textiles – Textile-based Pressure Sensor

Textile-based Sensor Approach

Motion Intention Detection System

Textile-based Sensor – ExoSense Approach

FF > FR
Frontal pressure

FF < FR
Rear pressure

Gait Cycle Analysis

Stance Phase
Swing Phase

Heel contact
Toe off

Leg
Foam padding
Metal

Sensor Position 1

Sensor Position 2

Sensor Position 3

Resolution
Response time

Resolution
Response time

Resolution
Response time

Foil
Electrode - Horizontal
Textile
Electrode – Vertical
Foil
Thank you for your attention!