





Dispositifs électroniques biomédicaux

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Positionnement local de la thématique « santé » à SU

Création de l'Institut Universitaire d'Ingénierie en Santé (IUIS) en Juin 2014

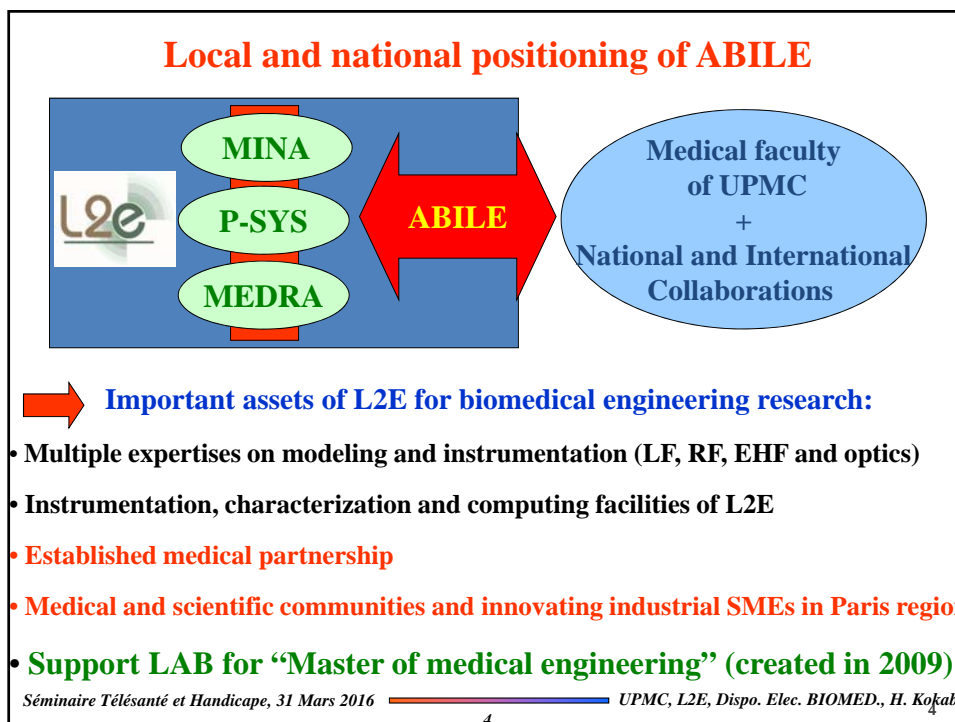
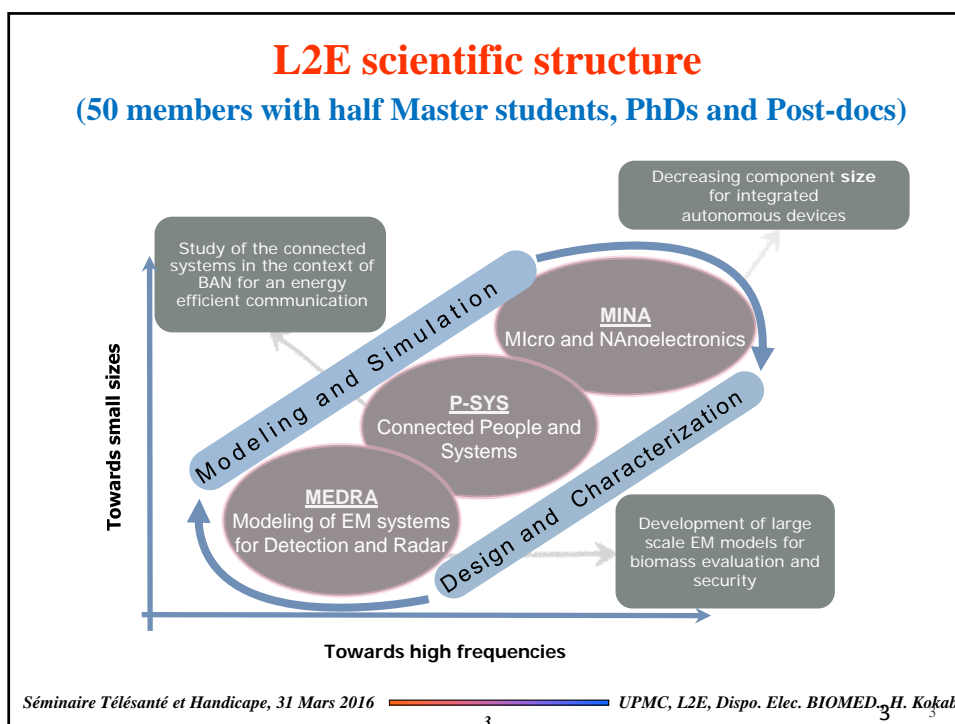
Objectifs de l'IUIS : continuum (tout au long de la vie et au sens continuum R, R&D, innovation, formation)

Projet scientifique structuré autour de quatre axes :

1. Modélisation et simulation du sujet sain et pathologique (patient spécifique)
2. Conception et réalisation de dispositifs biomédicaux
3. E-santé
4. Traitement et analyse des signaux et images (multi-modalité et interaction)

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Short descriptions of a few research projects of ABILE transverse axis at L2E

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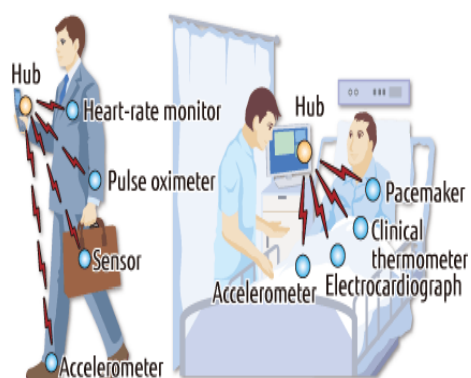
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Connected patient using BAN (Body Array Network) of sensors at home (E-patient)

Julien Sarrazin, L2E – UPMC
Fabien KOSKAS, Vascular surgery, Pitié Salpêtrière

Monitoring of a patient at home

- Rapid intervention in case of problems
- Faster return of the patient at home (comfort, release of a hospital bed, reduced postoperative stress ...)



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Connected patient using BAN of sensors at home (E-patient)

Monitoring through the Body Area Networks (BAN) wireless sensors

Running time: a few weeks

Several sensors are needed at different places of the body :

- Local temperature (low consumption, low rate)
- ECG (several electrodes required)
- Pressure (important sensor consumption)
- O₂ in the blood

Challenges

- Integration of wireless sensor in a sticker patch-type structure
- Autonomy of the sensor



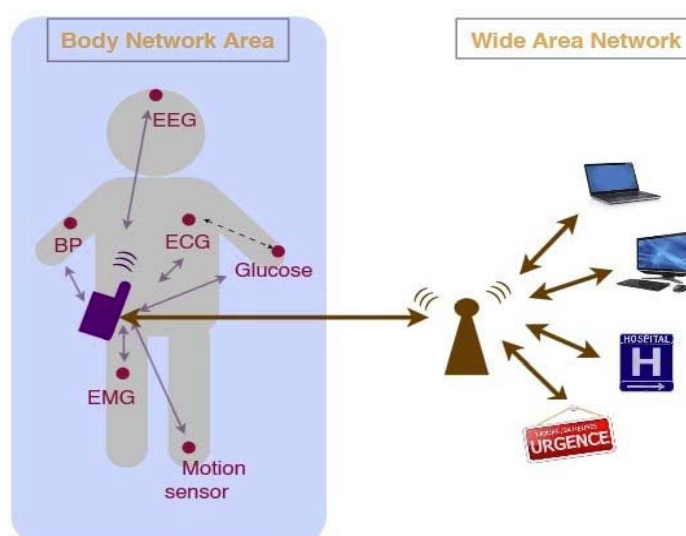
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Body Array Network (BAN) and Wide Area Network (WAN)

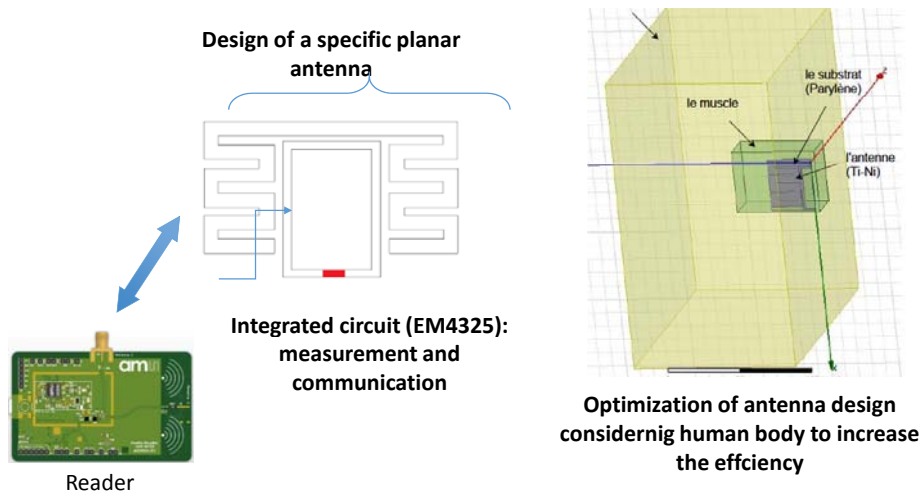


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Implementation of the locale temperature measurement



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Indoor localization and physiological measurement at distance

**Post-doc position, Dr. Ting ZHANG,
granted by "Chair E-Biomed" at L2E**

Supervising:

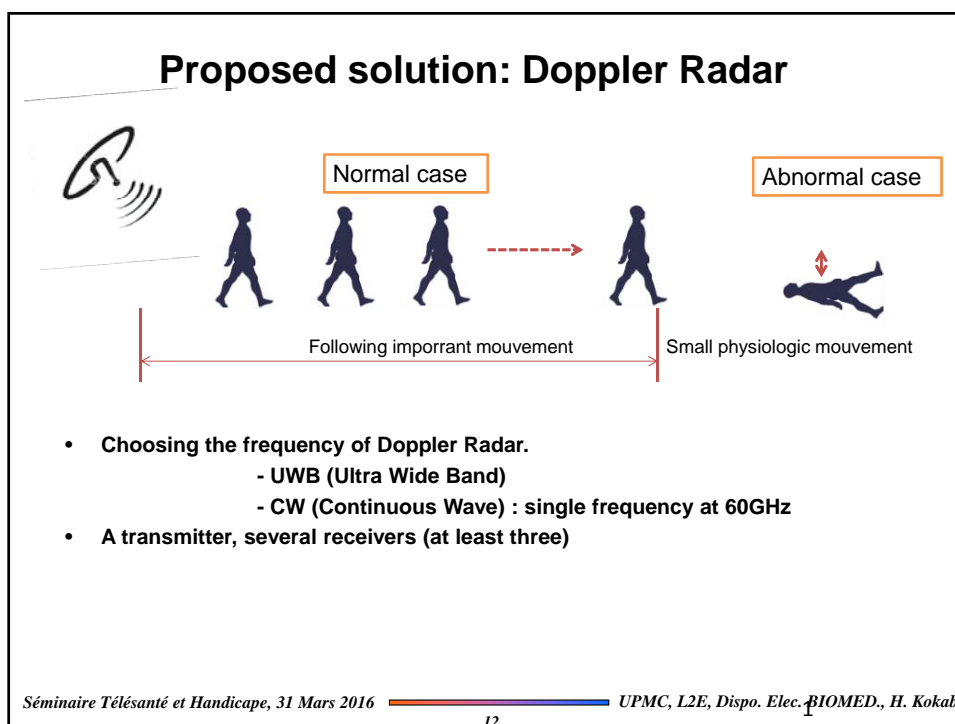
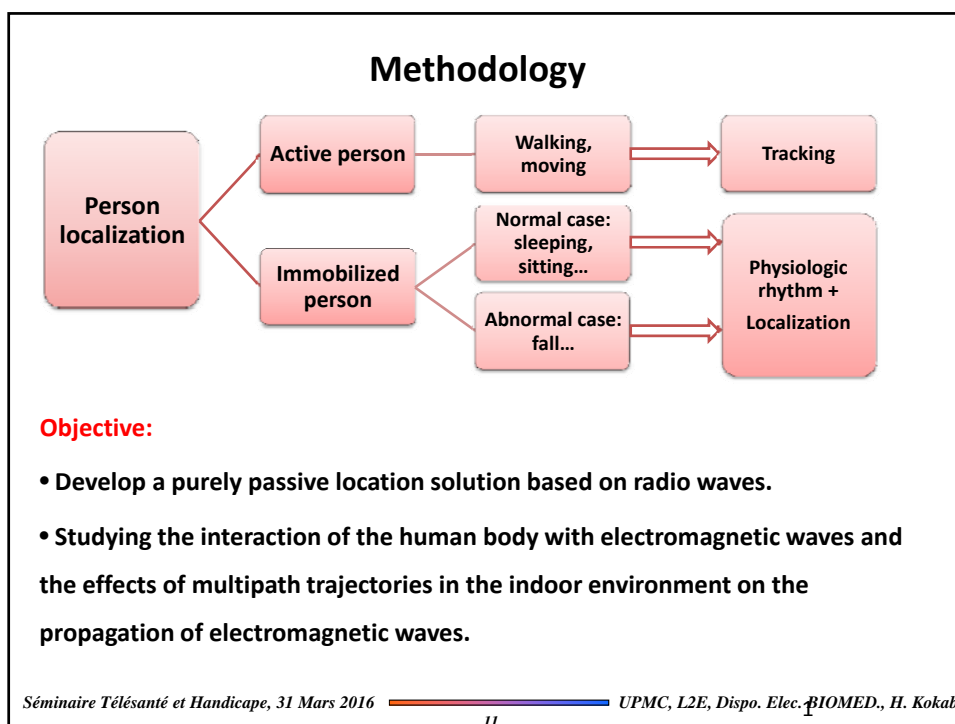
Julien Sarrazin and Guido Valerio, L2E – UPMC
Dan Istrate, Chaire EBiomed, BMBI UMR CNRS 7338 – UTC



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Principle of Doppler Radar

- Emission signal by TX $T(t) = A_e \cos(2\pi ft)$

- Reception signal by RX

$$R(t) = A_r \cos\left(2\pi ft + \frac{4\pi d}{\lambda} + \frac{4\pi x(t)}{\lambda} + \phi^{res}(t)\right)$$

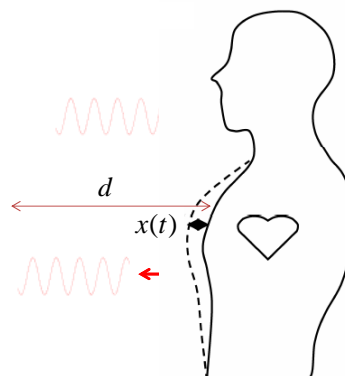
- For the immobilized person : d is a constant

Physiologique mouvement

Breathing

Heart beating

$$x(t) = m_r \sin(\omega_r t + \phi_r) + m_h \sin(\omega_h t + \phi_h)$$



Interactive and connected rehabilitation systems for E-Health

Phd candidate, Mr. Halim TANNOUS
granted by "Chair E-Biomed" in co-supervised with L2E

Supervising:

Julien Sarrazin and Aziz Benlarbi-Delai, L2E – UPMC
Dan Istrate, Chaire EBiomed, BMBI UMR CNRS 7338 – UTC
TT Dao BMBI UMR CNRS 7338 – UTC

Context

15% of the population suffers from disability (World Health Organization)



blog.militarydisabilitymadeeasy.com/

35-50% in developed countries,
76-85% in the developing countries
are not being treated !

Serious Gaming presents a solution, with less therapeutically



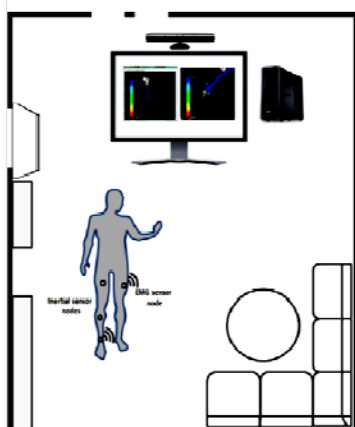
fitness-gaming.com

While allowing patients to remain at home and stay motivated.

Objective



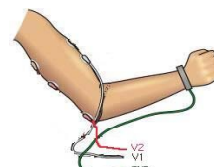
msdn.microsoft.com



Dao et al., Jetsan 2015



<http://www.shimmersensing.com/>



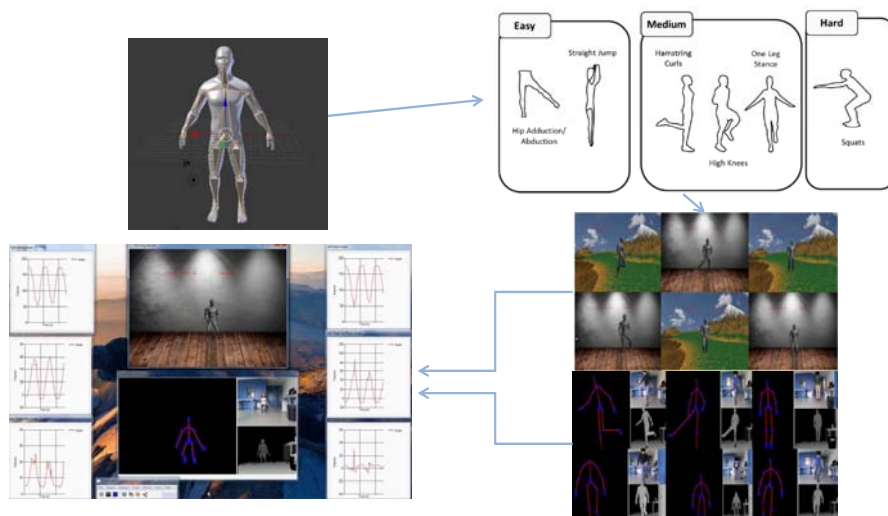
store.fut-electronics.com

Existing tools

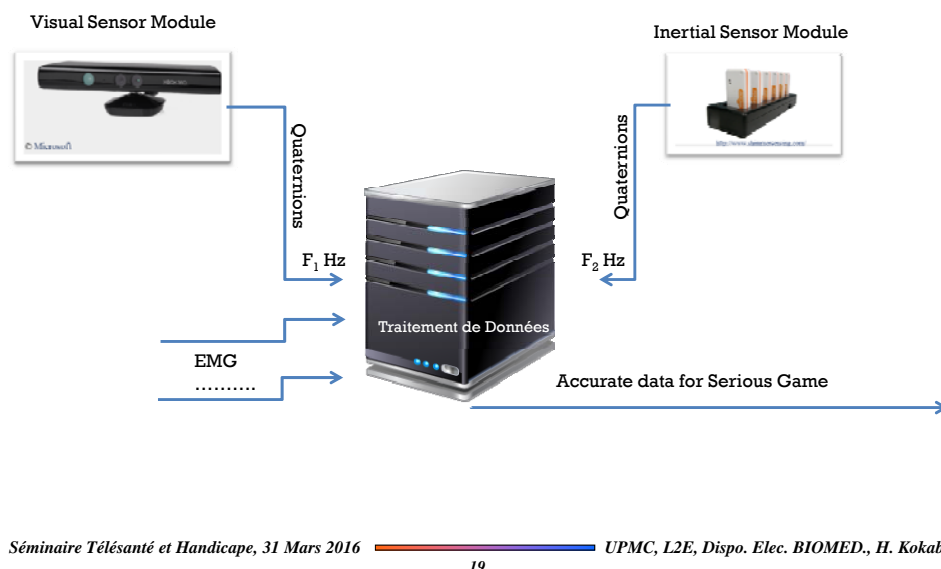


www.virtual-realityrehabilitation.com/products/seeme

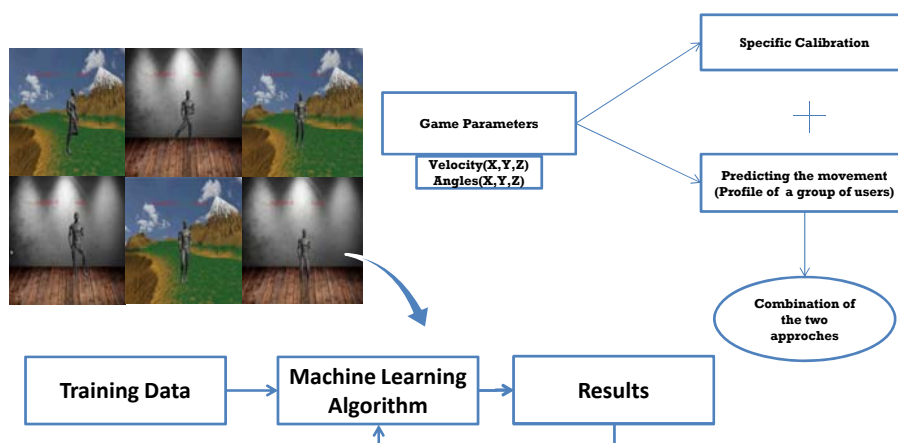
Preliminary developed software



Data fusion



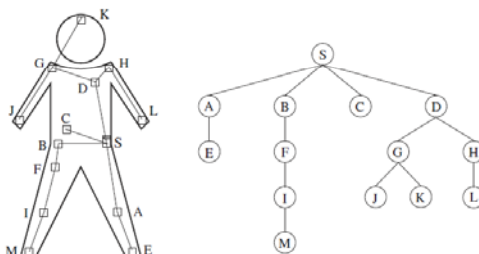
Movement correction



Power consumption

- Studying the optimization of the power consumption.

- Architecture
- Sensor positions



model	E_{tot} (μ J/bit)	E_s (μ J/bit)	N_R
Single-hop	127.740	9.826	-
Multi-hop	4.202	0.323	-
Relay Network	1.383	0.017	22
EAWD ($p = 200$)	1.923	0.017	11

Images from: J. Elias / Ad Hoc Networks 13 (2014)

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Thank you for your attention !



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