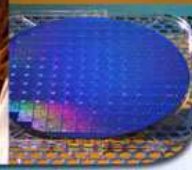


micro and nanoelectronics
microsystems
ambient intelligence
image chain
biology and health

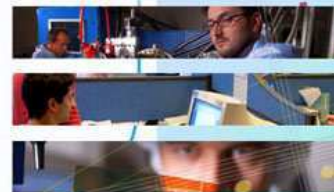


Utilisation de capteurs intégrés dans le textile pour le monitoring physiologique

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Plan de la Présentation

■ Que sont les capteurs intégrés pour le monitoring ?

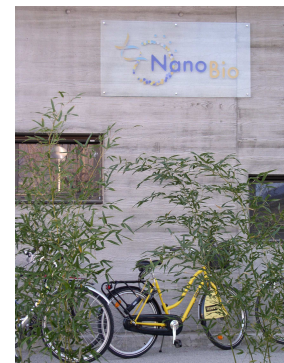
■ Capteurs Physiques



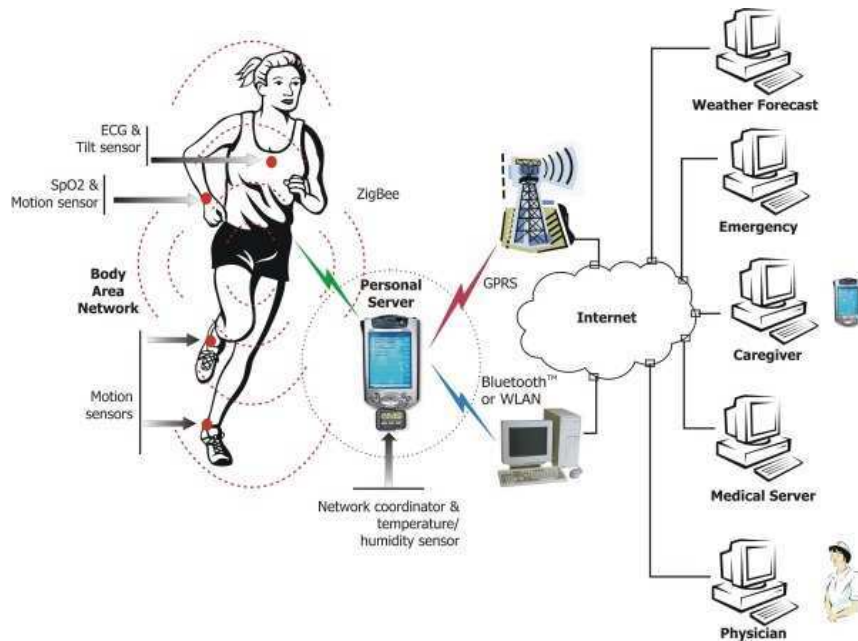
- Capteur de Mouvement : Caractéristiques et Applications
- Capteurs physiques intégrés au textile ou patch ?

■ Biocapteurs & Textiles Intelligents

- Caractéristiques
- Applications



Pourquoi des capteurs pour la santé?



Dispositif embarqué pour la santé :

- Pour monitorer, diagnostiquer, alerter, aider au traitement
- adapté à l'usage en vie courante : nouvelles modalités



Capteurs intégrés dans le textile pour le monitoring physiologique

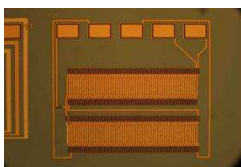
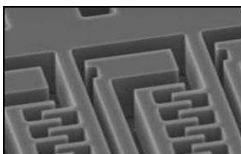
C. Gallis

11 Octobre 2010

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3D Motion Sensor



- CEA-Leti activity since 2002
- MOVEA company creation (march 2007)
- Wearable motion sensor
 - Tri-axis accelerometer (inclinometer)
 - Tri-axis magnetometer (compass)
- Main Benefits
 - MEMs sensor : high integration
 - Wireless transmission (x measurement nodes)
 - Low power consumption : autonomy
 - Operation volume not restricted : ambulatory solution (w.r.t camera-based system)



Capteurs intégrés dans le textile pour le monitoring physiologique

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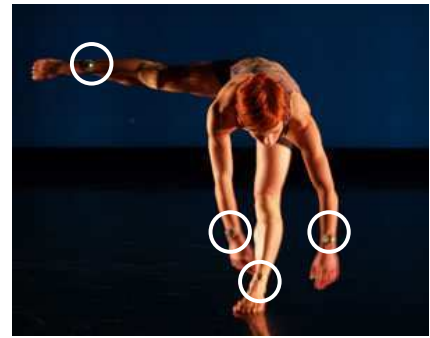
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Motion Sensors

Applications

- Posture detection
- Fall detection
- Gait analysis
- Physical rehabilitation monitoring
- Physical activity assessment
- Motion analysis for neurology epilepsy
- Condition and activity analysis
- Gaming applications
- Gesture recognition
- Status & activity analysis

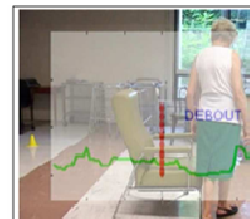
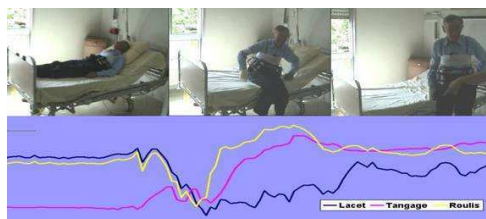


Motion Sensors

Frail elderly dependency analysis :

- Motion monitoring with one tracker (in daily life)
- Offline activity parameter computation : posture and transfer, global activity level
- Detection of dependency increase from activity evolution

Patients studies (2003-2004) with french hospitals

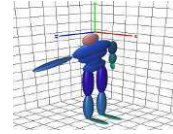


- Work in progress with french hospitals for diagnostic tool for hospital, and daily living activity monitoring

Limb Motion Analysis

■ Neuro-rehabilitation

- Development of a wireless integrated 3D motion sensor
- European project (2004)



■ Knee motion and gait analysis

- Collaboration with Metis/Thuasne/CHU (2006)

■ Gait analysis in daily life : monitoring tool

- Monitoring tool for rehabilitation
- Collaboration with CHU St Etienne (2007)
- Work in progress : PHRC to evaluate impact of hemiplegics patients (brain vascular stroke)

Bioval®, produit RMI / Movea



Motion Analysis for Epilepsy

■ Motor characterization of epilepsy seizures

- Collaboration with CHU Grenoble/Pr. Kahane (2006)
- LETI device installed in the diagnostic room



■ Nocturnal epilepsy seizure data base

- Collaboration with association EPI, FCEs (2007)
- Study in an unsupervised environment
- Proof-of-concept for real time epilepsy seizure detection



■ Analysis of movement during seizure : diagnostic & monitoring tools

- Collaboration with EPI, FCEs, Movea, CTR, CHU Grenoble (2008)
- Seizure (offline) **characterization** : quantitative analysis of movement during seizure
- Night seizure (online) **detection** in socio-medical establishment
=> validation in 2010 for 5 patients



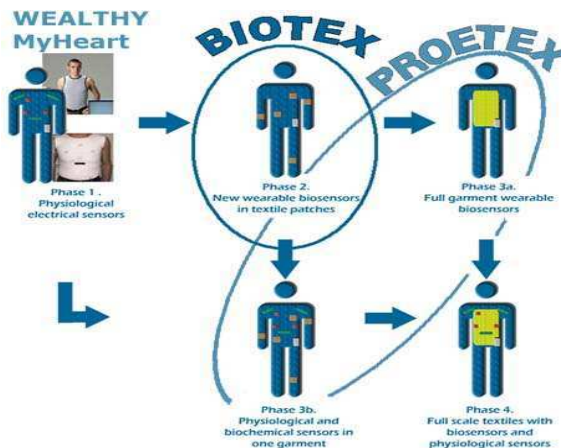
Capteurs Physiques et Textiles?

■ Capteurs intégrés au vêtement de l'individu : textiles «intelligents»



- ECG
- Capteur de température
- Respiration
- Activité, attitude
- Liens de communication Bluetooth et GPRS
- Etc...

Why BioSensors ?



Physiological measurements

■ From wearable physical sensors

- ECG
- Respiration rate
- Motion, fall
- Activity
- (Bluetooth, GPRS, ...)

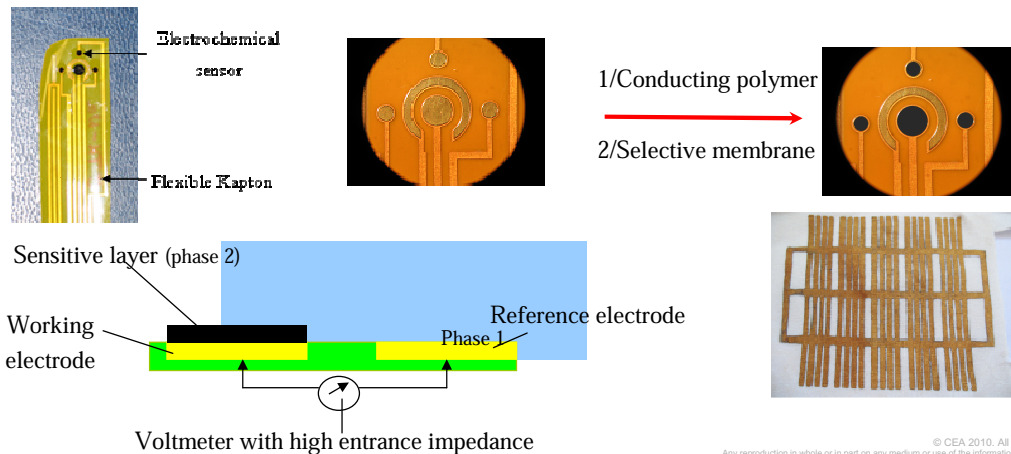
■ to **wearable biochemical sensor**

- Medical parameters from body fluids
 - sweat, saliva, tears, urea, exudates ...
- non-invasive measurement

Biosensors : Features

Electrochemical Techniques

- Sensitive detection & continuous or punctual quantification
- Integration in textile or on flexible materials
- Multiparametric detection

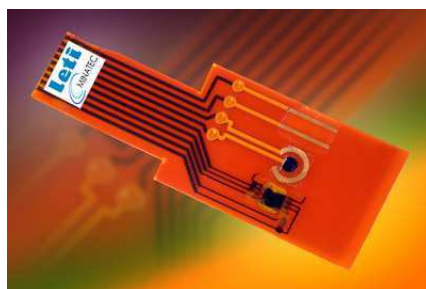


Biosensors : Application 1

Sweat Analysis for health monitoring

Biosensing textiles to support health management

- Development of biochemical sensing techniques for health monitoring, and development of a **flexible sensing patch** integrated in a sweat textile collector : analysis of concentration of Na^+ , K^+ and Cl^- ions in sweat
- Monitoring of body fluids on people via sensors distributed on a flexible substrate and performing biochemical measurements



Flexible sensing patch (Kapton)



Integrated Biosensors

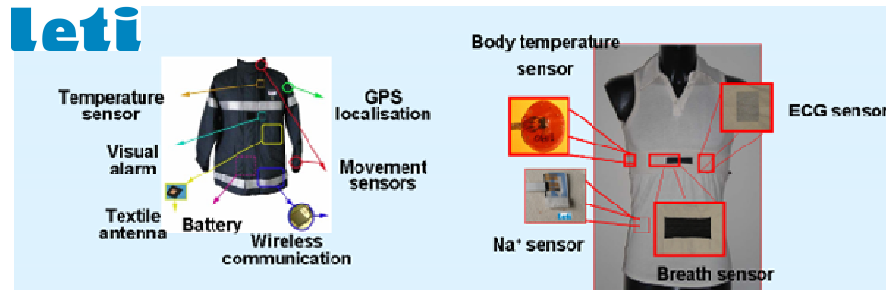
Biosensors & Smart Textiles : Application 2

Advanced e-textiles for firefighters and civilian victims

- Sweat analysis for dehydration level (Na^+ concentration)
- Transfer of the electrodes on fabrics & miniaturization of electronics and implementation of signal processing on micro-controller

PROETEX

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Capteurs intégrés dans le textile pour le monitoring physiologique



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Conclusion : Leti - Facilities & Healthcare

200 m² Clean room for Biology / Chemistry

- Spotting
- Electro polymerization
- In-situ Synthesis
- Fluorescence Detection



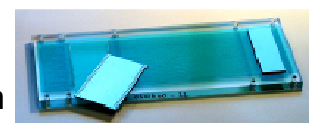
700 m² Laboratories

- Biology
- Surface Chemistry
- Microfluidics



Technological Platforms

- Silicon 200 mm MEMS
- μ packaging
- Molecular imaging for small animals



=> 4900m² dedicated to micro and nanobiotech

micro and nanoelectronics
microsystems
ambient intelligence
biology and health
image chain



Thank you for your attention!

Loyalty
Entrepreneurship
Team work
Loyalty
Entrepreneurship
Team work
Innovation

**Innovation
for industry**



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