



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

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Jornades formatives 2014: Projectes de recerca al Departament d'Enginyeria Electrònica



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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



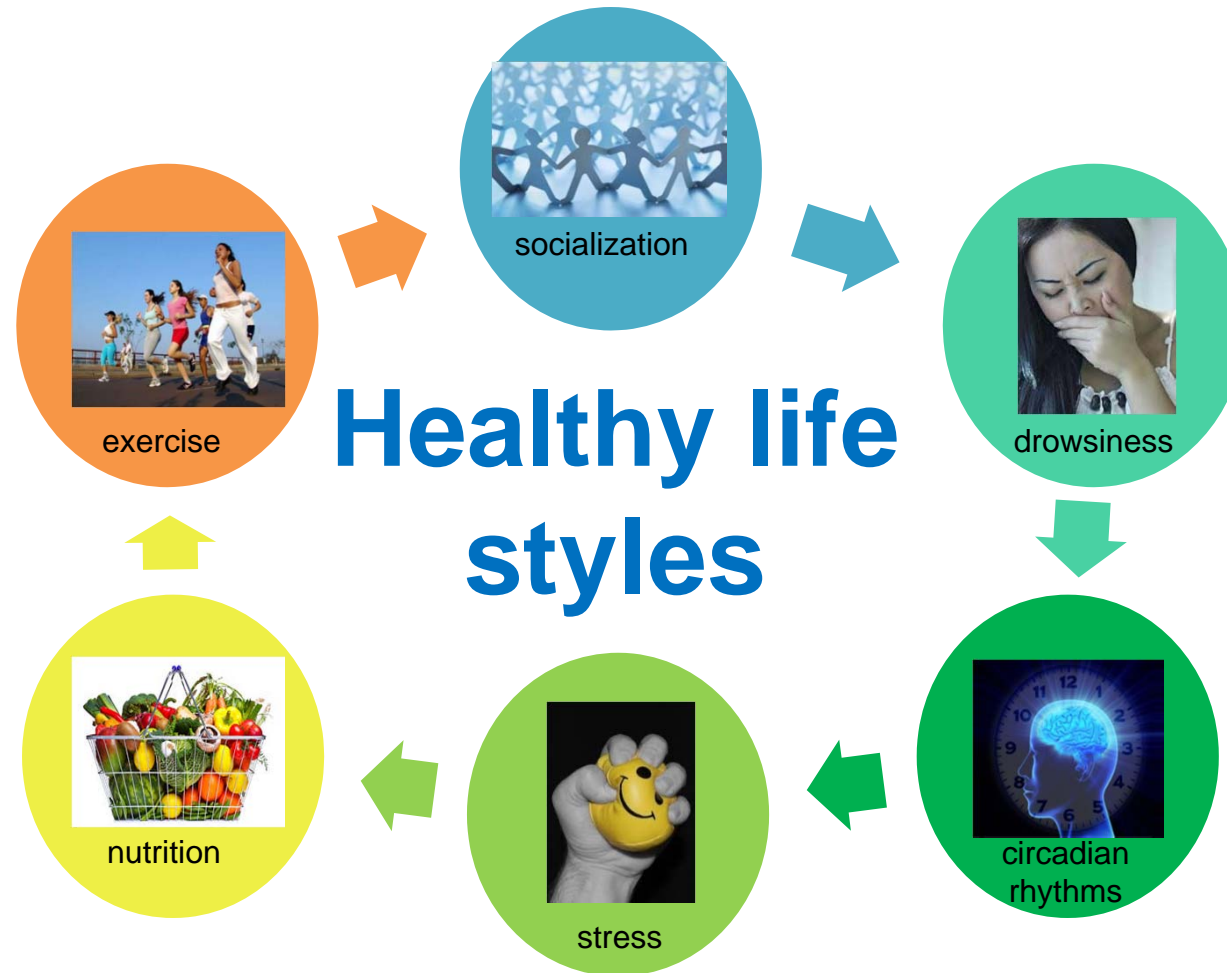
● Increasing life Expectancy

● promotion of healthy lifestyles

● aging with wellbeing guaranty



Introduction



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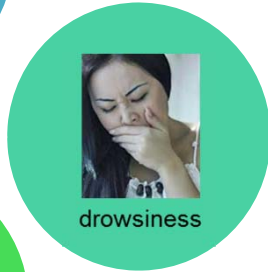


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Introduction



socialization



drowsiness



circadian rhythms



stress



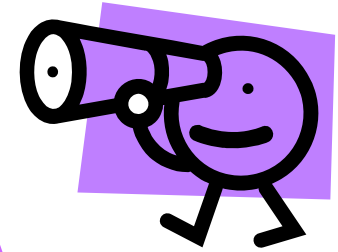
nutrition



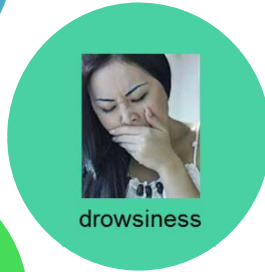
exercise



Introduction



socialization



drowsiness



circadian rhythms



stress



nutrition



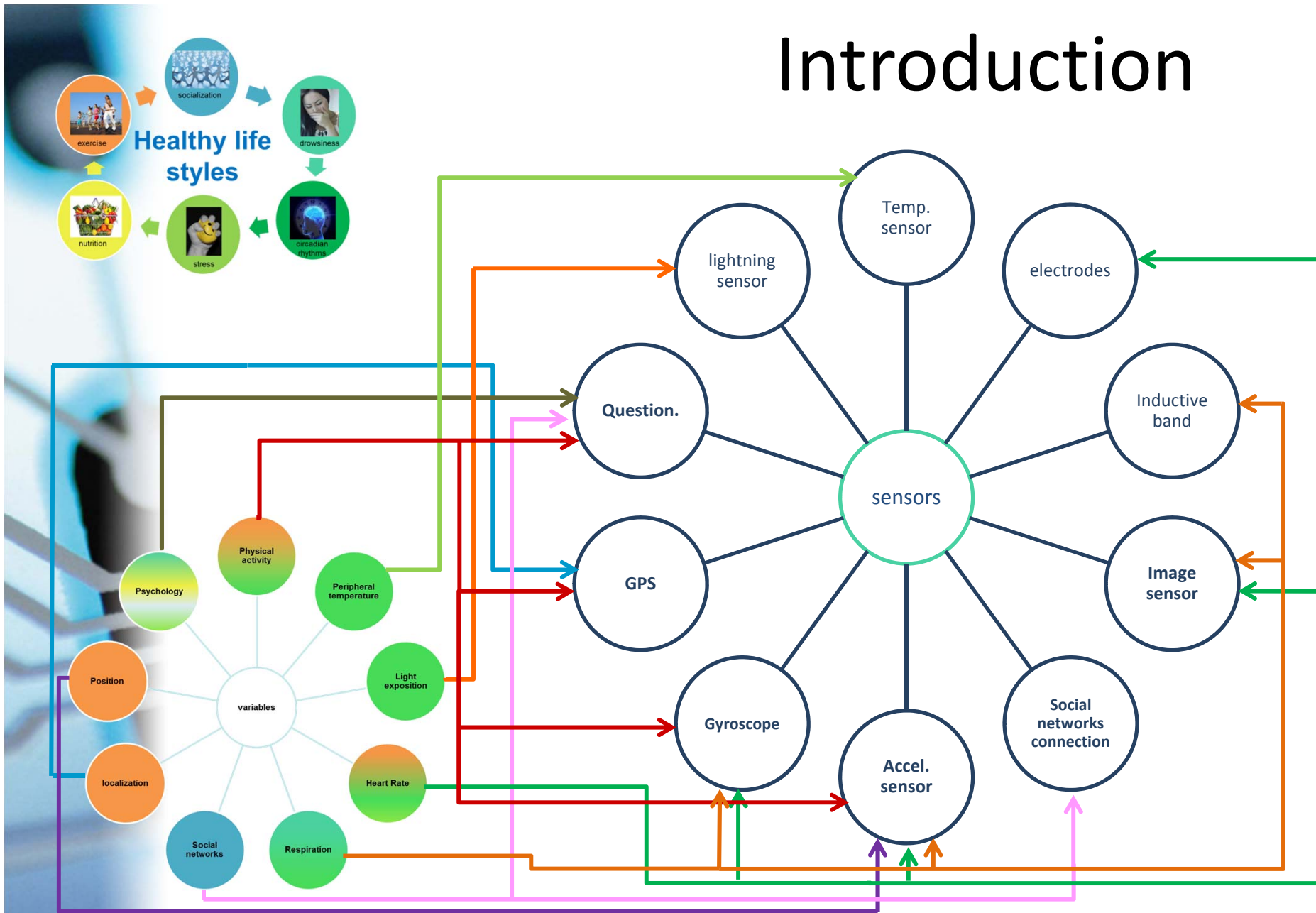
exercise



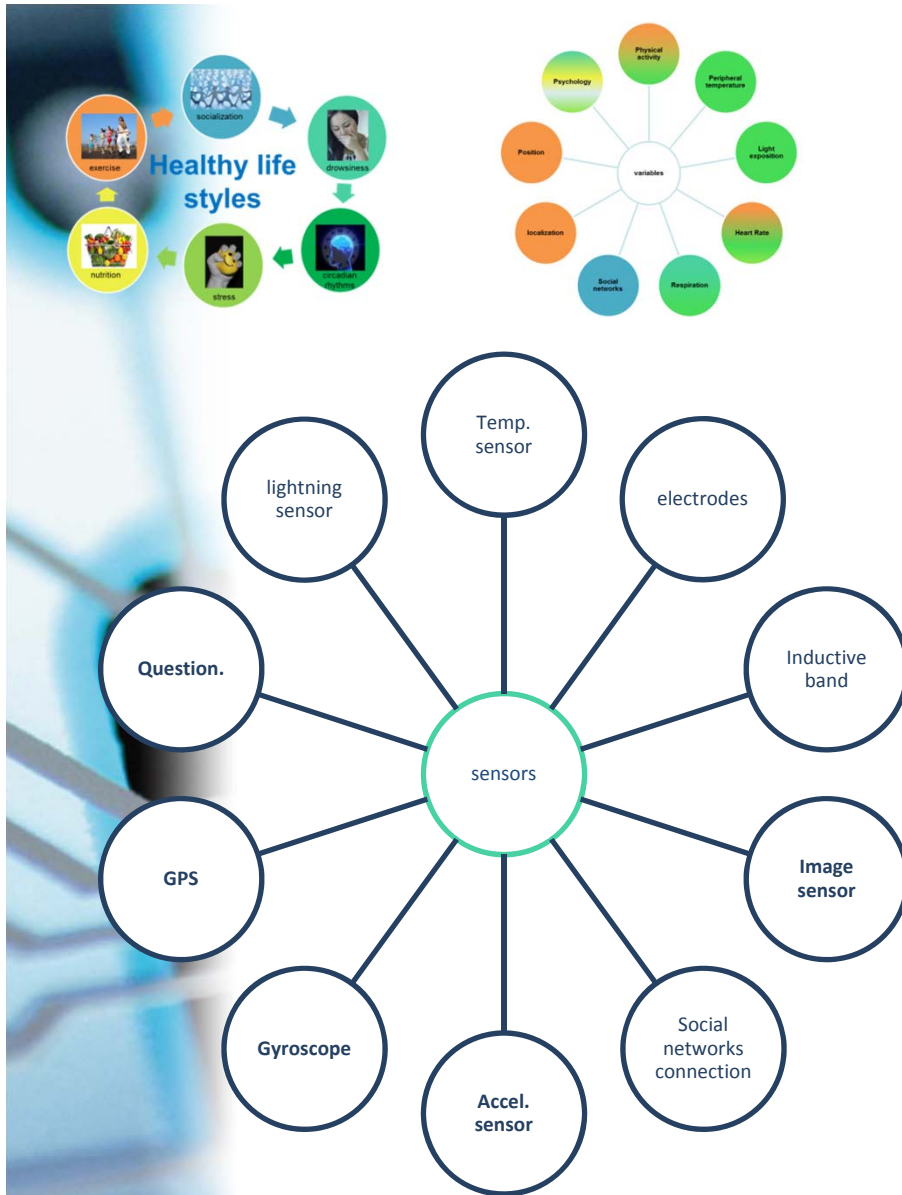
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Introduction



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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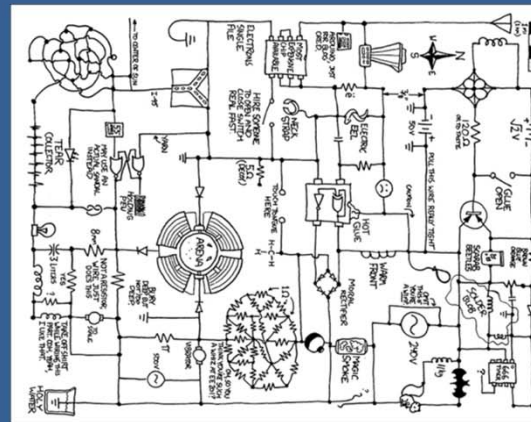




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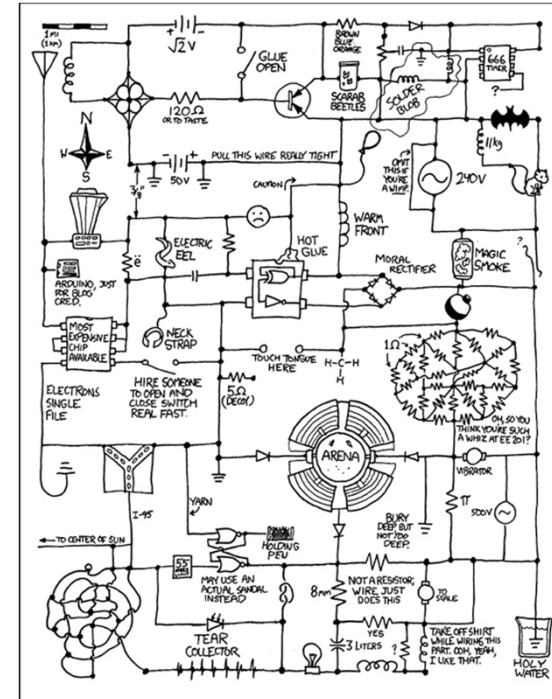
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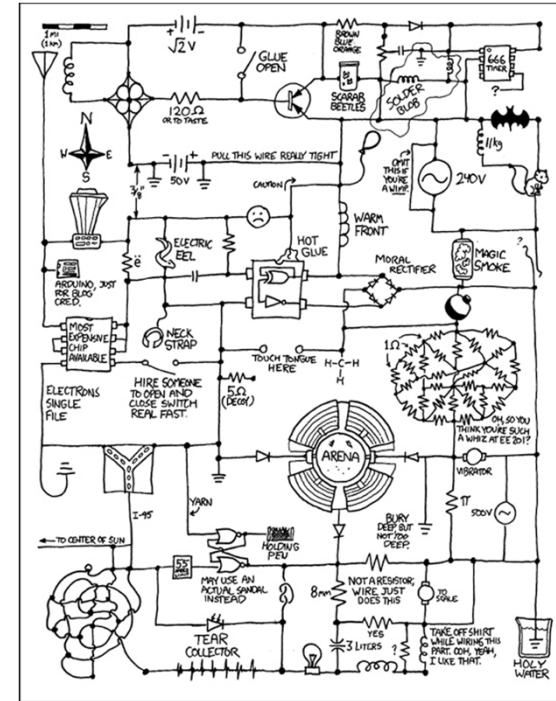
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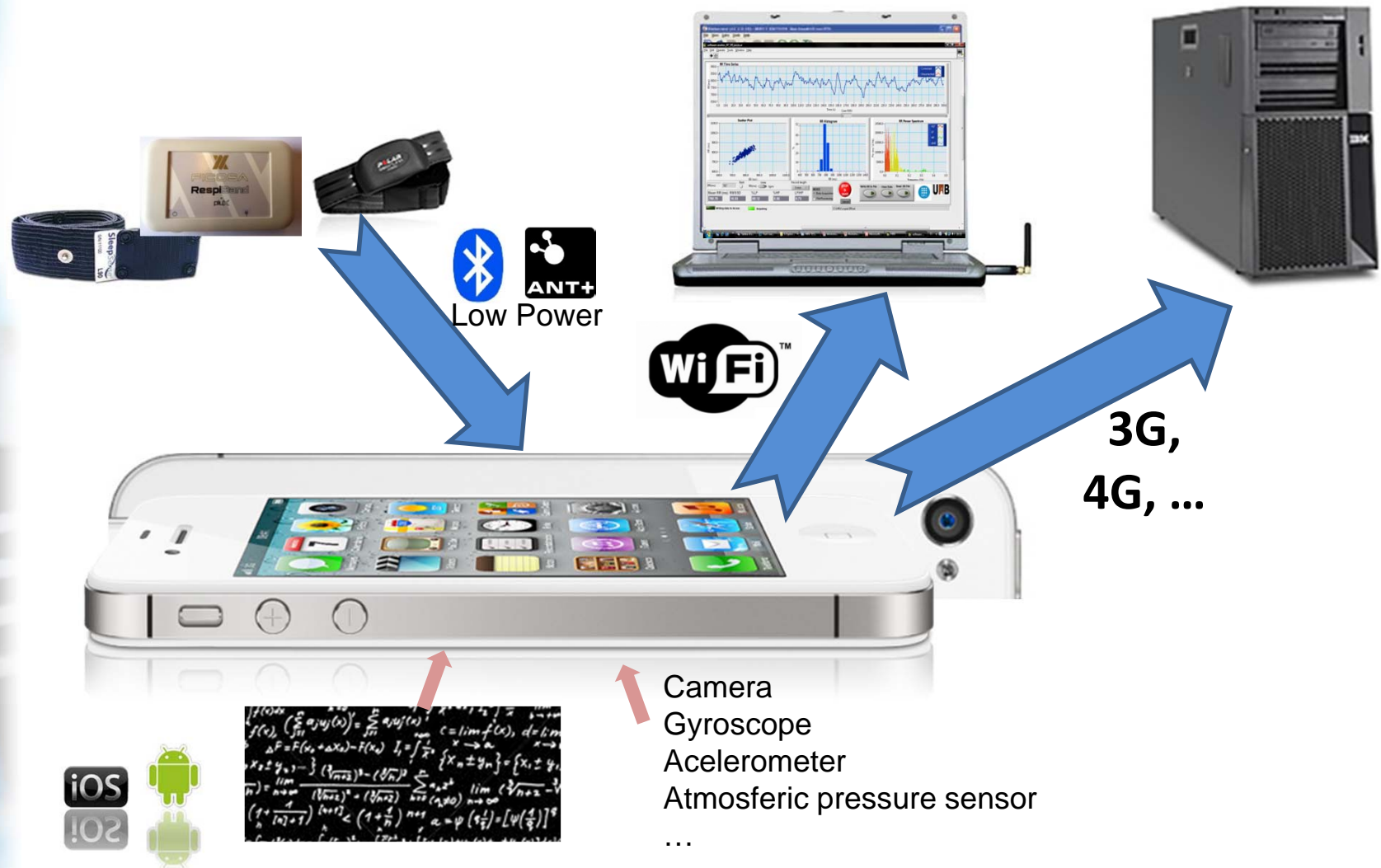
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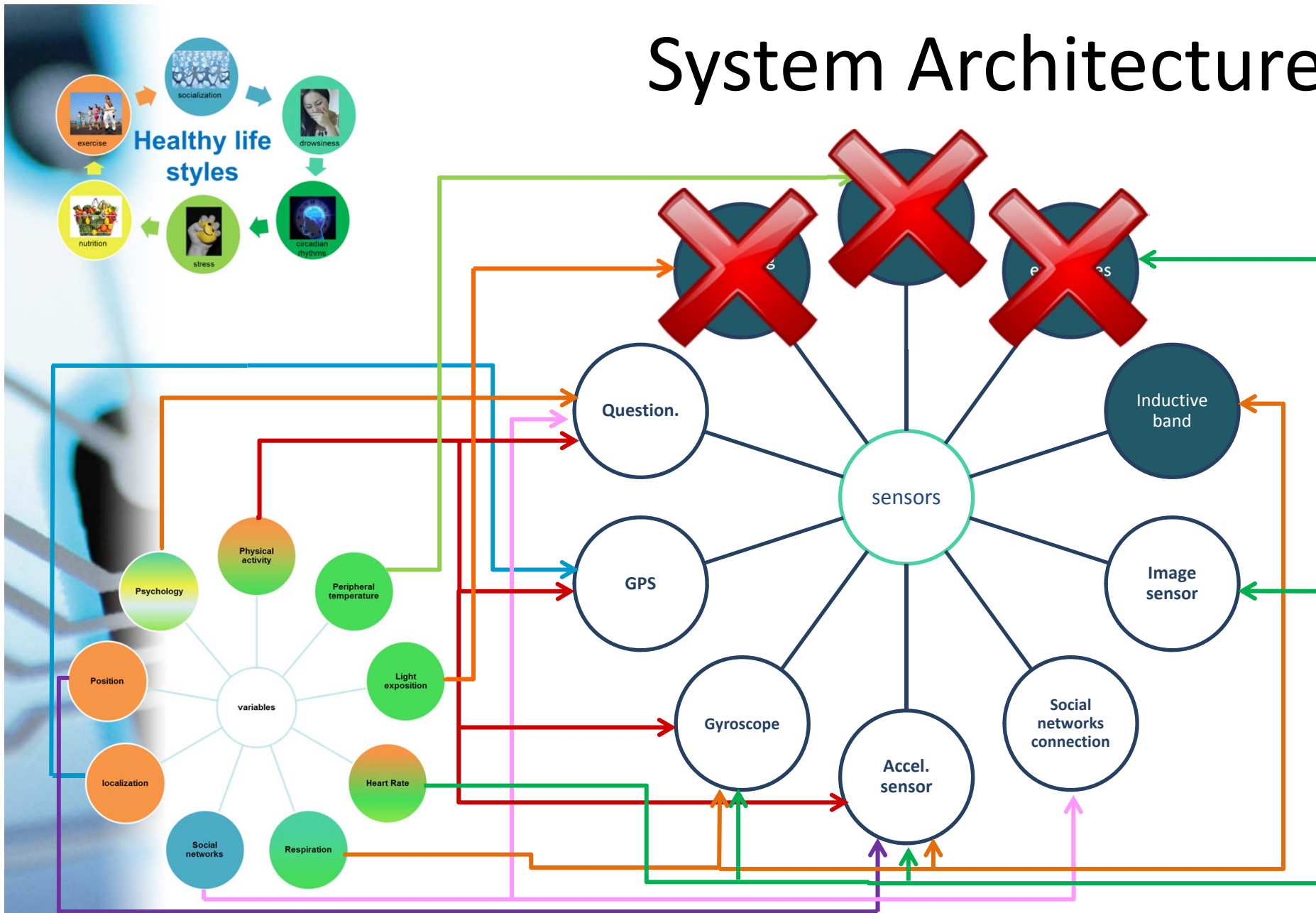
System Architecture



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System Architecture



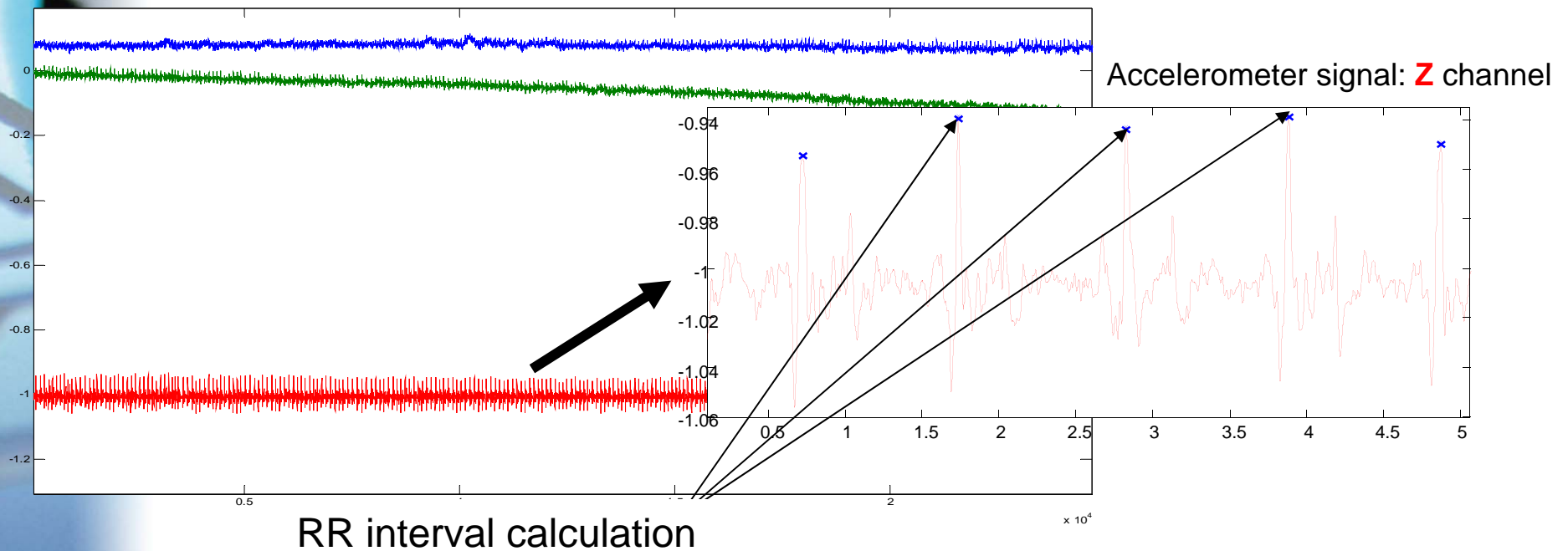
What have we done

Measuring Heart Rate Variability with accelerometer

UAB



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



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What have we done

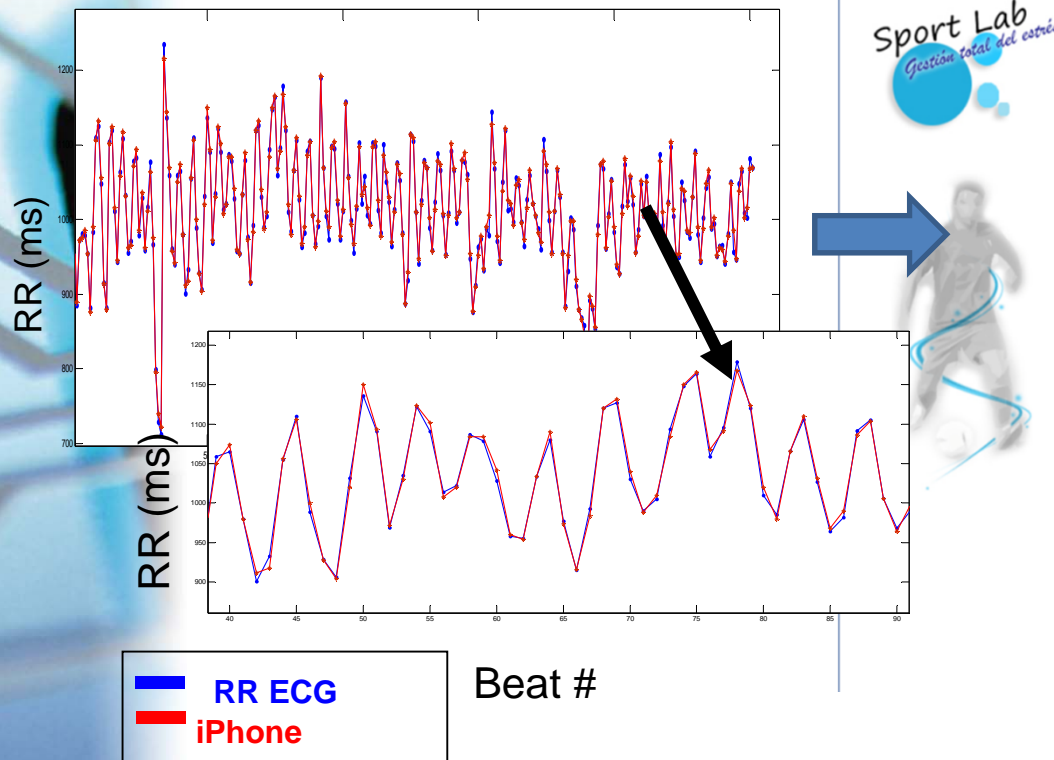
Heart Rate Variability as stress predictor.
How good is our signal?

UAB



Comparison: RR ECG / iPhone

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



Sport Lab
Gestión total del estrés

Inicio Lista de deportistas Gestionar Deportistas Mi perfil

Informe: PERFIL CARDIORESPIRATORIO

Nombre: S30 Migcampista

Fecha: 08/02/2012



Frecuencia Cardiaca: Bradicardia

Promedio FC: 51,284

Regulación Cardiaca: Predominio del estado de recuperación

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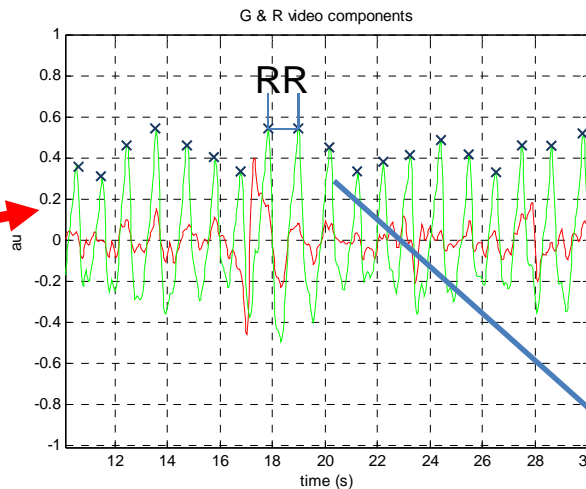
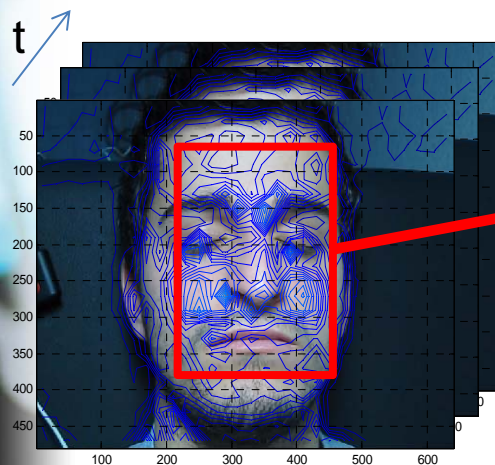


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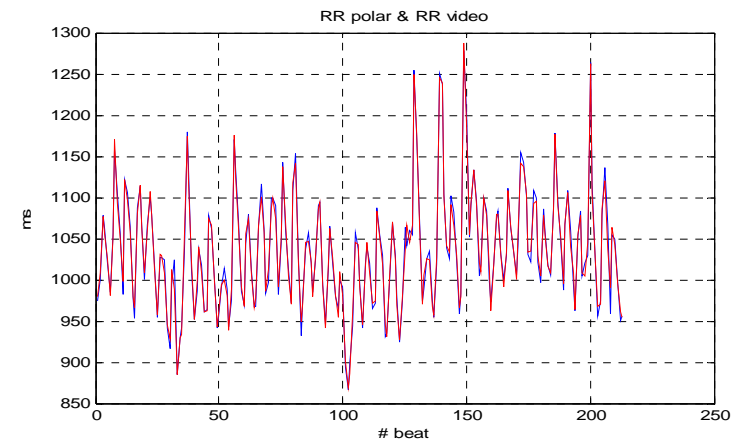
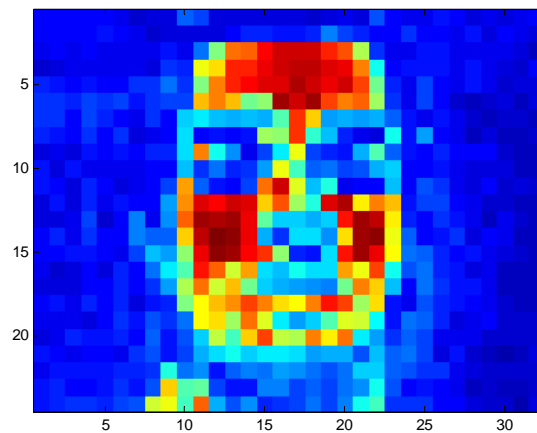
What have we done



Measuring Heart Rate and respiration by video signal analysis



Correlation image



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What have we done

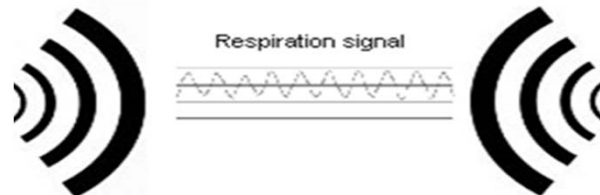
Drowsiness Detection



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

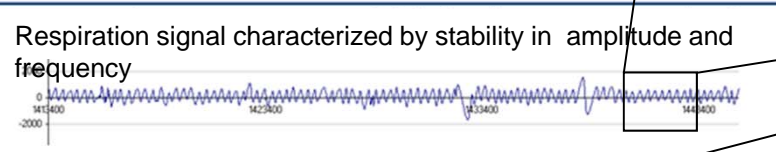
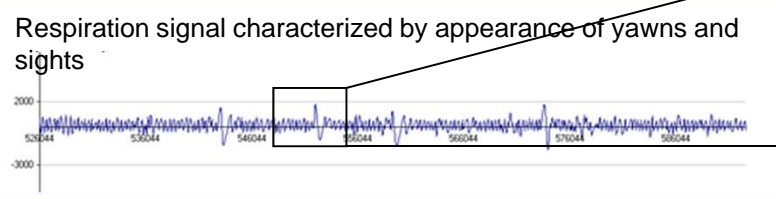
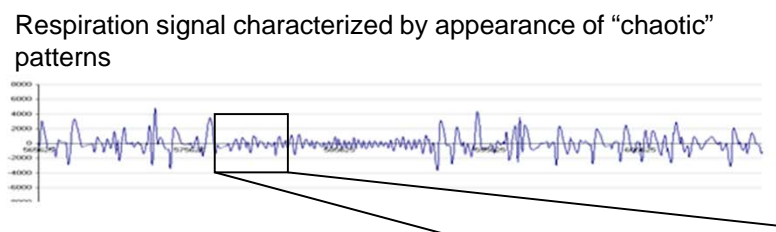


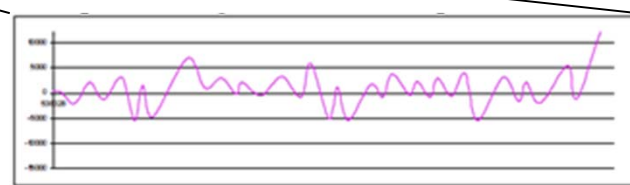
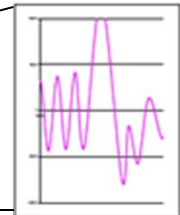
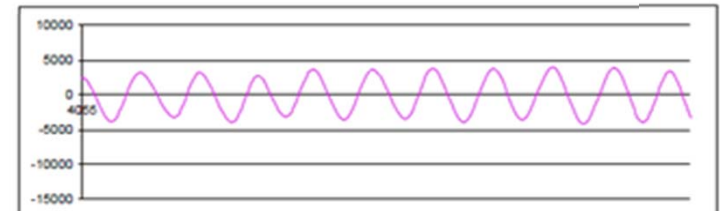
What have we done



Drowsiness Detection

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

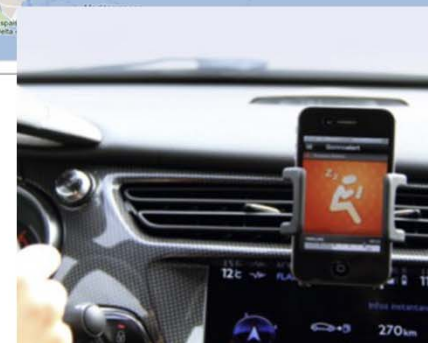
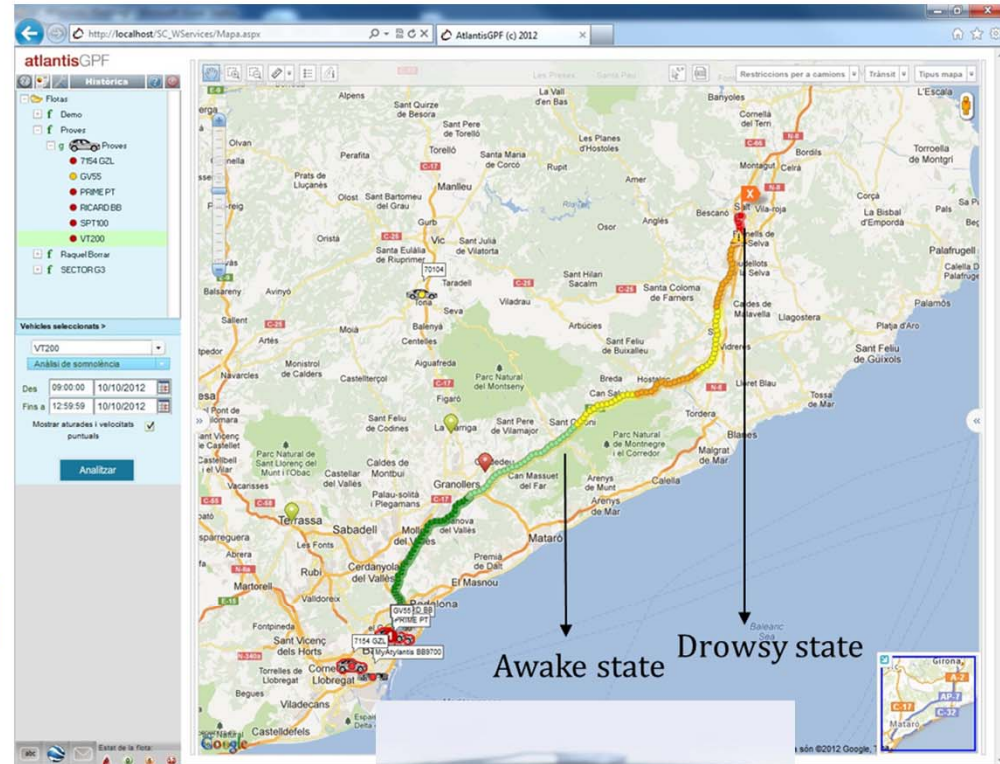
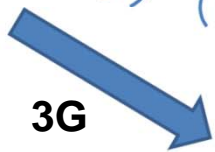
State 0 (Apt to Drive)	Respiration signal characterized by stability in amplitude and frequency 
State 1 (At-Risk to Drive)	Respiration signal characterized by appearance of yawns and sighs 
State 2 (Not-Apt to Drive / Somnolence)	Respiration signal characterized by appearance of "chaotic" patterns 



What have we done



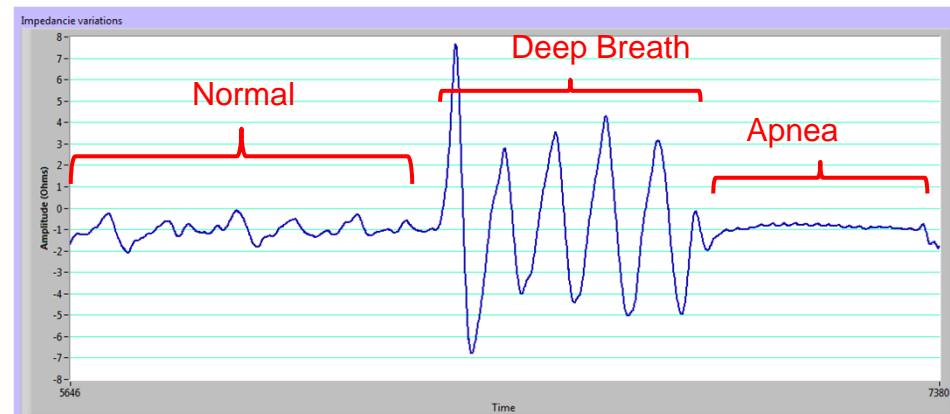
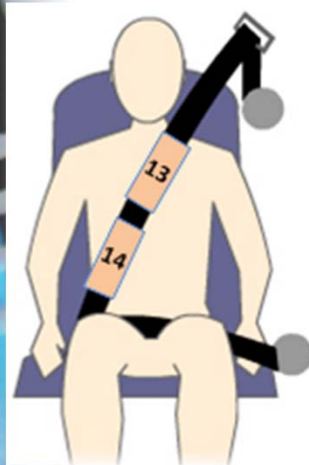
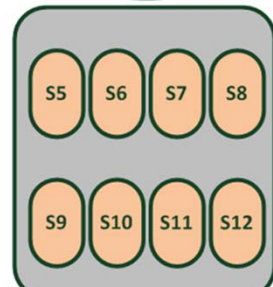
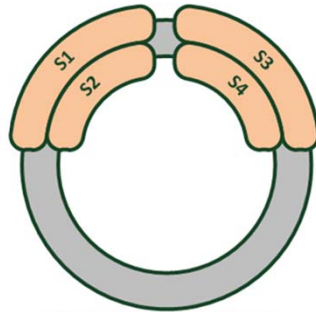
Drowsiness Detection



What have we done

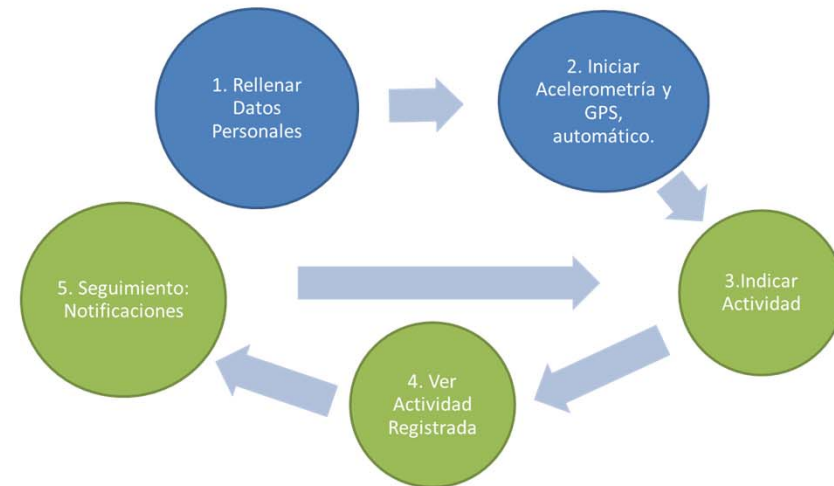


Bioimpedance Contactless Respiration Sensor.



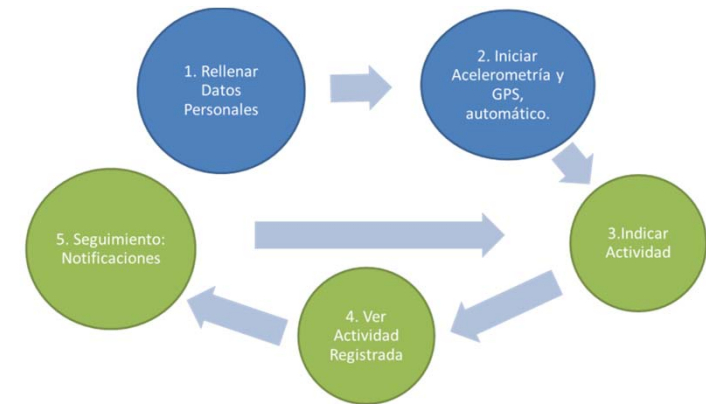
What have we done

Weekly Physical Activity Log (RSAF in Spanish)



What have we done

RSAF



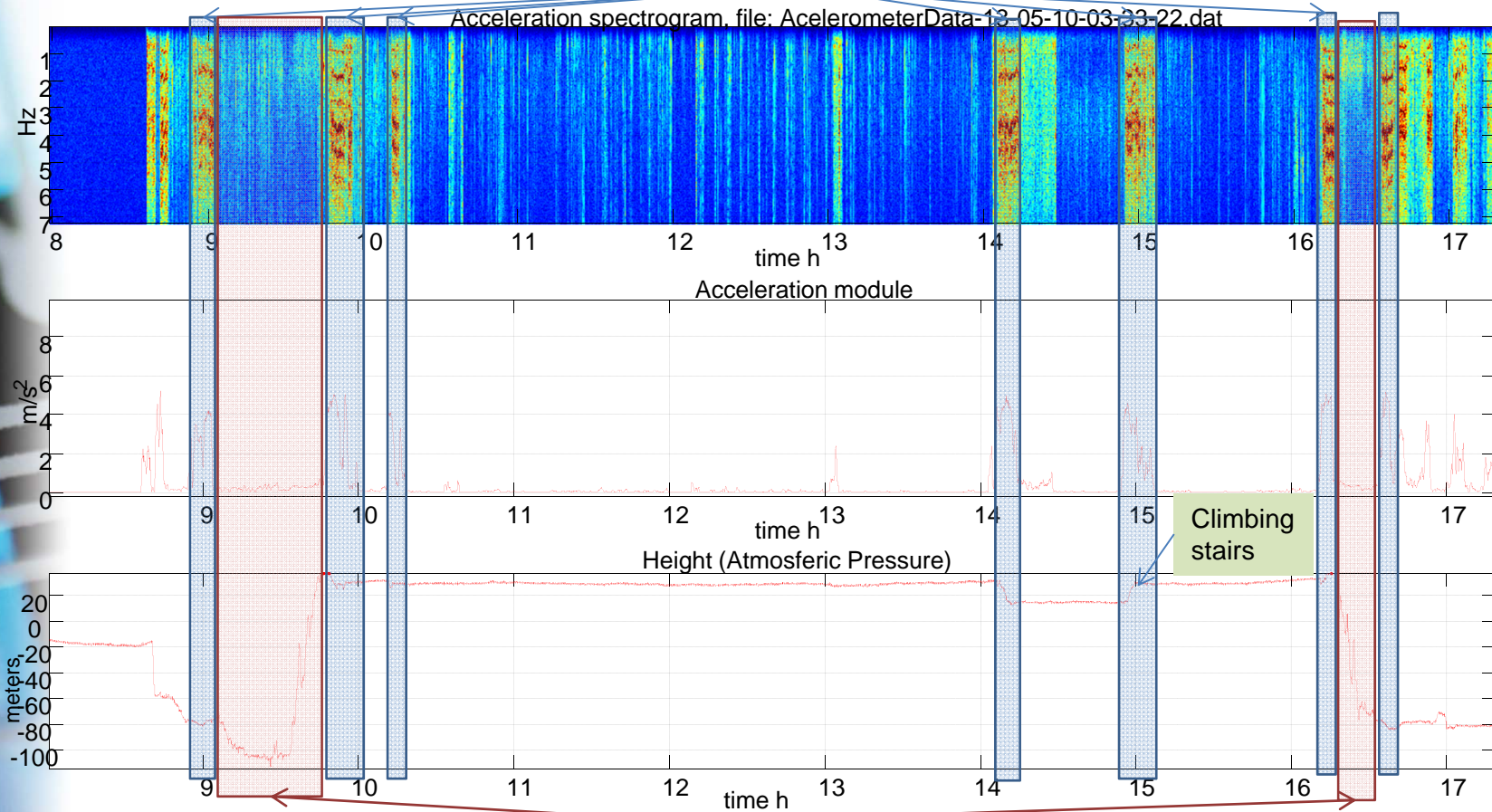
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Where we are now

RSAF, Automatic activity identification

Walking



Car driving

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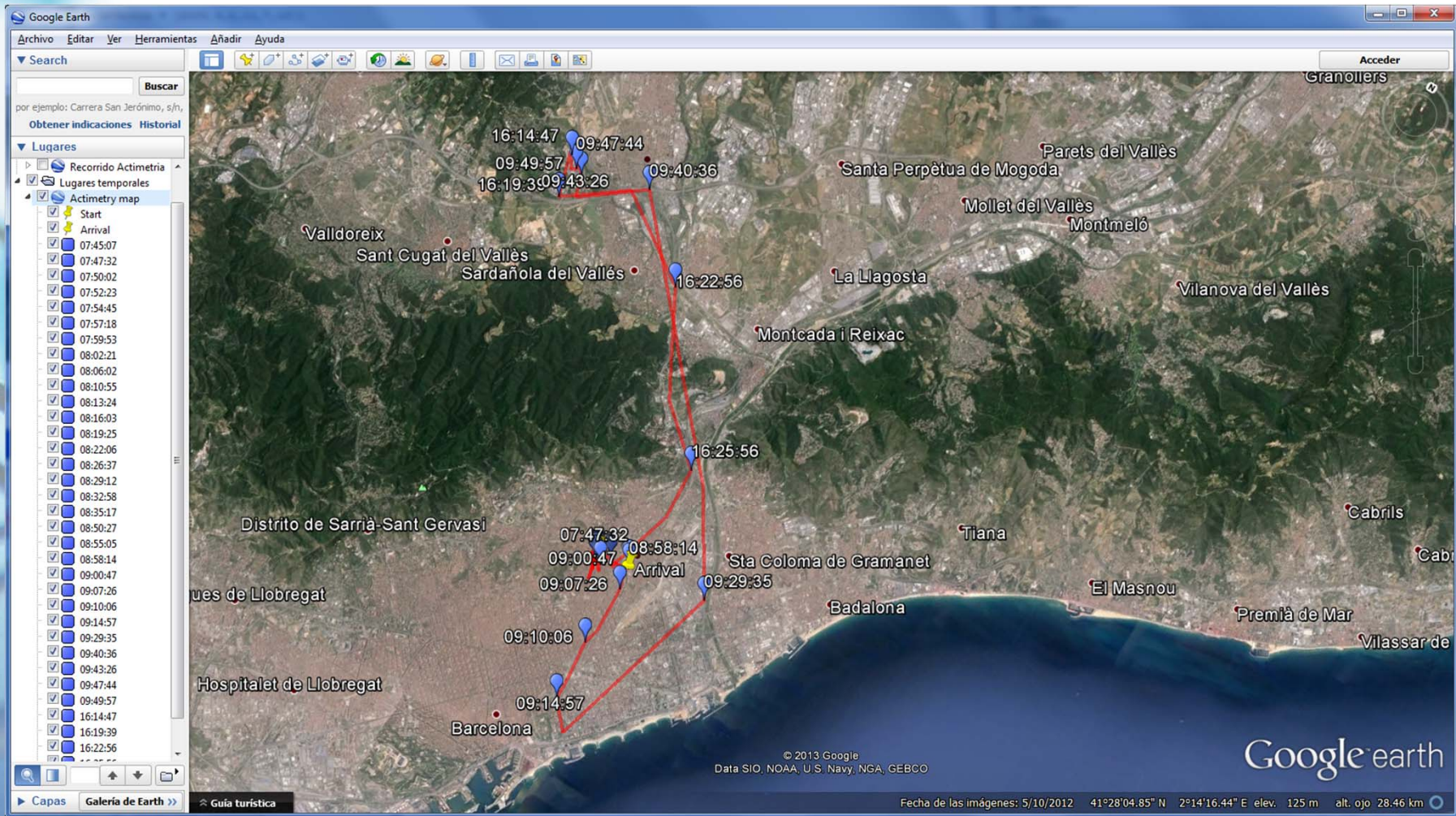
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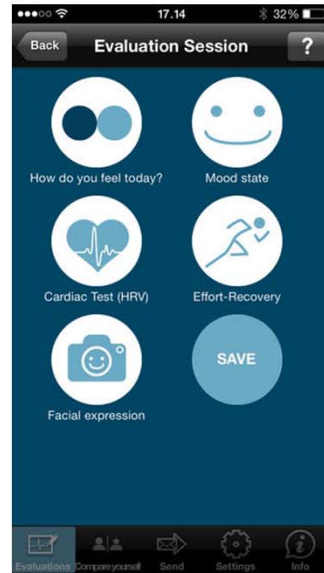
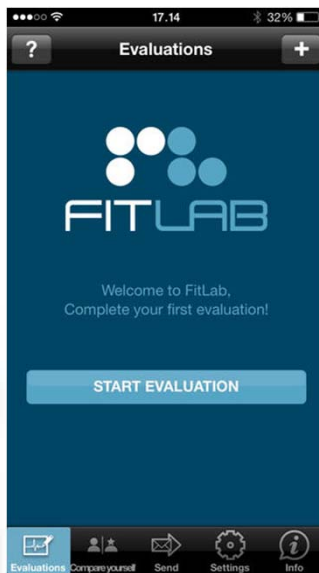
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Where we are now

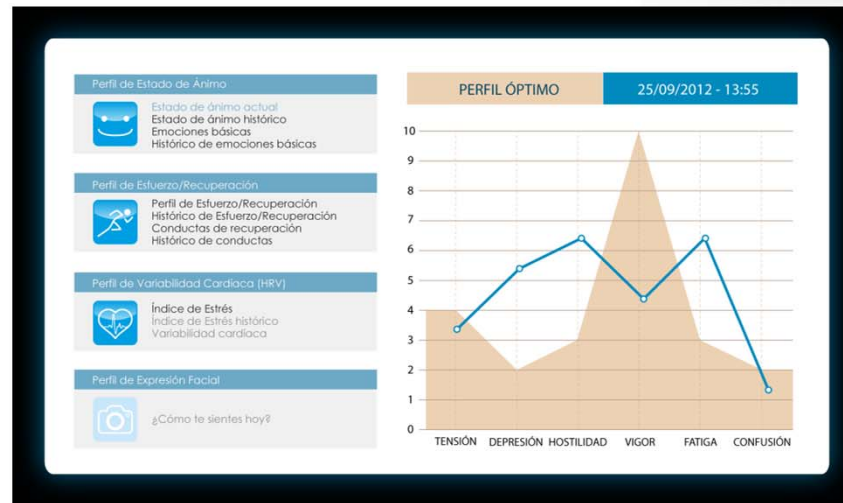
RSAF, Automatic activity identification



Where are we now



www.healthsportlab.com



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Who have made this possible



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Resources



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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



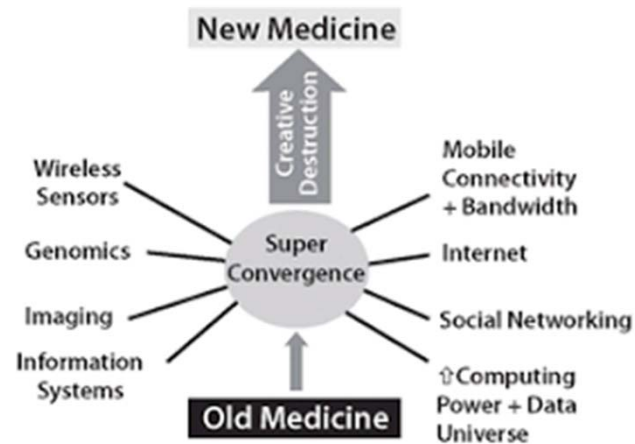
What's the future?

Changes in current model of health care

- Personalized medicine
- Promoting Prevention

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

- Patient at home



The screenshot shows the Qualcomm Tricorder XPRIZE website. At the top, it features the Qualcomm Tricorder XPRIZE logo and the tagline "Healthcare in the palm of your hand". Below the logo is a navigation menu with links for "Competition Details", "Teams", "Media", "Blog", and "About". The main content area features a hand holding a smartphone displaying a health interface, with the text "Science fiction reality in the palm of your hand" and "A \$10 million global competition to empower your own healthcare". At the bottom, there is a section titled "Introducing the Qualcomm Tricorder XPRIZE. A \$10 million competition to bring healthcare to the palm of your hand." followed by a brief description and the URL <http://www.qualcommtricorderxprize.org/>.

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