SHERPAM

Sensors for Health Recording and Physical Activity Monitoring

- LTSI - INSERM 1099 - UR1
- CASA - IRISA UMR 6074
- M2S EA 7470 - ENS Rennes
- LP3C EA 1285 – UR2
- CIC 1414 – CHU Rennes

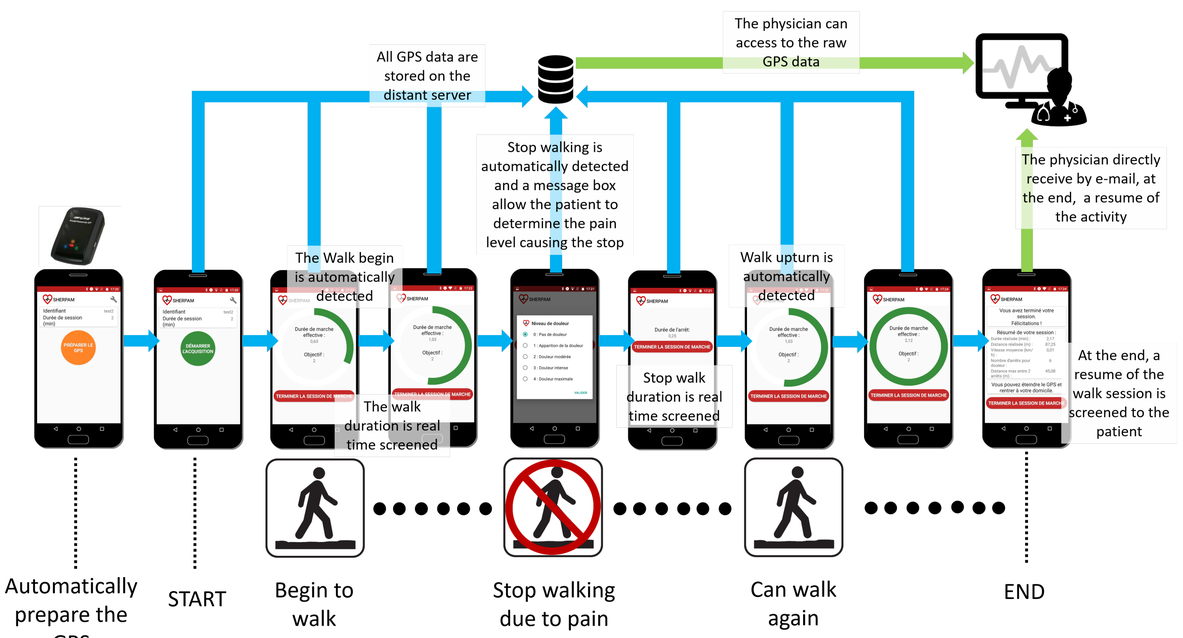
OBJECTIVES

Conceive, **implement**, and **validate** experimentally devices allowing biophysical data of mobile subjects to be gathered and exploited in a continuous flow

Publications: J Euro Appl Physiol (2017), Biomedical Signal Processing and Control (Journal, 2017), Advances in Biomedical Engineering (ICABME'15), Mobihealth'16 - 6th EAI International Conference on Wireless Mobile Communication and Healthcare (November 2016) - Healthcom'16 - 18th International Conference on e-Health Networking, Applications and Services (September 2016) - ECSS'16 Conference - European College of Sports Science (2016) 45ième Computing In cardiology (2018).
Software registrations: Sherpam App, Sherpam AOMI, RACHA.
Honorable Mention Award: student oral presentation in the International Conference on Ambulatory Monitoring of Physical Activity and Movement (ICAMPAM'17).

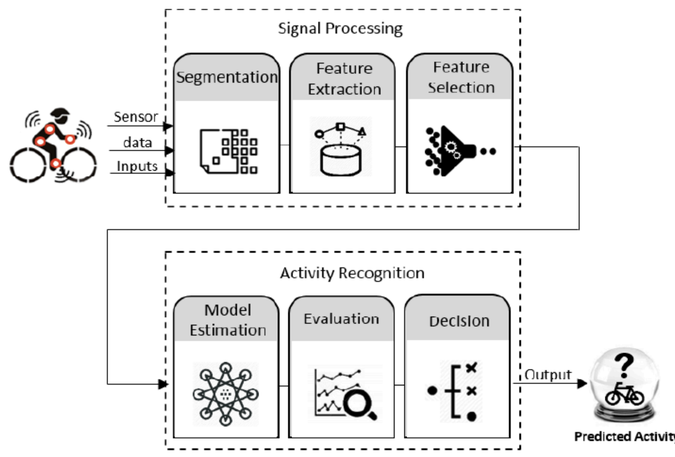
TWO CLINICAL APPLICATIONS

1) Rehabilitation of patients with peripheral artery disease



Conception of a mobile platform
Outdoor assessment of functional limitations and community-based walking programs

2) Activity recognition algorithms in real-world scenarios



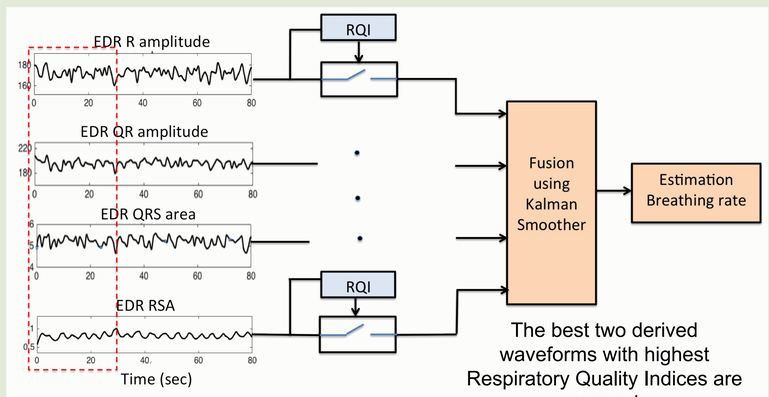
	F-score	Zephyr	ActiGraph	Shimmer
Case 1	Train: Standardized / Test: Standardized	Chest: 95.4 %	Ankle: 89.9 %	Ankle: 91.8 %
Case 2	Train: Standardized / Test: Free-Living (vs)	50.7 % (- 44.7)	49.8 % (- 40.1)	55.0 % (- 36.8)
Case 3	Train: Standardized + Free-Living / Test: Free-Living	62.2 % (+ 11.5)	59.5 % (+ 9.7)	62.4 % (+ 7.4)

Conception of a generic activity recognition platform

1. An activity recognition model trained on controlled data reveals high performance
2. Performances decreases at recognizing activities performed in uncontrolled manner in a free-living environment.

RESPIRATION RATE ANALYSIS

Design of a new signal processing chain for Respiration Rate estimation based on PPG and ECG



The best two derived waveforms with highest Respiratory Quality Indices are merged

Comparison of our approach with existing methods in the literature on the CapnoBase dataset (42 subjects)

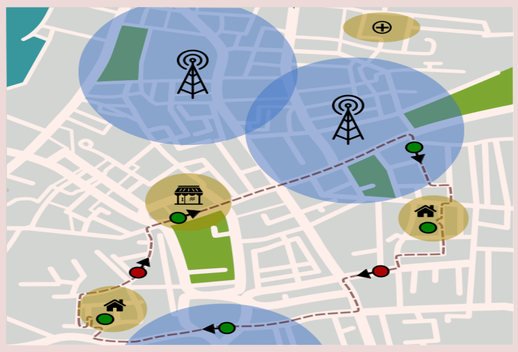
	Window size: 32s	Window size: 64s
	MAE(bpm)	
Proposed method	**0.43(0-3.33)**	**0.21 (0-3.1)**
Pimentel(2016)	1.5 (0.5-3.4)	1.9 (0.3-3.4)
Karlen(2013)	1.2(0.5-3.4)	0.8 (0.3-2.7)
Flemming(2007)	1.4 (0.5-3.8)	1.1 (0.4-3.5)
Shelly(2006)	4.5 (0.8-10.5)	2.2 (0.2-8.3)
Nilsson(2000)	10.5 (4.9-12.7)	10.2 (4.8-12.4)

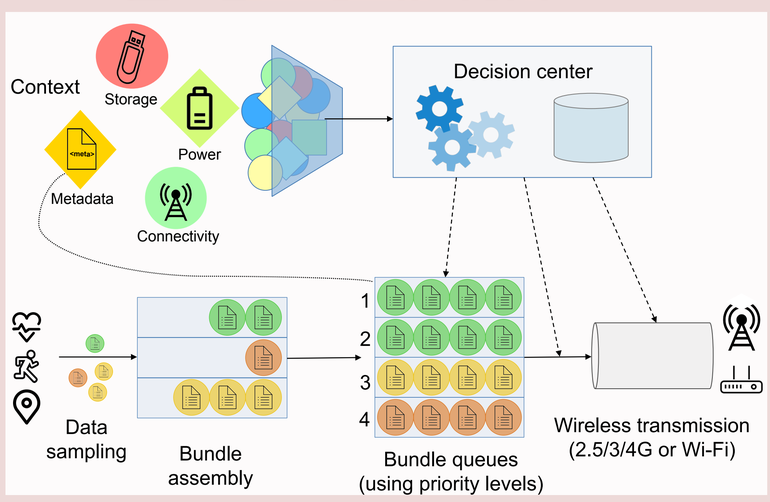
Median Absolute Error (breaths/min and interquartile range (25^{th}-75^{th}))

ADAPTIVE DATA TRANSMISSION STRATEGIES

Need for agility to account for fluctuating constraints:

- Network connectivity
- Power
- Storage capacity
- Amount and nature of data to be transmitted (priority, deadline, etc.)





USER UNDERSTANDING

1) User's profiles and requirements for both patients and professionals involved.
2) Authentication of primary functions and risks of sensors/ gateway/mobile app. /web site use
3) Review wearable sensor acceptance and usability
4) Pre-test of the acceptance survey and test of the SHERPAM user manuel's understanding