DOCTORATE PROGRAM IN ELECTRONIC ENGINEERING

DOCTORAL TRAINING SEMINARS: RESEARCH PROJECTS IN THE DEPARTMENT OF ELECTRONIC ENGINEERING

Markers of healthy life styles adherence by using smartphones as monitoring device.

Mireya Fernández & Juan Ramos

21-02-2014

PROGRAMA DE DOCTORAT EN ENGINYERIA ELECTRÒNICA

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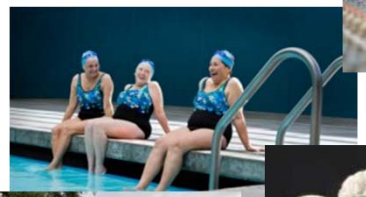
UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH
Departament d'Enginyeria Electrònica

OUTLINE:

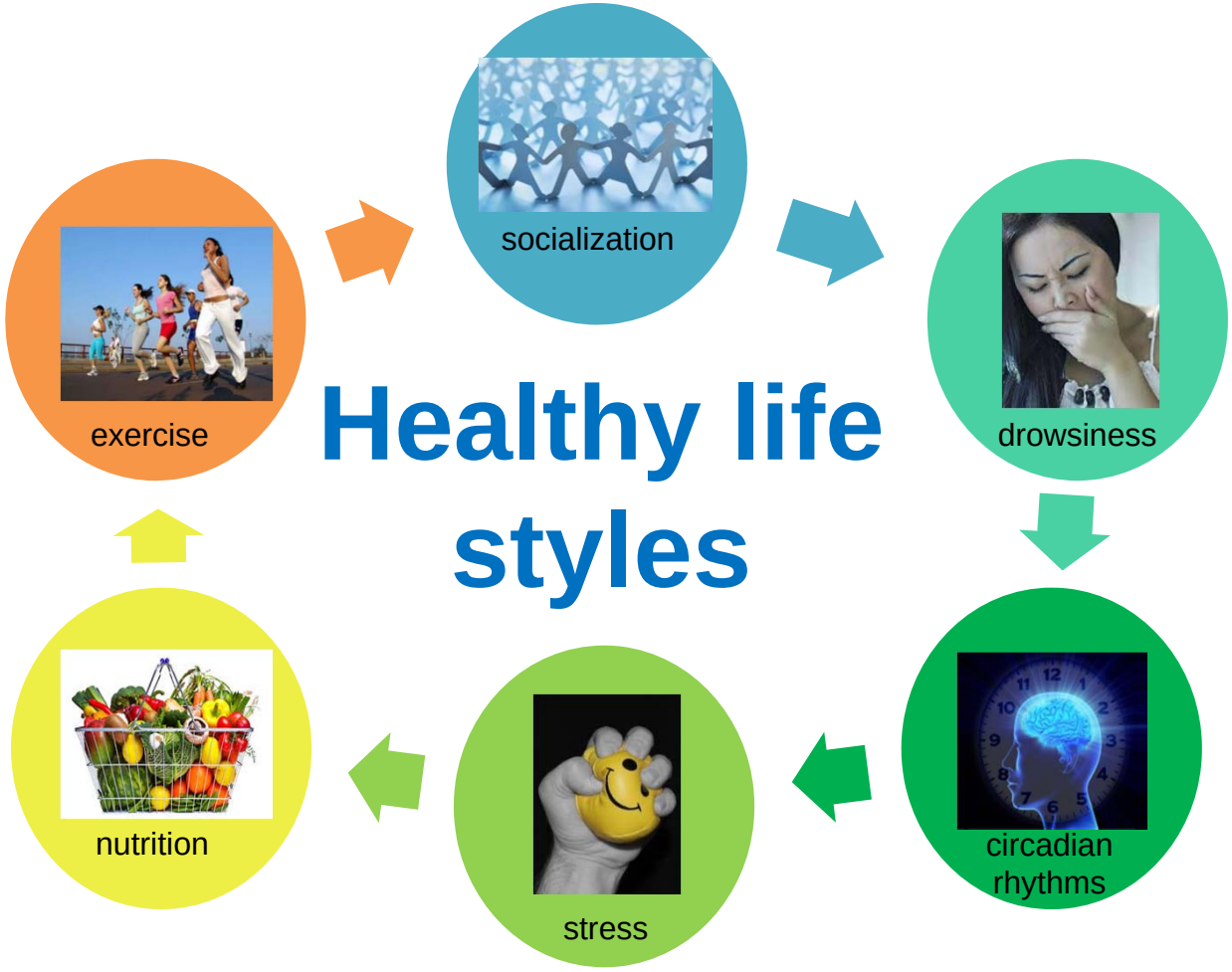
1.- Introduction
2.- Goals
3.- System Architecture
4.- What have we done
5.- Where we are now
6.- Who have made this possible - Resources
7.- Next steps

Introduction

- Increasing life Expectancy
- promotion of healthy lifestyles
- **aging with wellbeing guaranty**



Introduction



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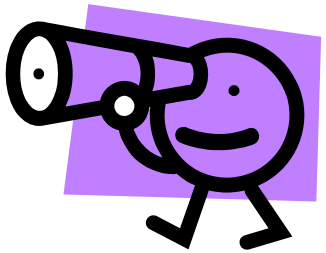



socialization

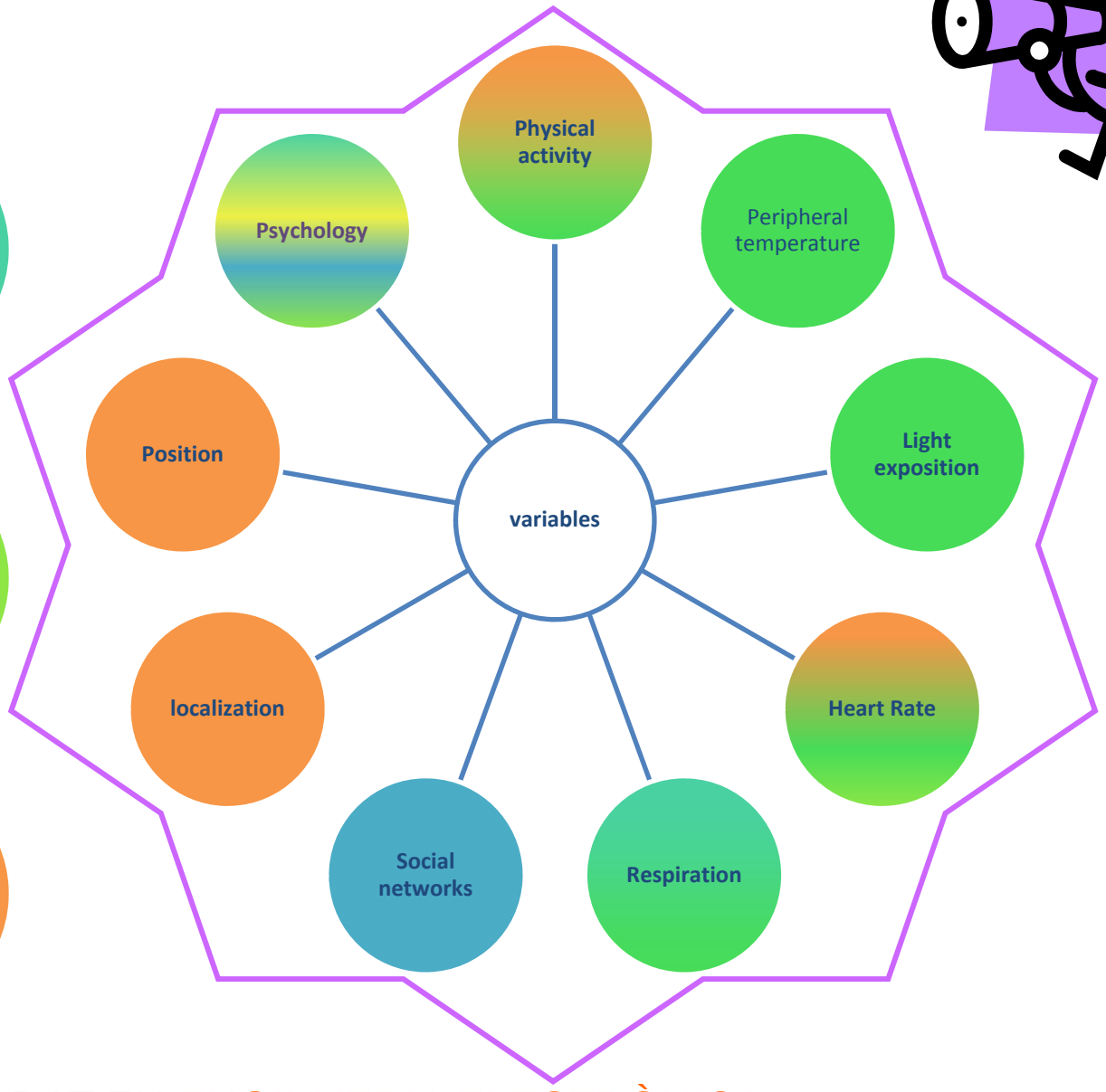

drowsiness


circadian rhythms


stress


nutrition


exercise



Introduction

Goals

1.- Development of sensor platforms for measuring biological and behavioral signals for the assessment of the condition of the individual

Sensor platform = physical sensor + psychological questionnaires analysis

2.- Development of a modular acquisition system, portable (wearable) …and inconspicuous.

3.- Development of signal processing algorithms to evaluate healthy life styles adherence

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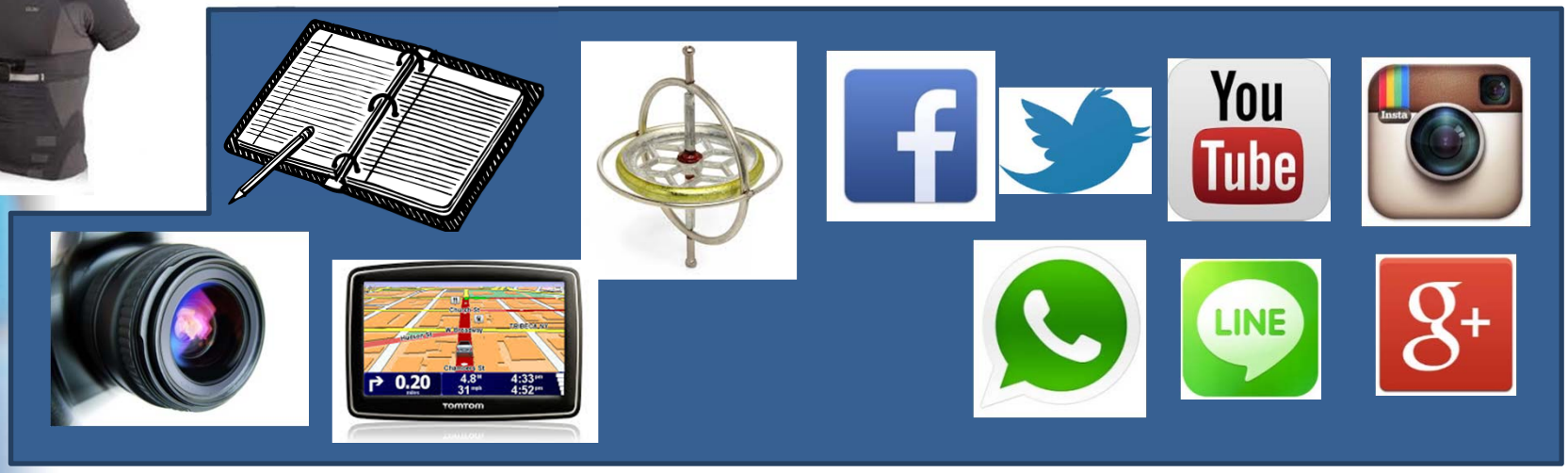

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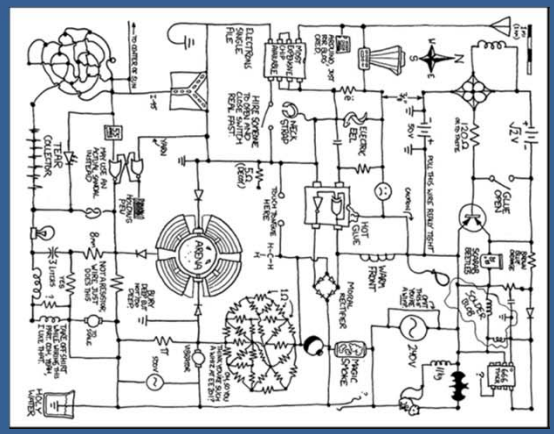

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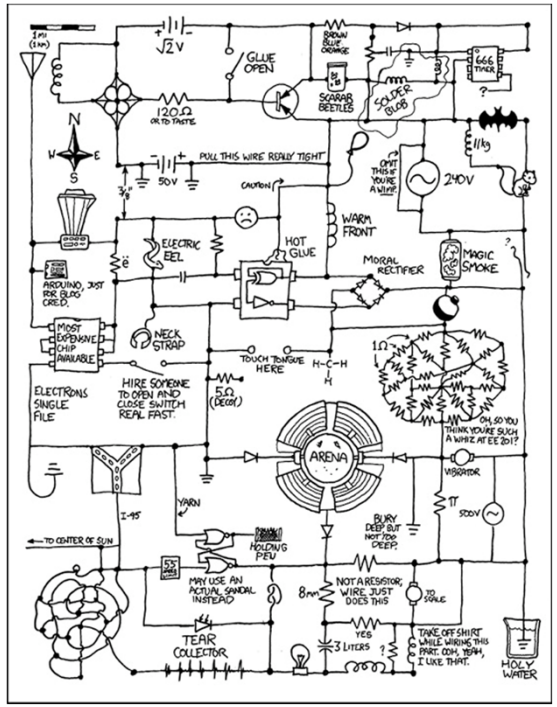

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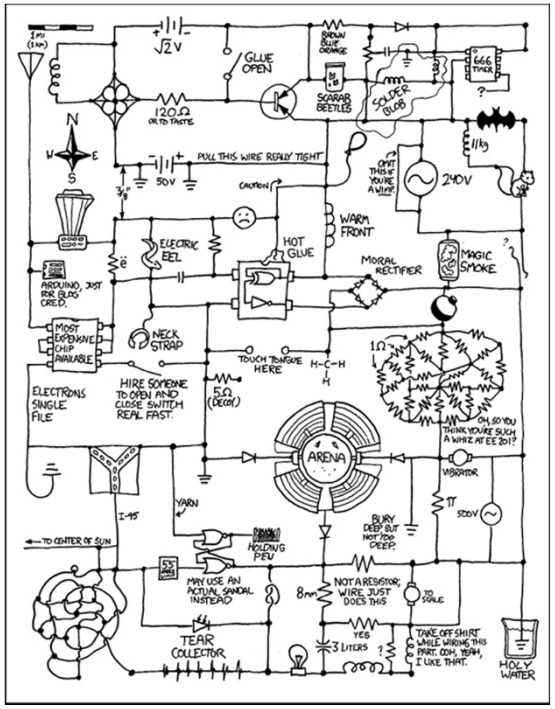

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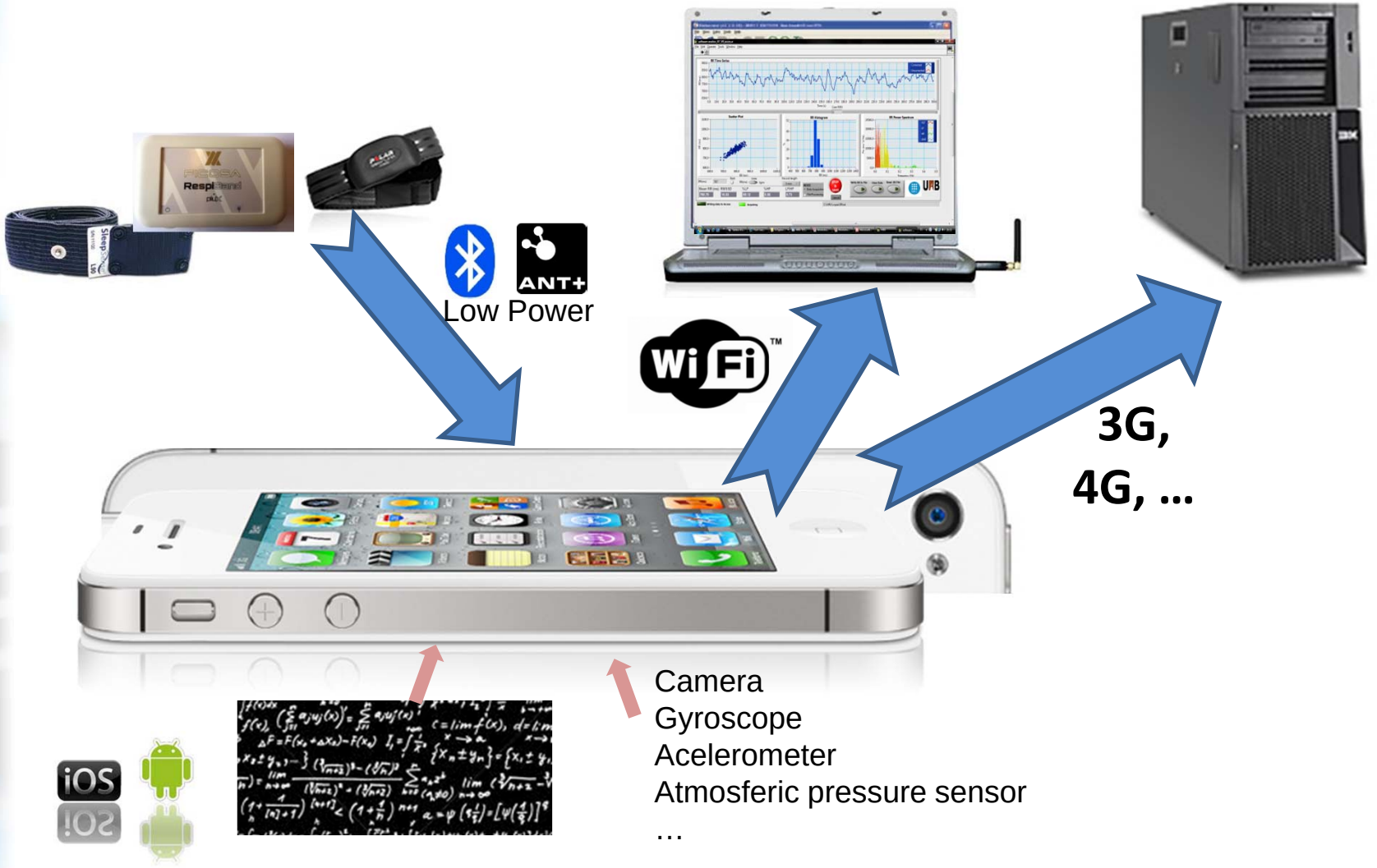
System Architecture

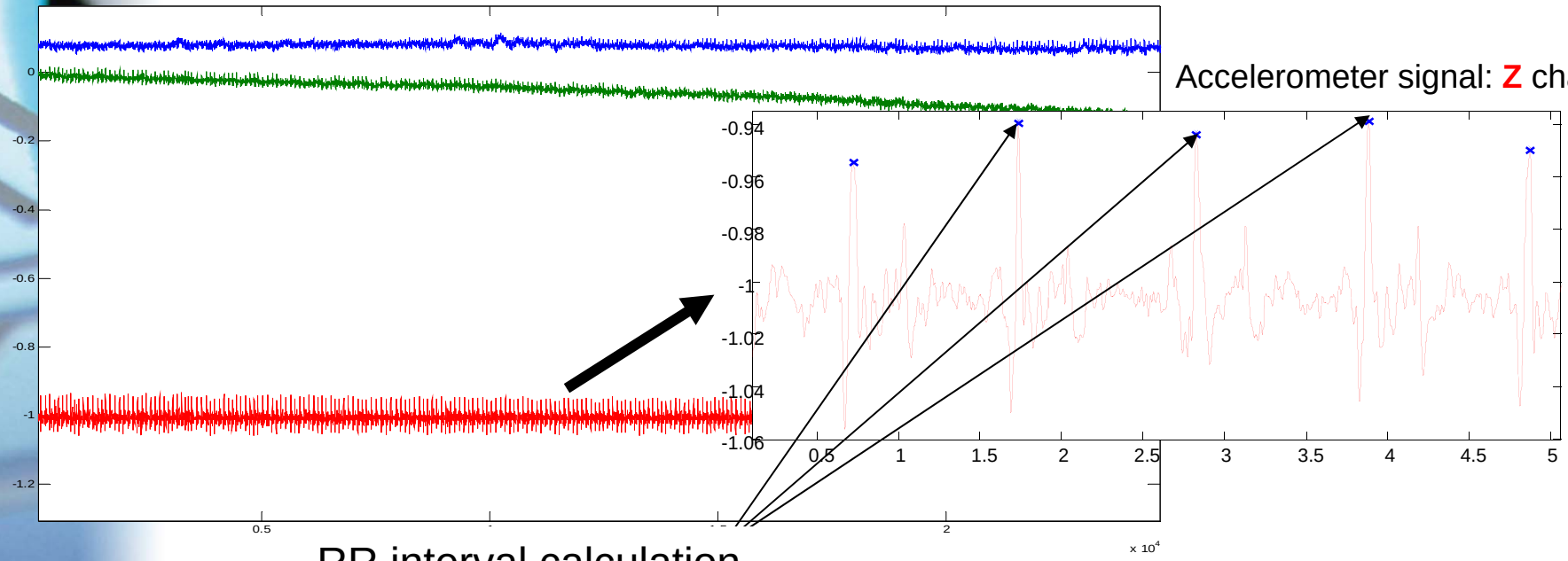


System Architecture

What have we done

Measuring Heart Rate Variability with accelerometer

FCB - Bàsquet Base - Resultados - Jugador D.M.



Accelerometer signal: **Z** channel

RR interval calculation

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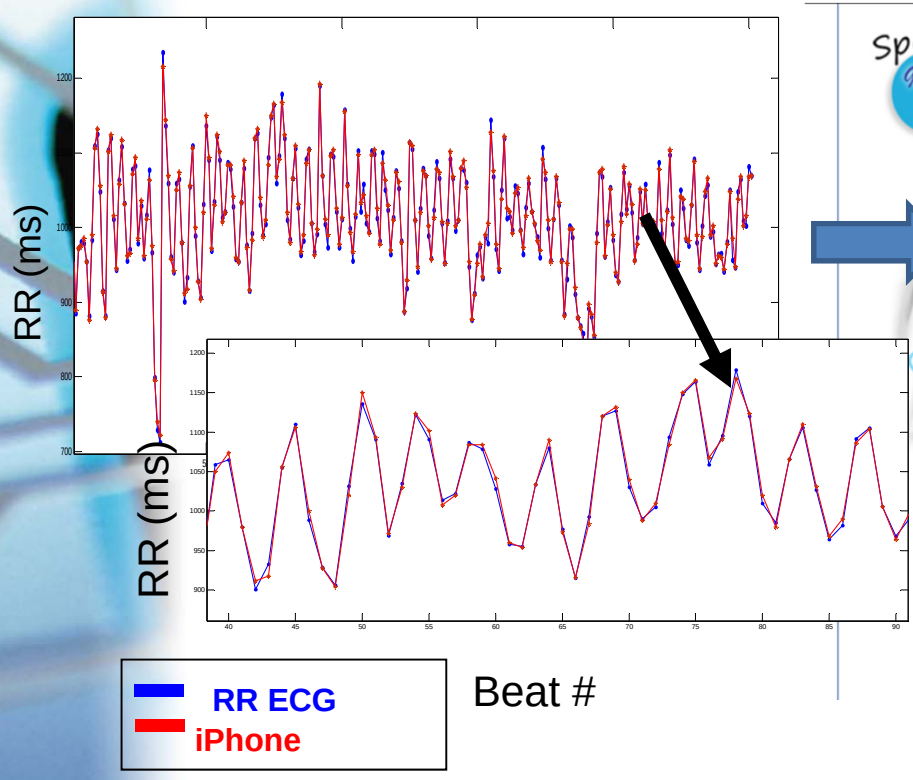
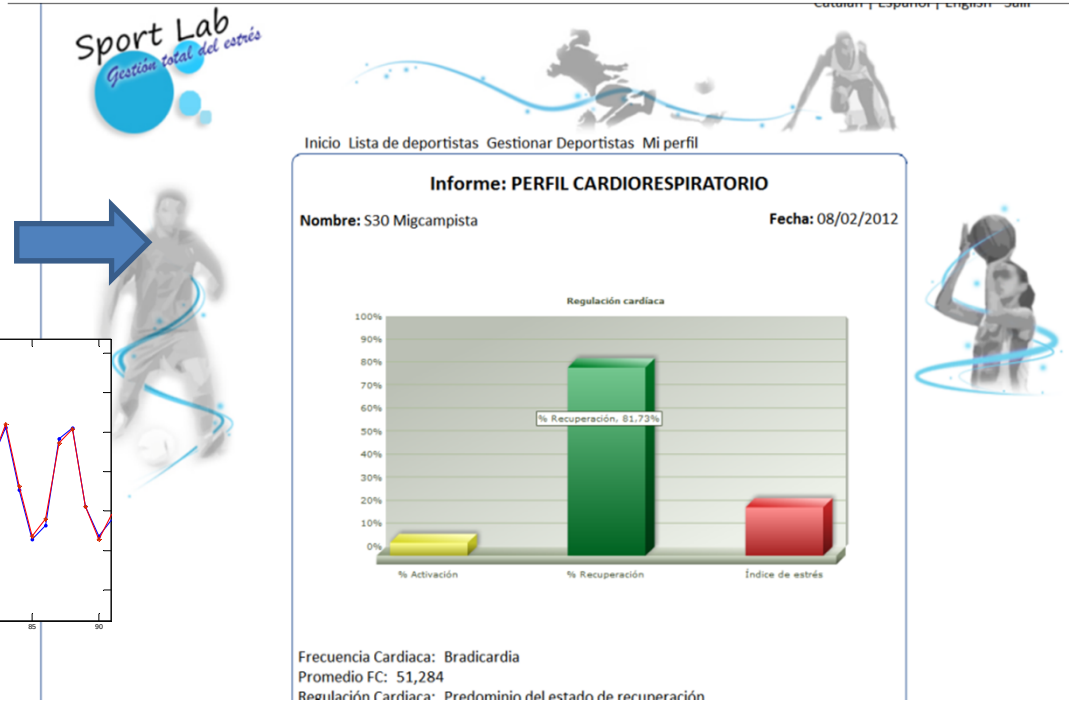
What have we done

Heart Rate Variability as stress predictor.
How good is our signal?

Comparison: RR ECG / iPhone

FCB - Bàsquet Base - Resultados - Jugador D.M.





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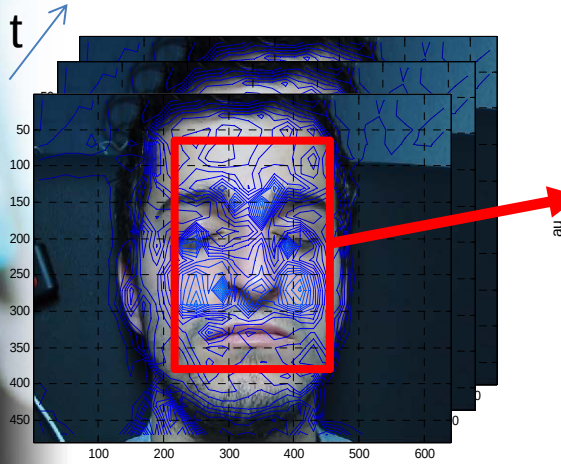
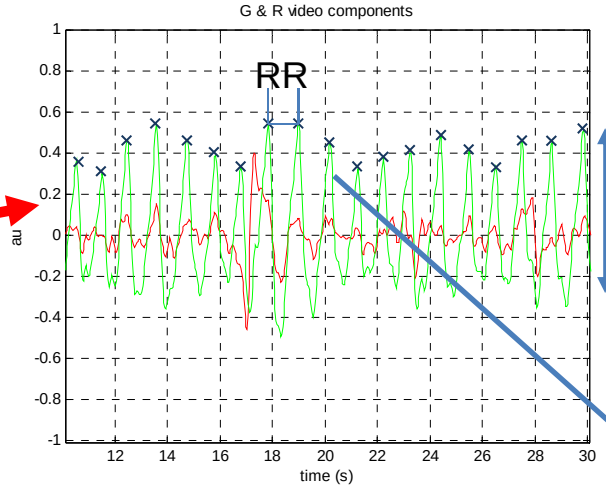
What have we done

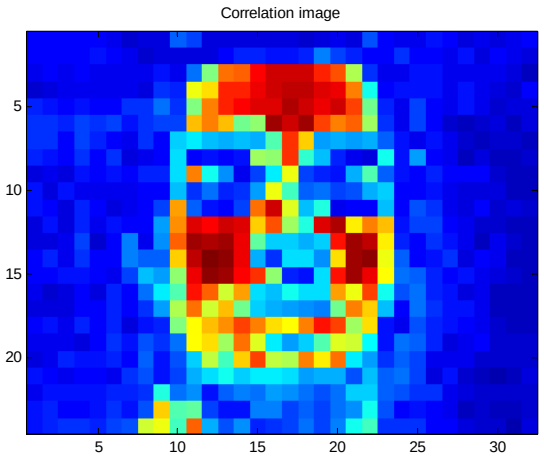
UAB

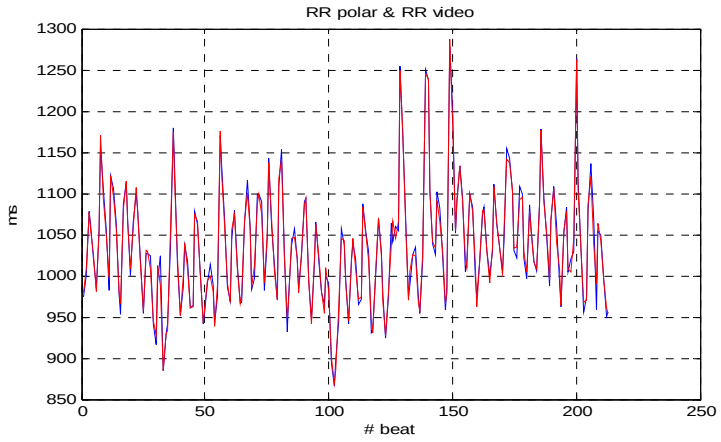
Measuring Heart Rate and respiration by video signal analysis





Very small changes in image <1LSB





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What have we done

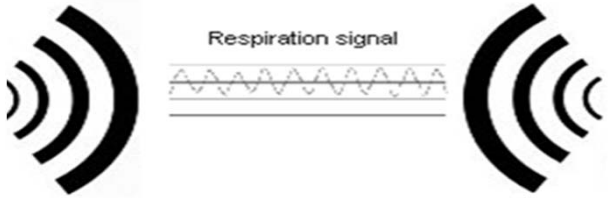
Drowsiness Detection

FICOSA

P9: Wireless for fleet tests

P9 – Drowsiness detection through the analysis of driver's biological data.
System addressed to driver' fleets, is composed by 2 modules :

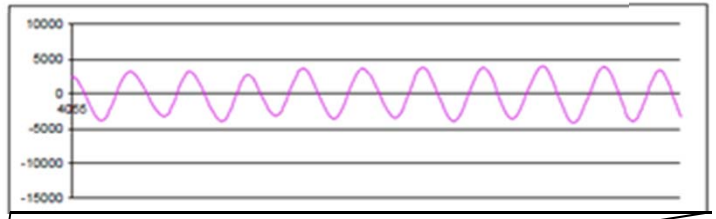
- Portable biomedical sensor that sends variations of the thoracic effort through Bluetooth.
- Smartphone: Application in the Smartphone that allows to analyze and store data and that it is used as interface with the user
- Possible system functionality
  - User identification
  - Characterization signal strategy
  - Data sending remotely to a control center for testing purposes.
  - Send an automatic SMS to a preprogrammed telephone number



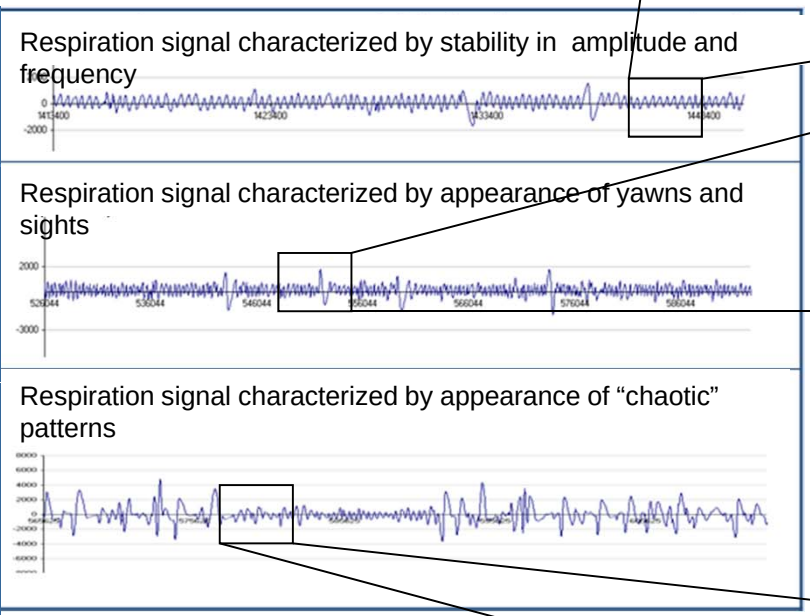
What have we done

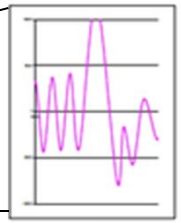
Drowsiness Detection

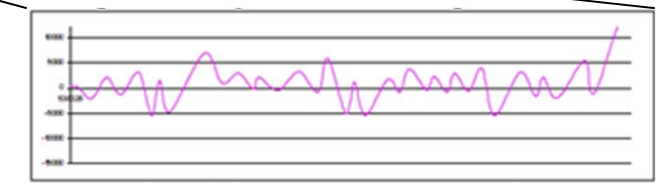
Drowsiness detection algorithms estimates fatigue based on the morphology of the respiratory signal



State 0 (Apt to Drive)	Respiration signal characterized by stability in amplitude and frequency
State1 (At-Risk to Drive)	Respiration signal characterized by appearance of yawns and sights
State2 (Not-Apt to Drive / Somnolence)	Respiration signal characterized by appearance of "chaotic" patterns







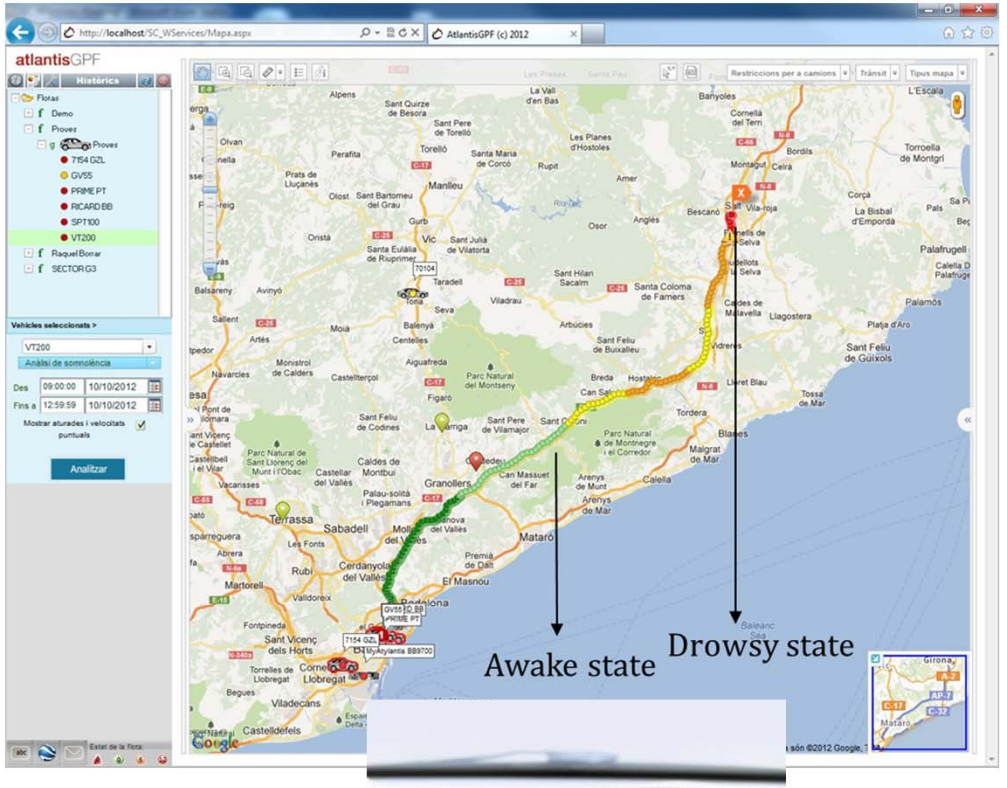
What have we done

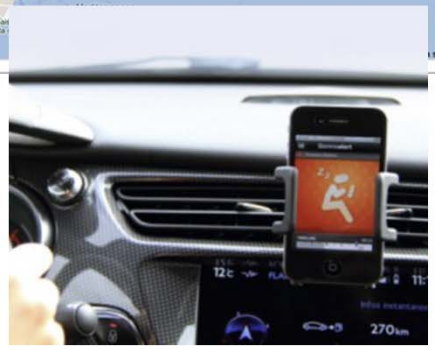
FICOSA

Drowsiness Detection

Wi Fi

3G

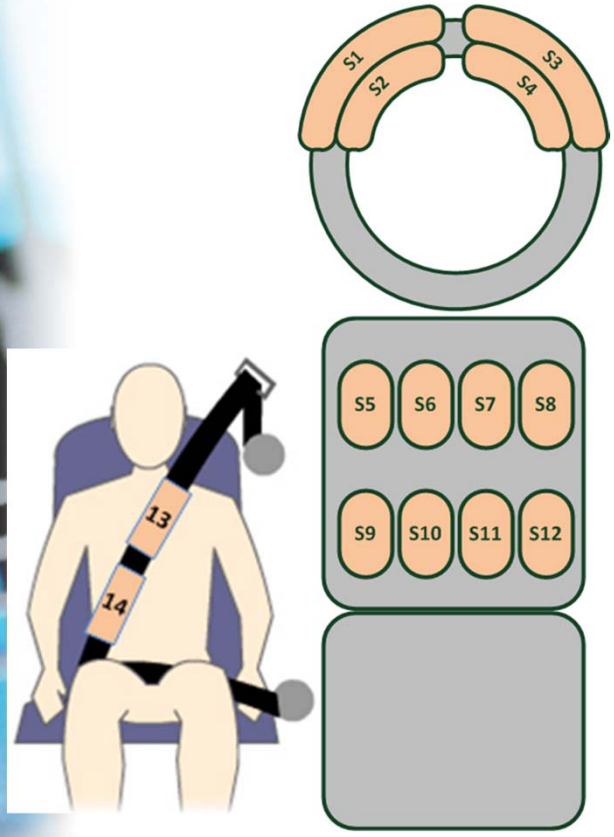


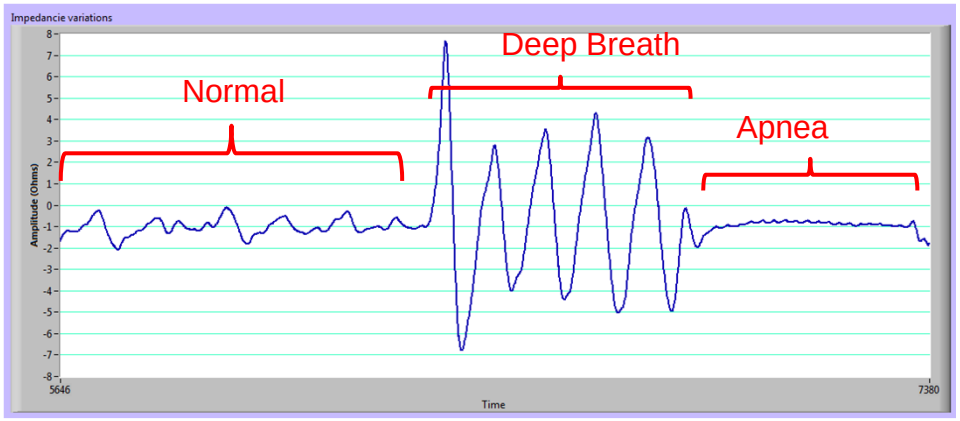


What have we done

FICOSA

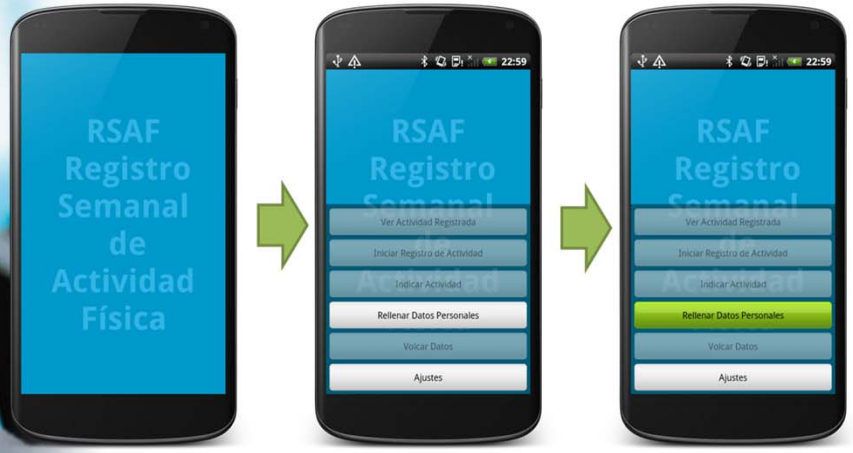
Bioimpedance Contactless Respiration Sensor.

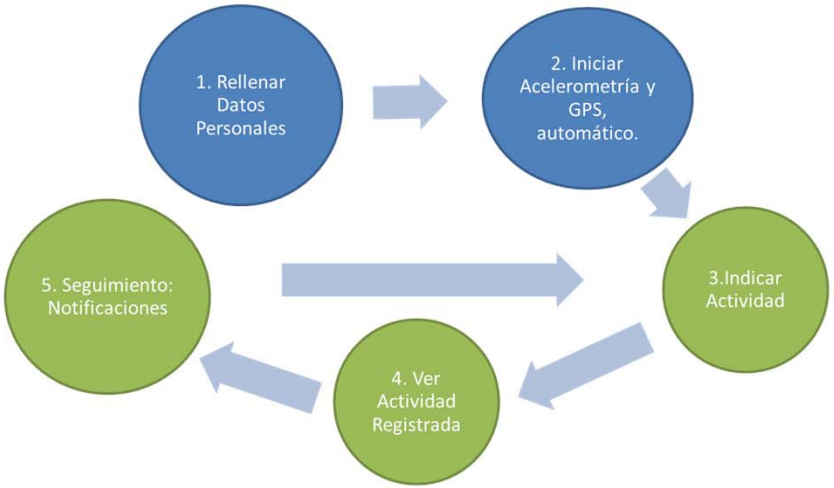




What have we done

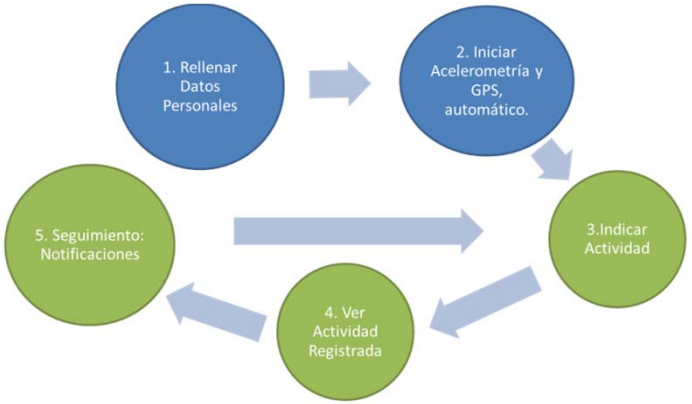
Weekly Physical Activity Log (RSAF in Spanish)





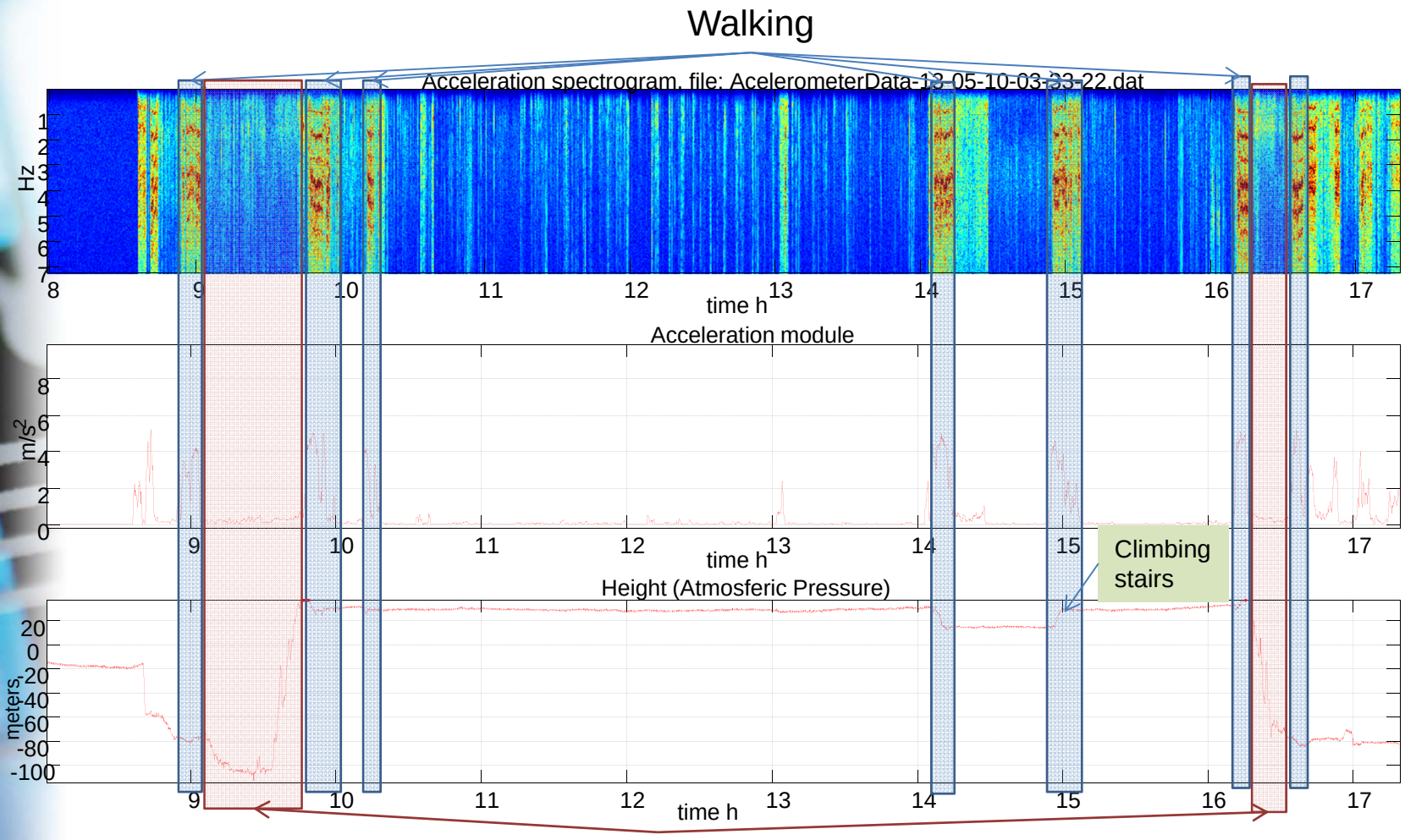
What have we done

RSAF



Where we are now

RSAF, Automatic activity identification



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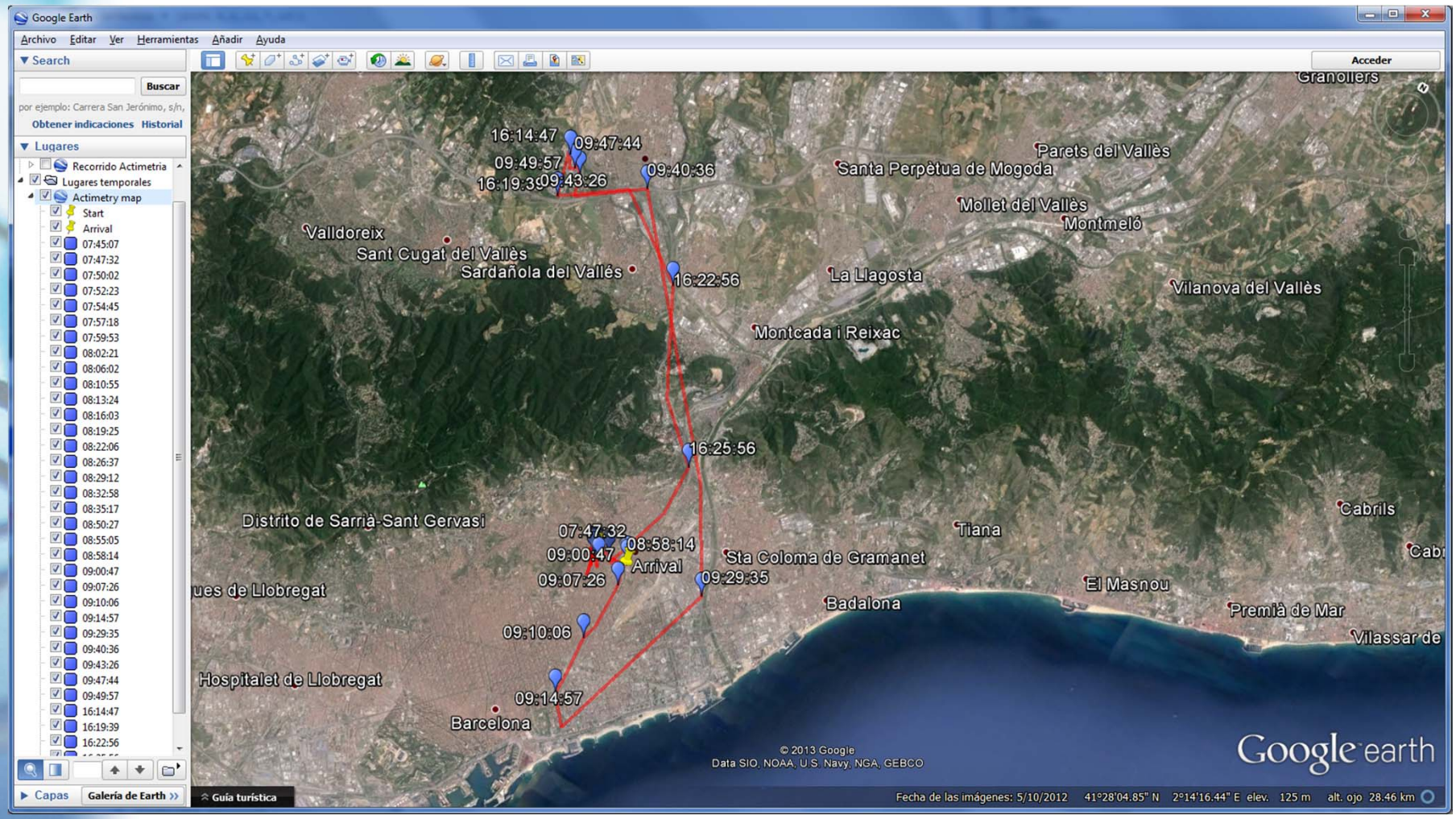

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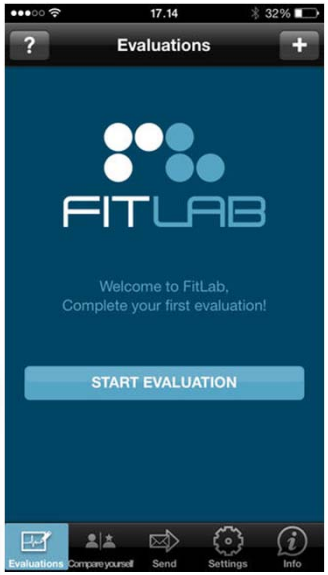
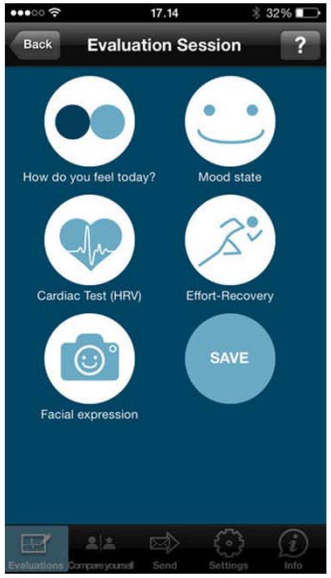




www.healthsportlab.com

Who have made this possible

Resources

Next steps

Recercaixa project

Built a set of modular systems

Adding circadian rhythms

Start with nutrition

Go on with Drowsiness detection

Go on with RSAF

Go on with FITLAB

FITLAB

FICOSA

What's the future?

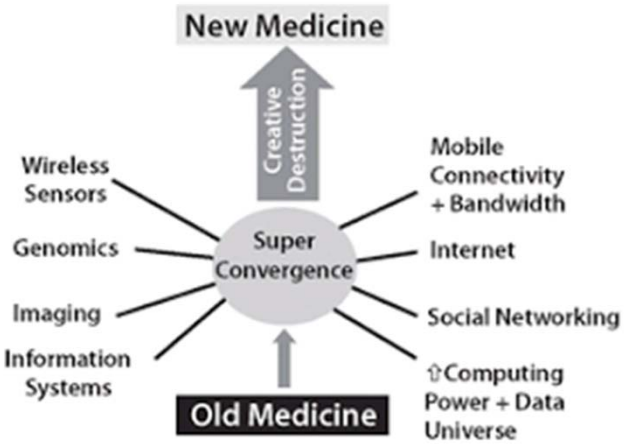
Changes in current model of health care

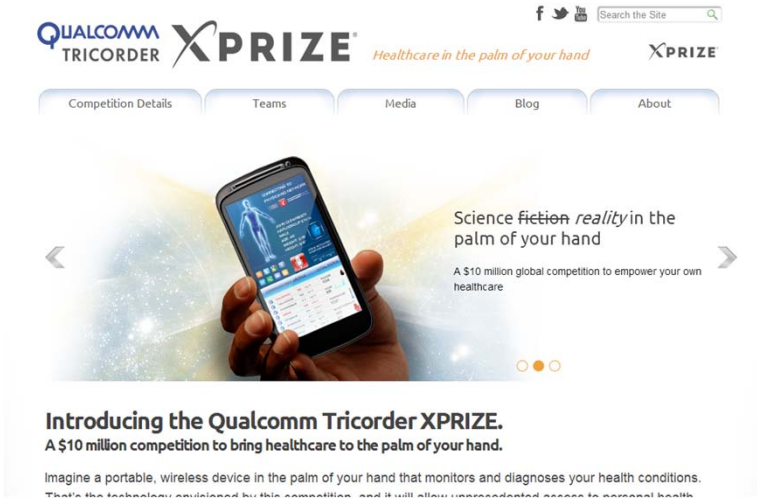
-Personalized medicine

-Promoting Prevention

CHF, High BP, Diabetes, Asthma … (most common chronic diseases)

-Patient at home





http://www.qualcommtricorderxprize.org/