

Remote Monitoring of Biomedical Signals Using 3G

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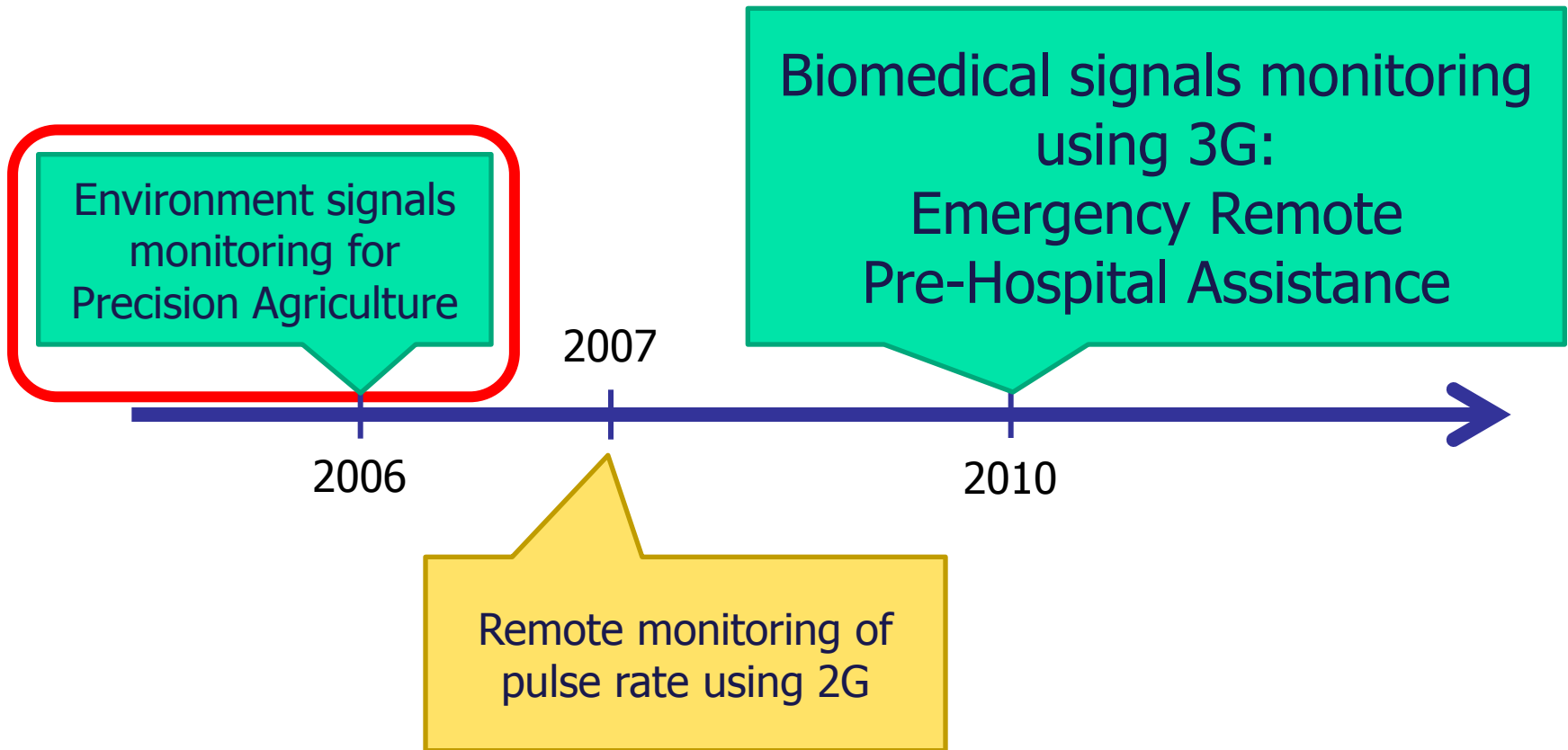




Outline

- Previous work
 - Remote monitoring of environment variables using WSN and 2G
 - Remote monitoring of pulse rate using 2G
- ERPHA: **E**mergency **R**emote **P**re-**H**ospital **A**ssistance
- ERPHA demo

Using **Wireless** Metropolitan Area Networks





Remote monitoring of environment variables using WSN and 2G

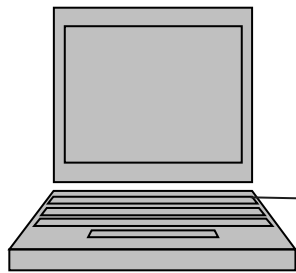


Remote monitoring of environment variables using WSN and 2G

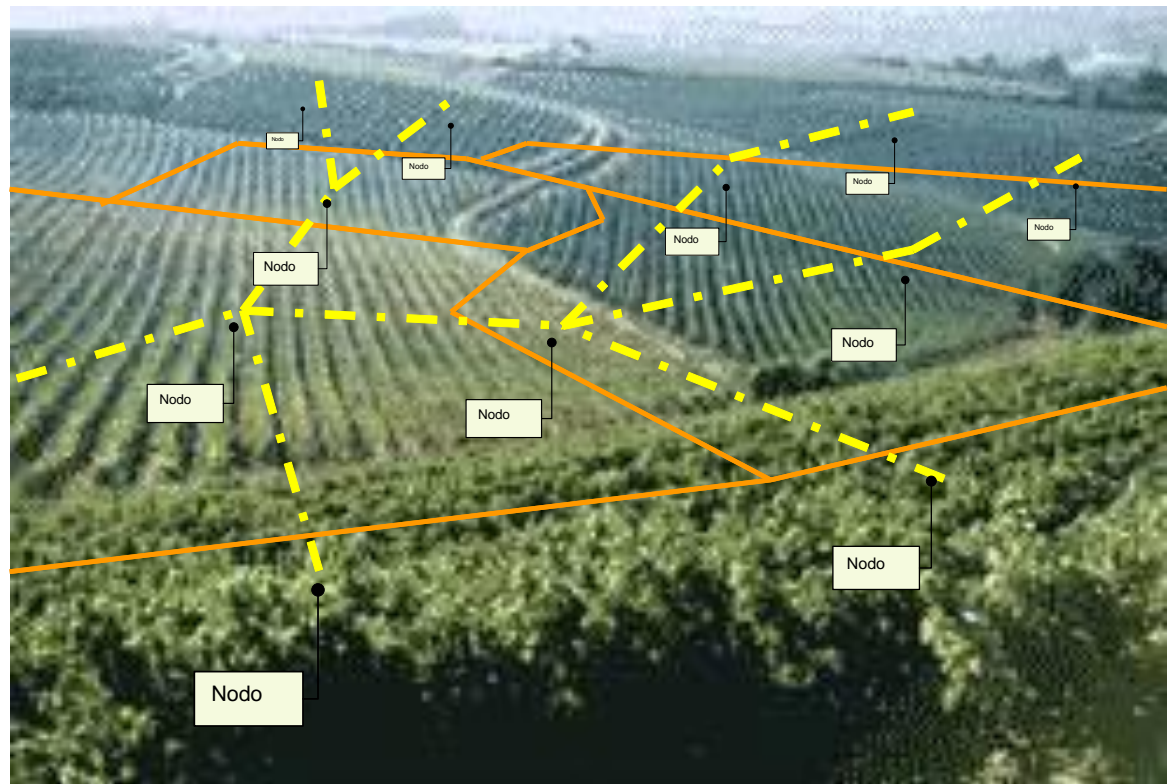
- In collaboration with a local company, we developed WiseField, a system to monitor relevant agro-climatic variables using **W**ireless **S**ensor **N**etworks.
- An extended version also uses 2G.
- The system is working today in different farms.



Precision Agriculture Application V1.0



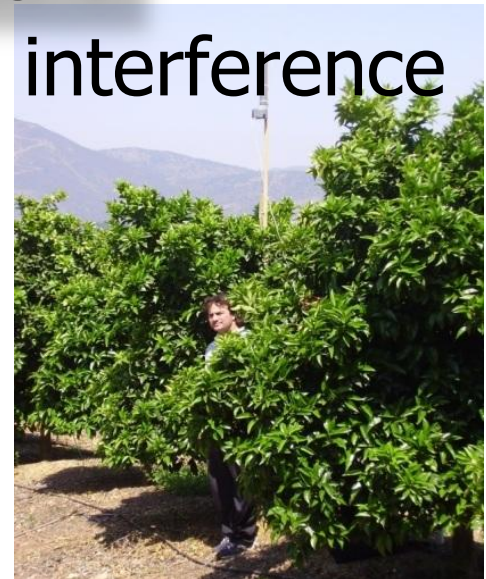
GTW



Issues we addressed

- Application driven by interaction with the environment
- Limited resources (Memory, CPU)
- Remote operation
- Scalability requirements
- RF Signal propagation and interference

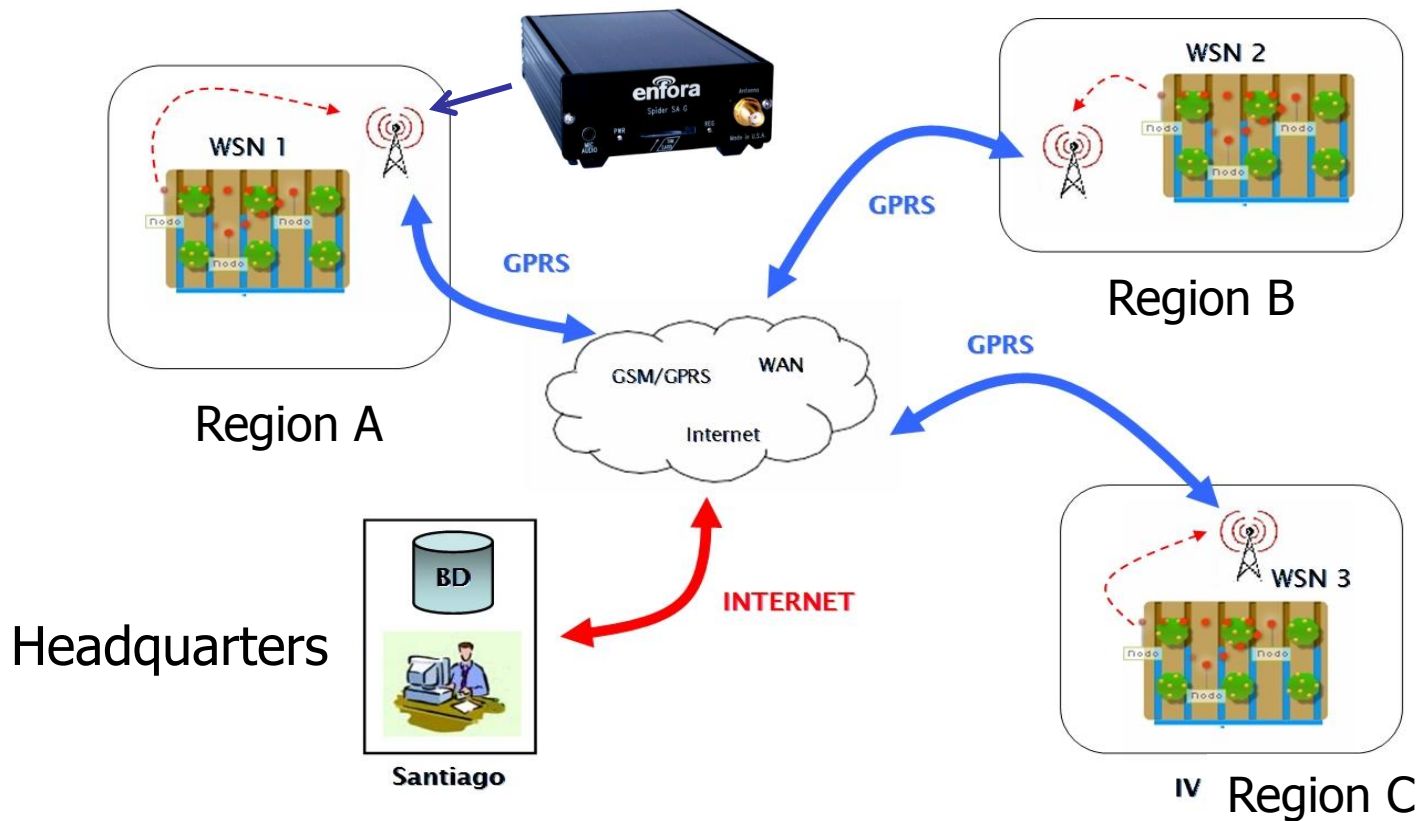
Any similarity with remote biofeedback ?



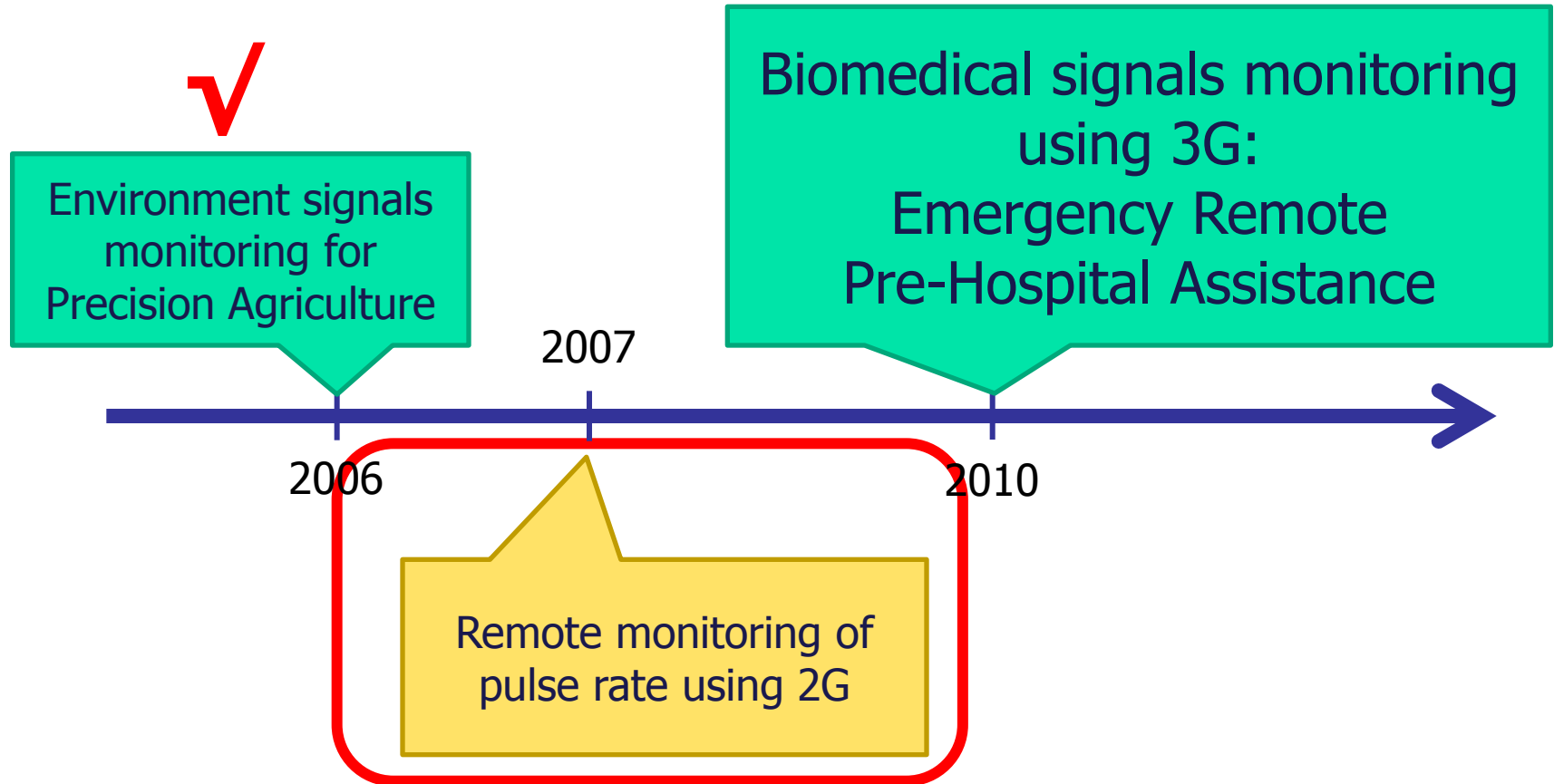
Extension:

Many fields \rightarrow 2G

Using a WSN-GPRS gateway in each field



Using **Wireless** Metropolitan Area Networks



Mobile devices and phones over time

We have developed applications using their acquisition, processing, storing, and communications capabilities.

'90



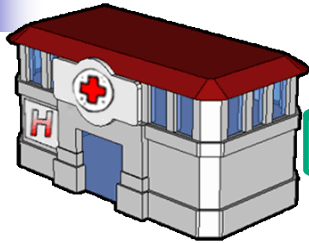
2011



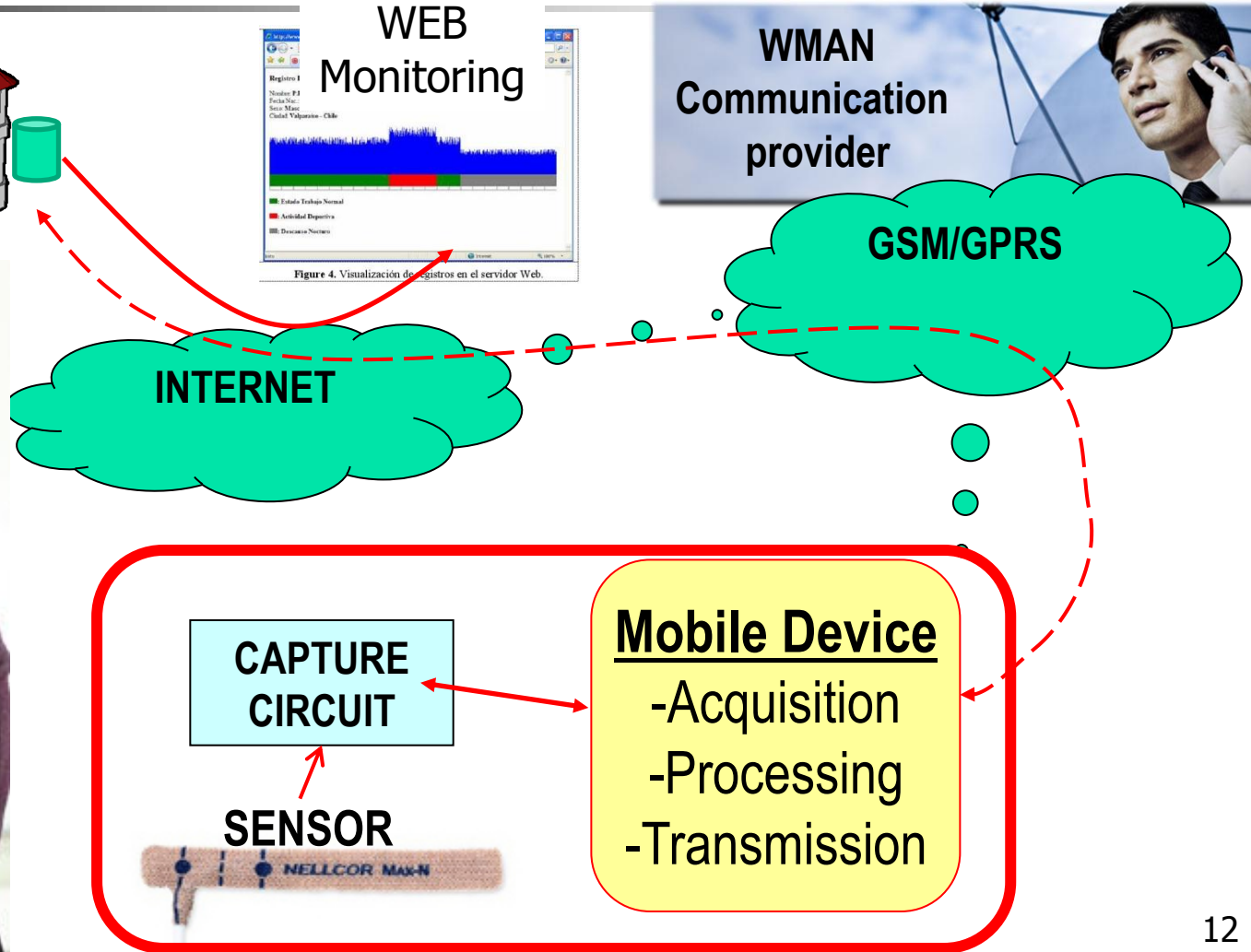
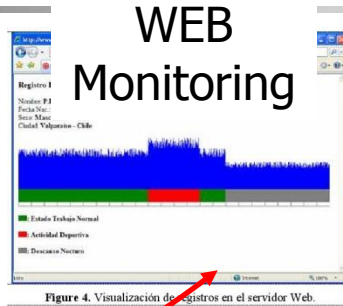


Remote Monitoring of Biomedical Signals Using **2G**

Patient Telemonitoring

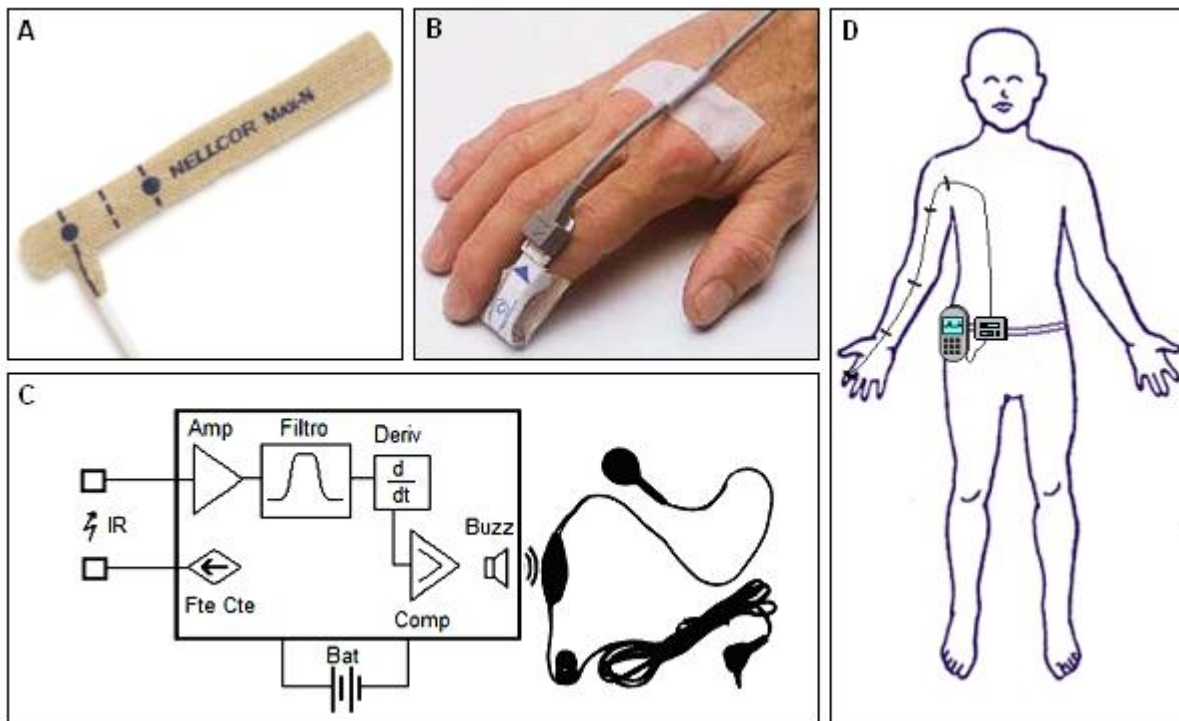


Pablo Roncagliolo



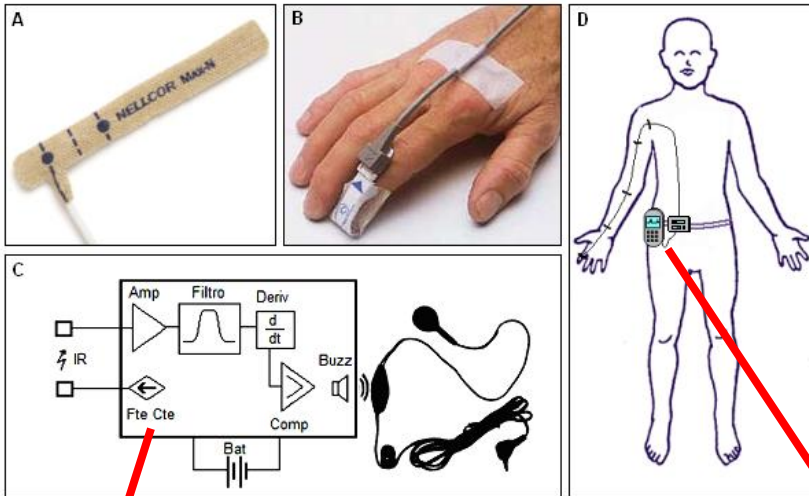
First prototype

Sensor
Nellcor Oximax
MAX-N

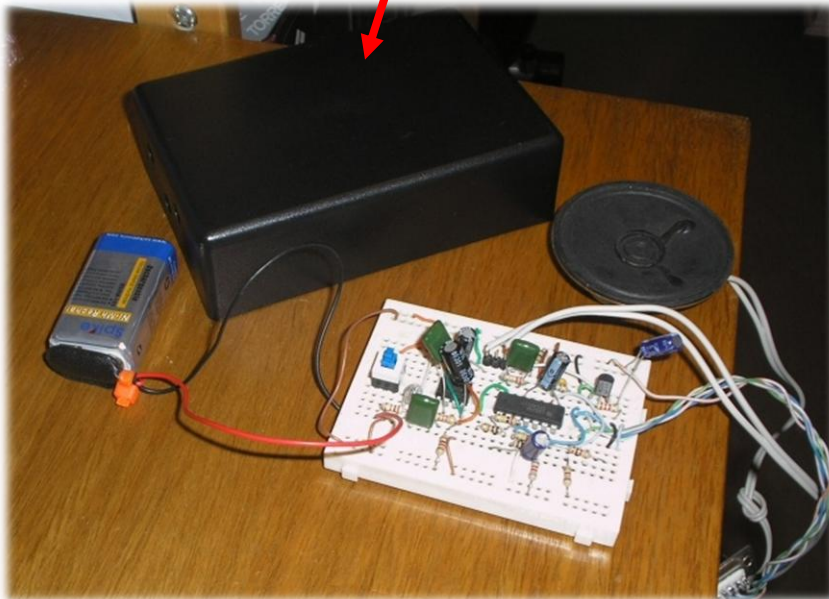


Adaptation Circuit
(Homemade)

System prototype



We tested it with all these phones.

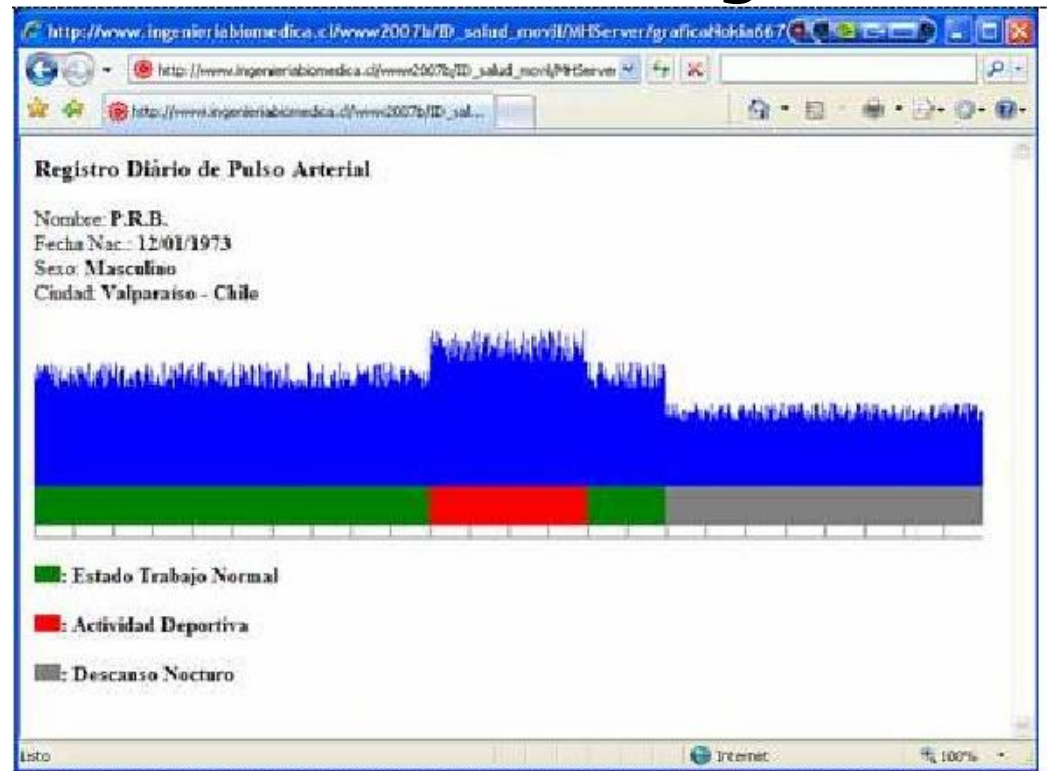


Results

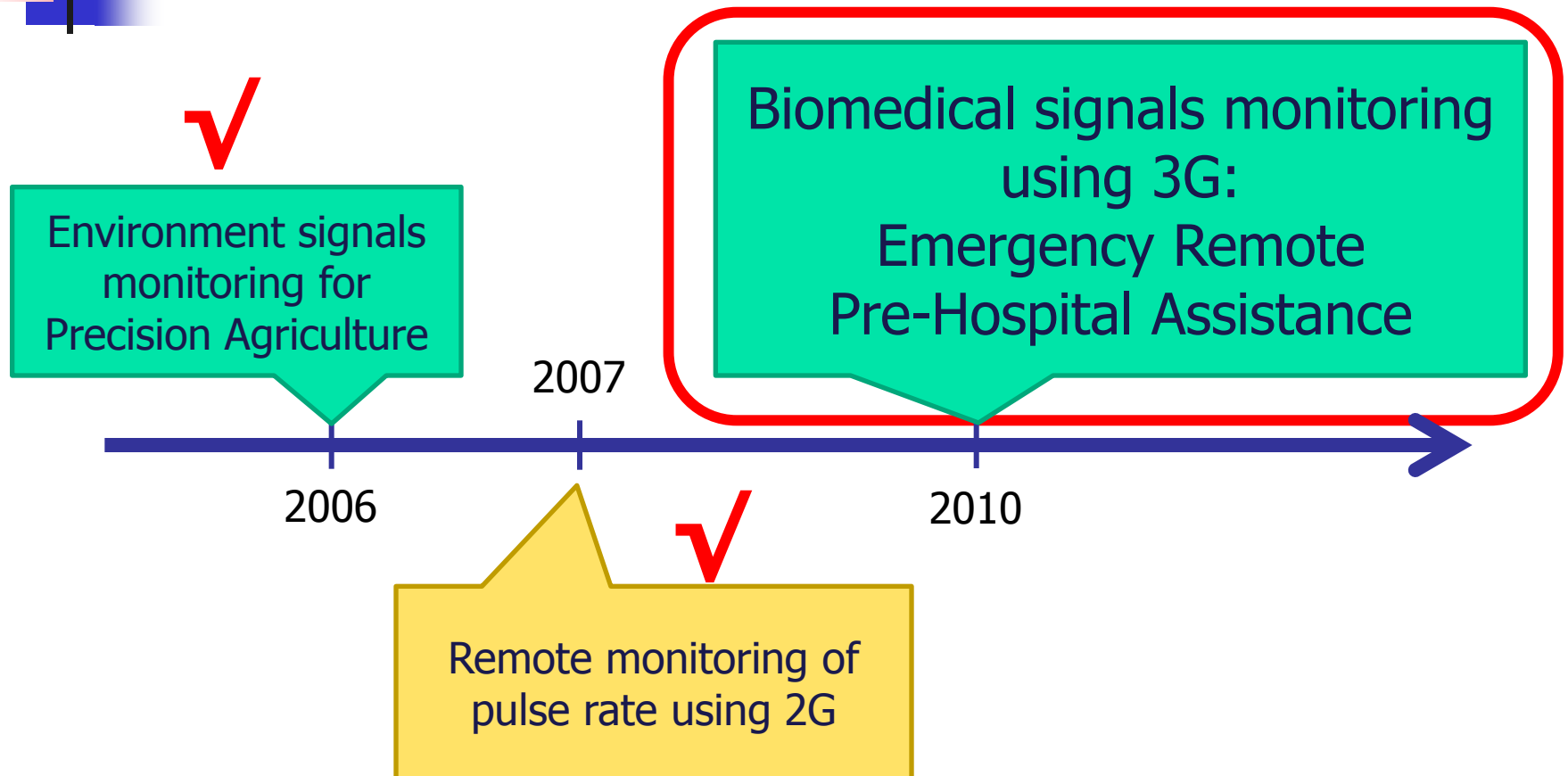
- Phone capture and display



- WEB monitoring



Using **Wireless** Metropolitan Area Networks





Remote Monitoring of Biomedical Signals Using **3G**, ERPHA project

In collaboration with the Instituto
Tecnológico de Monterrey, Mexico

Funded by



Microsoft



Motivation

- Vehicular accidents with traumatic results are among the main causes of death in the world.
- Emergency care provided during the first hour, the “golden hour”, determines if the life of the most severely injured people can be saved.
- Neither Chile nor Mexico provides pre-hospital continuous monitoring.

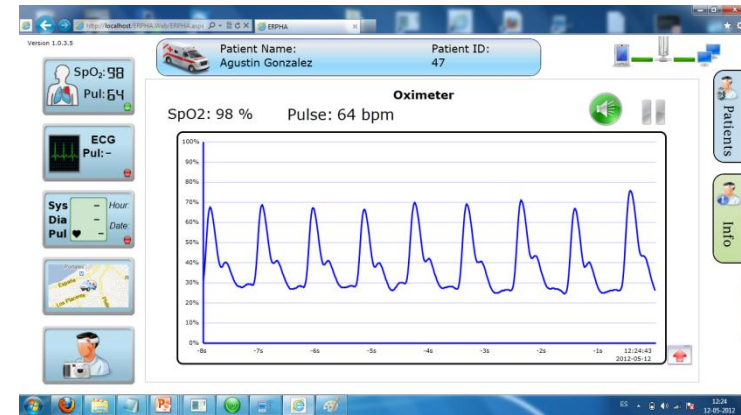
Emergency Remote Pre-Hospital Assistance

Overall
view



What biomedical signals are important ?

- Emergency specialists requested us:
 - Pulse rate
 - Pulse oximetry
 - Blood pressure
 - Electrocardiogram (ECG)
 - Geographic position
 - Patient's pictures



Sensors and phones

- Vital signs sensors

- Oximetry: Nonin 4100
- Blood pressure: Corscience BOSO
Medicus Prestige
- ECG: Corscience BT 3/6



- Smartphone

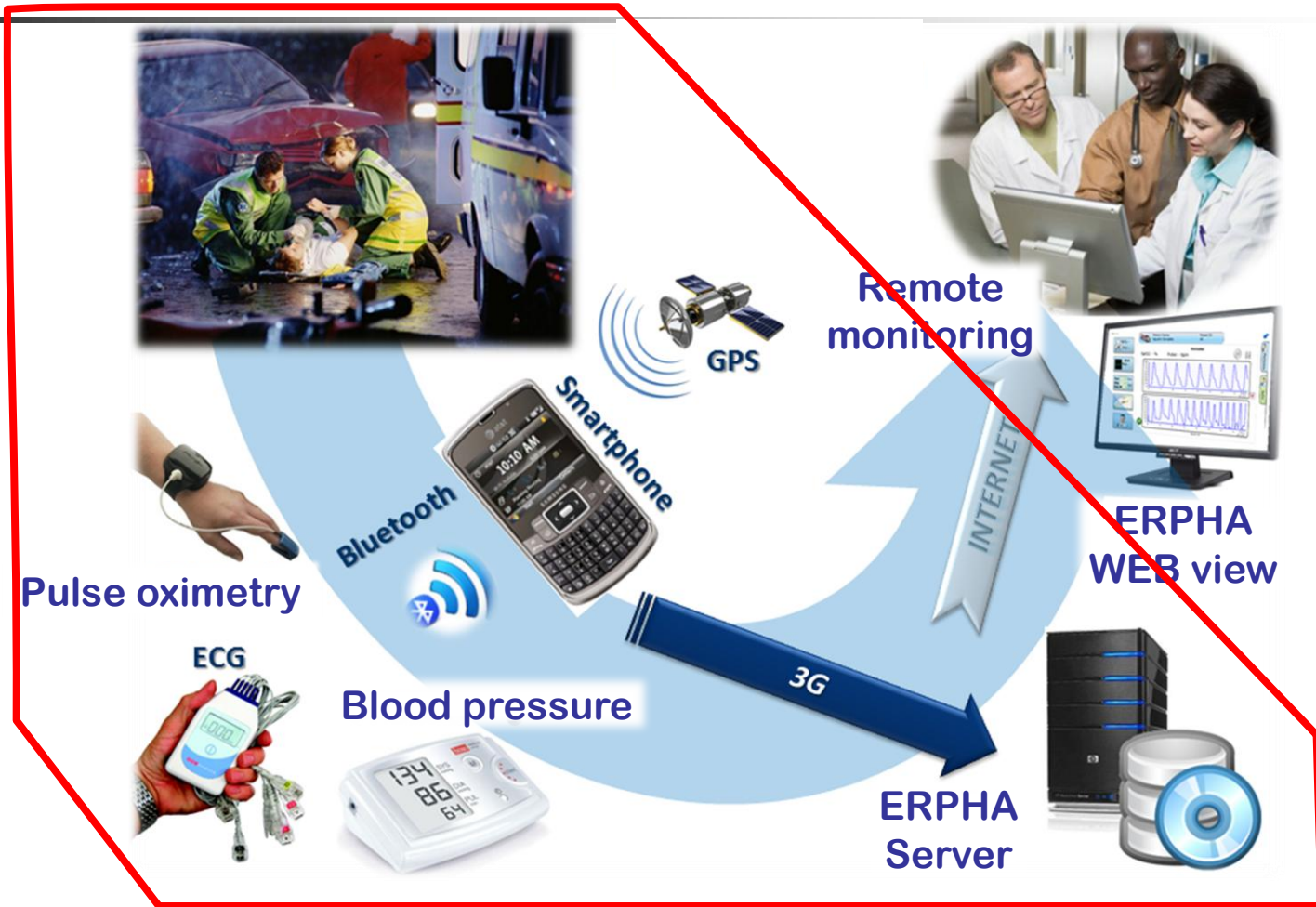
- Samsung i637
 - GPS, 3-Mpixel camera
 - Bluetooth, 3G, Wifi



Sensors and phones



Acquisition and storage architecture ...



Acquisition architecture

Sensors



Pulse oximetry



ECG



Blood pressure

Acquisition and communication control

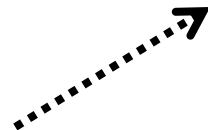
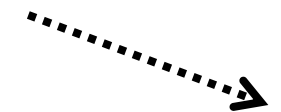


- + Pictures
- + GPS

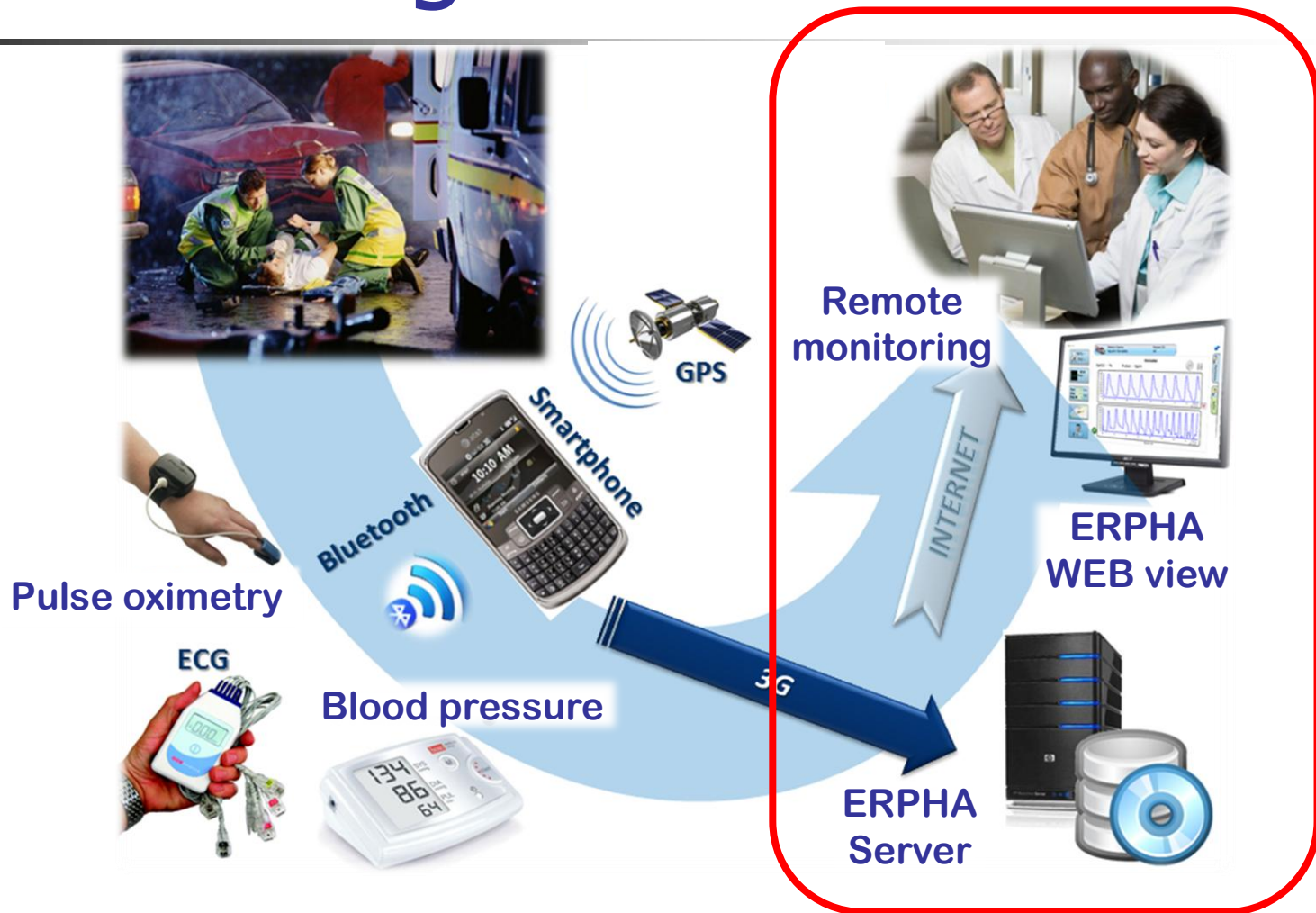
Storage server



- Storage Server
- + DB
- + WEB server



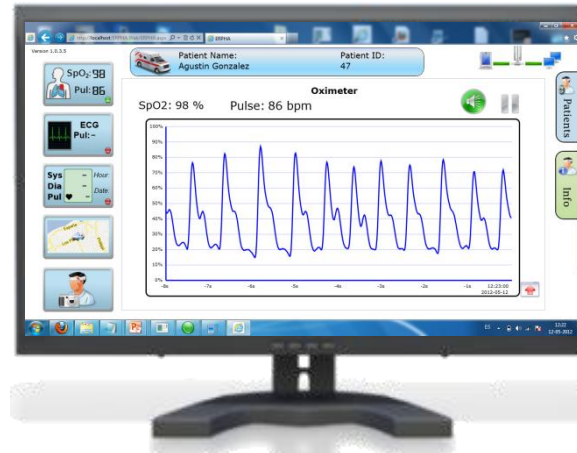
Monitoring architecture ...



Monitoring Architecture



Storage Server
+ DB
+ WEB server

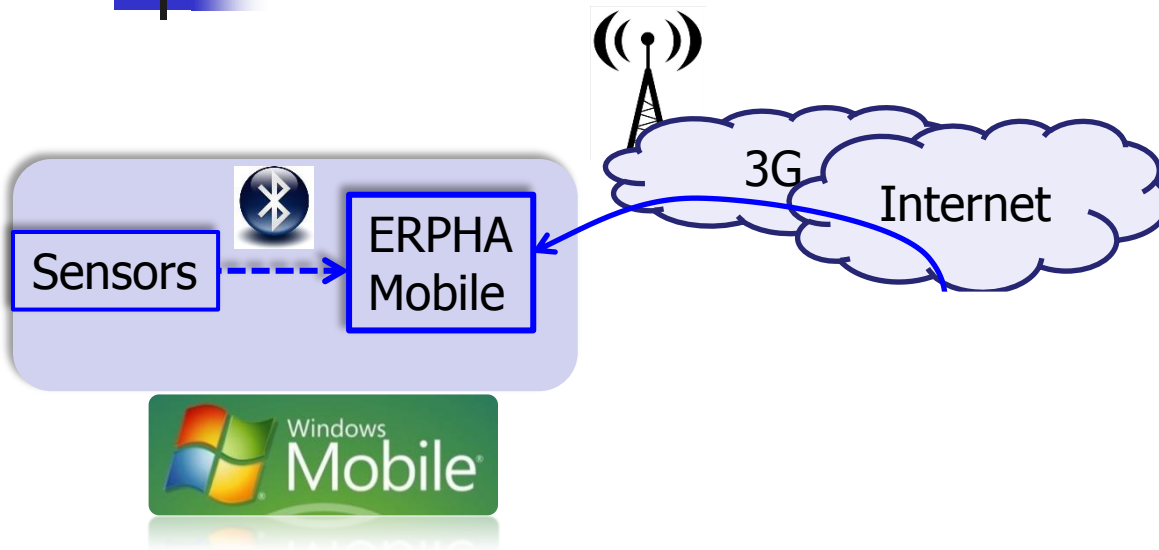


- Blood oxygen monitoring
- Pulse plethysmography
- Pulse rate (oximeter, EGC, pressure sensor)
- EGC
- Blood pressure
- Pictures
- Patient trajectory



ERPHA local Demo

Software tools



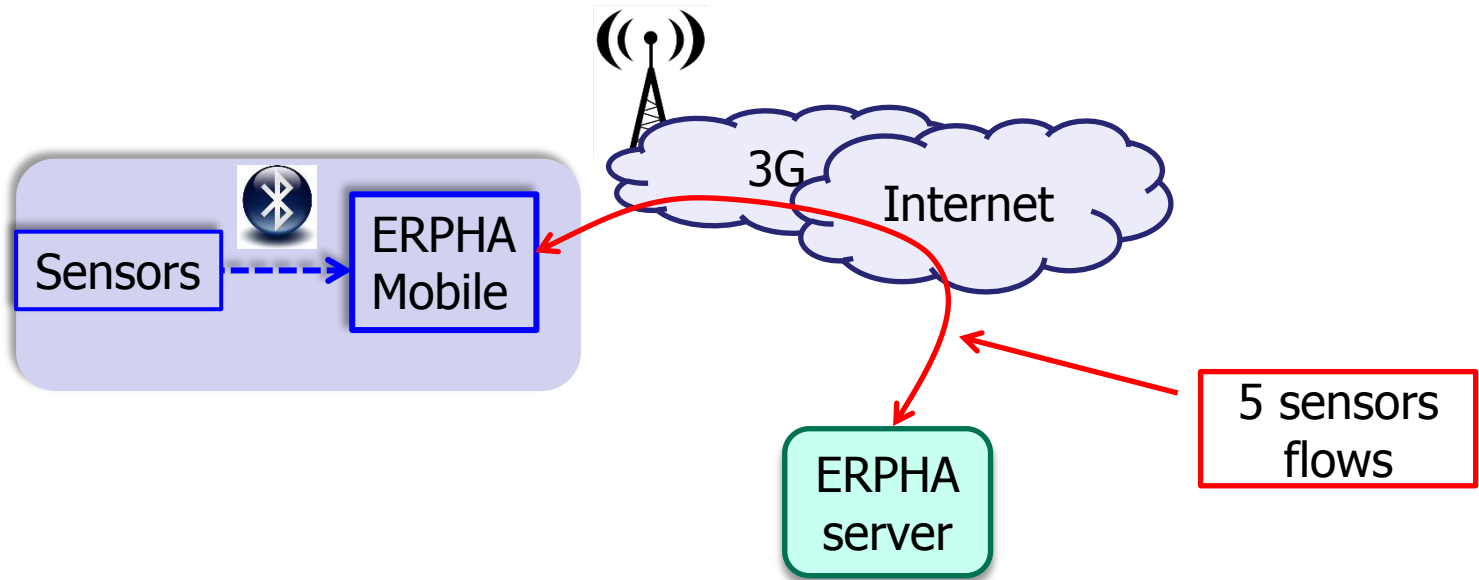
Languages: C# + XAML



↔ TCP

→ IPC

Work in progress



- Idea: by controlling the allocated bit rate to each sensor flow, we can reduce the latency of the critical flow.



Final comments

- In normal conditions, current 3G service provides enough throughput and latency for this type of applications.
- In congested links, managing the available bit rate can reduce the latency of a critical signal flow while delaying the others.
- The prototype has been already validated by emergency physicians in the lab.

ERPHA team





Thanks for your attention

Agustín J. González

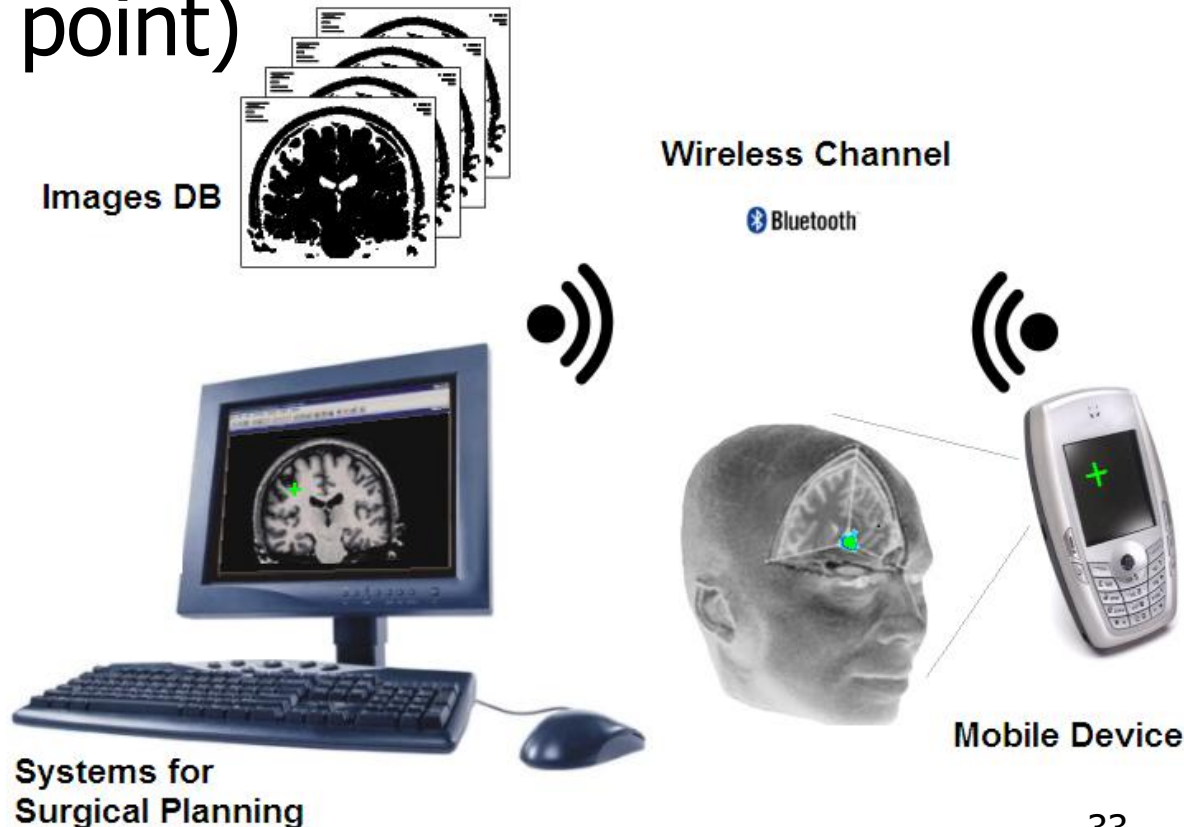


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Using augmented reality for neurosurgical planning :Craniotomy

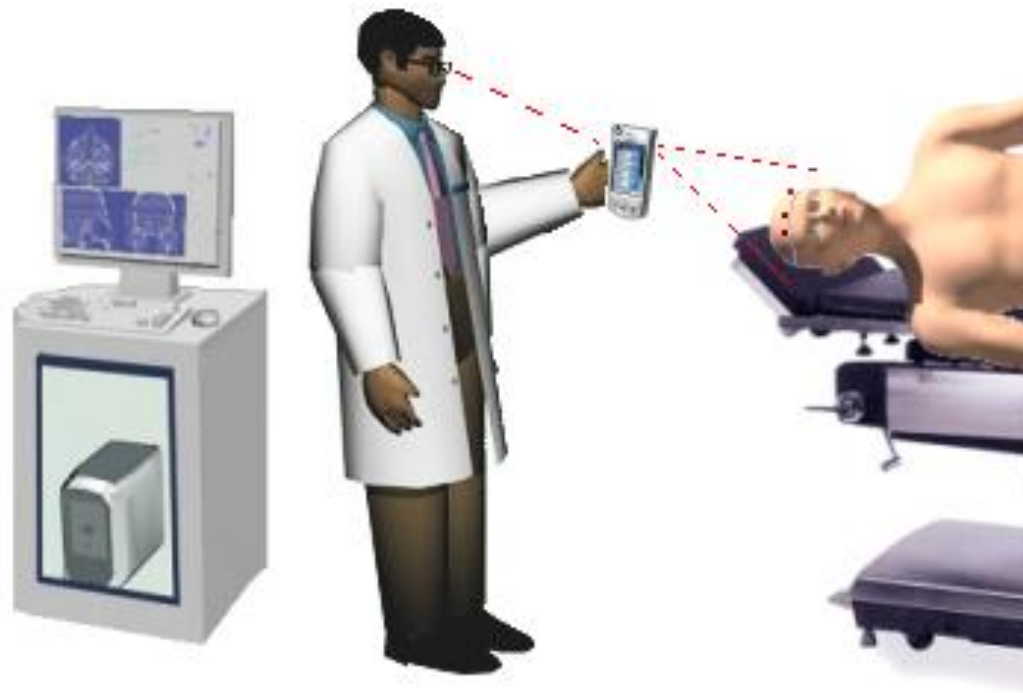
- Objective: To help surgeon to find attach point (opening point)



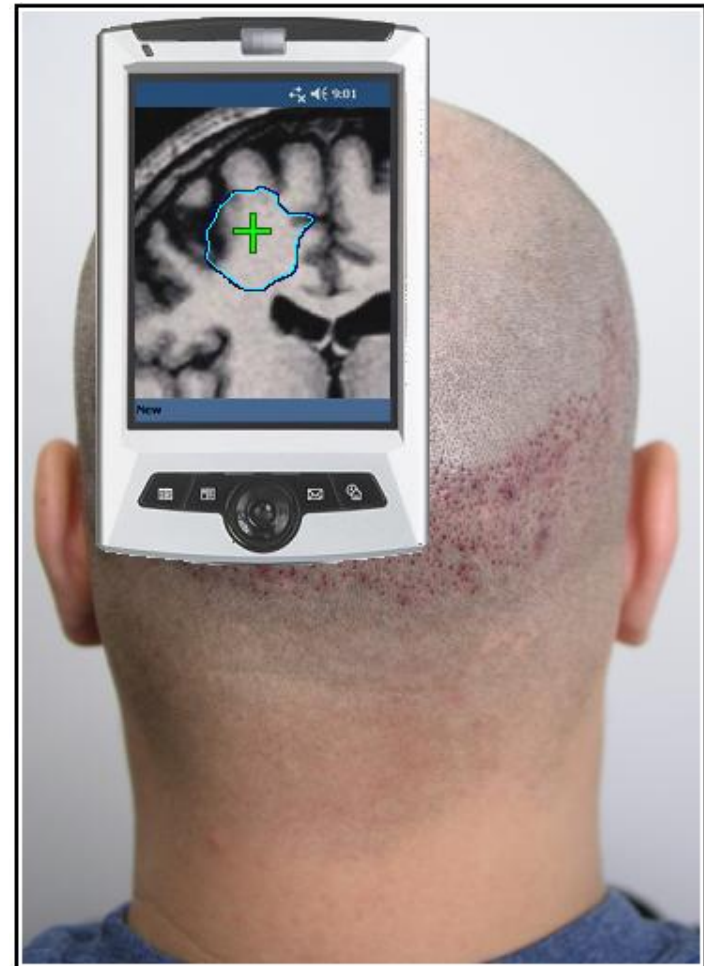
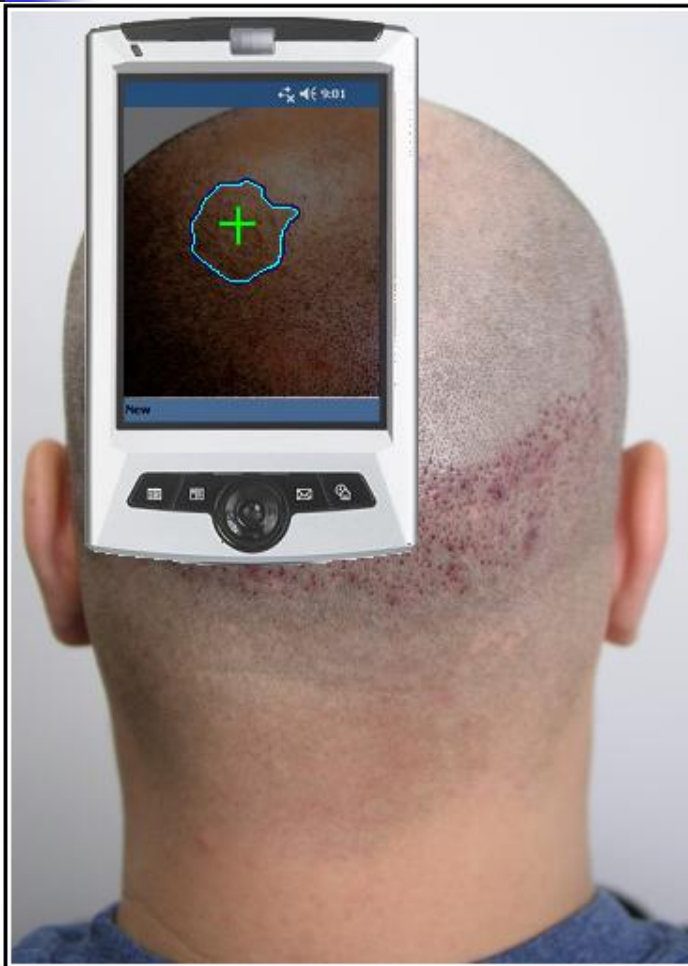
Propose system



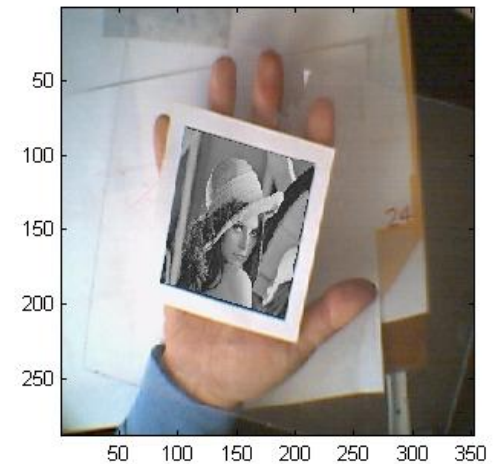
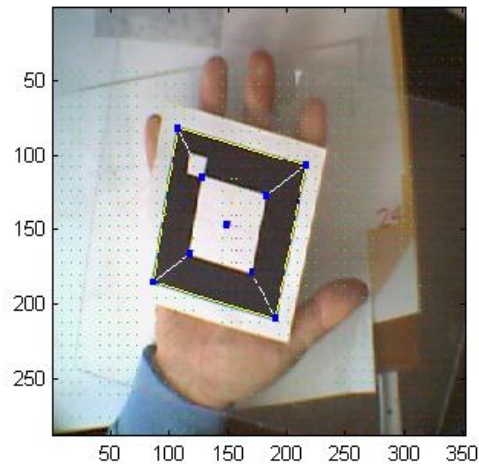
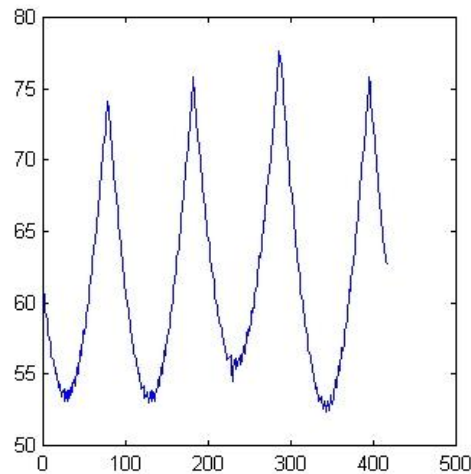
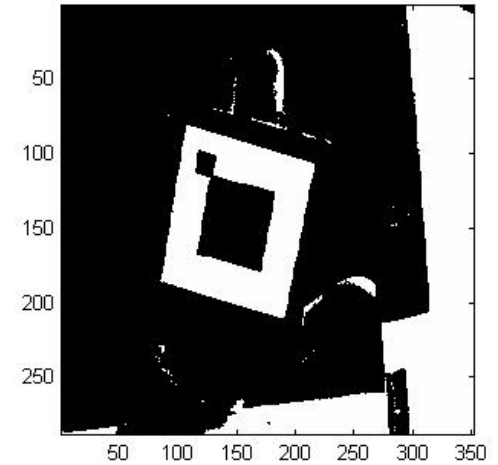
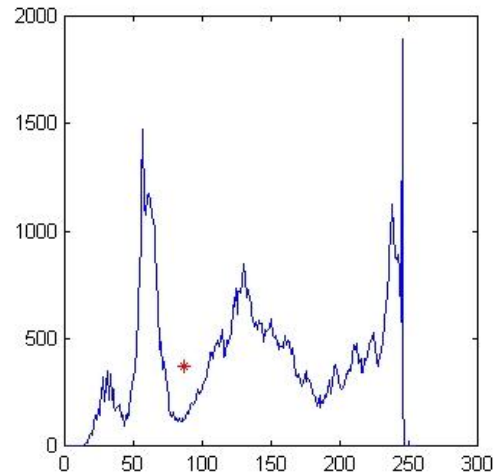
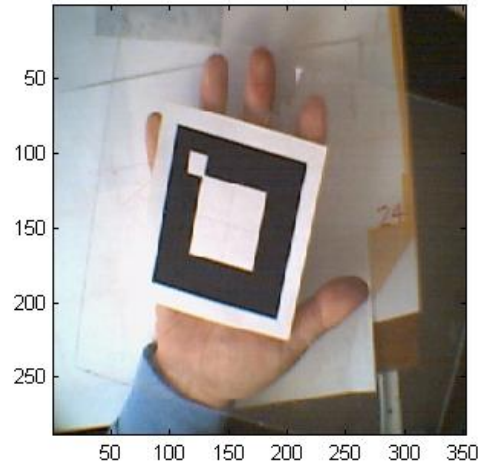
Use scenario



Expected result

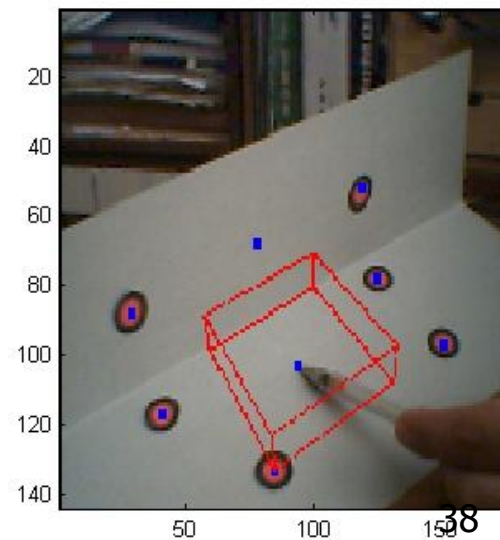
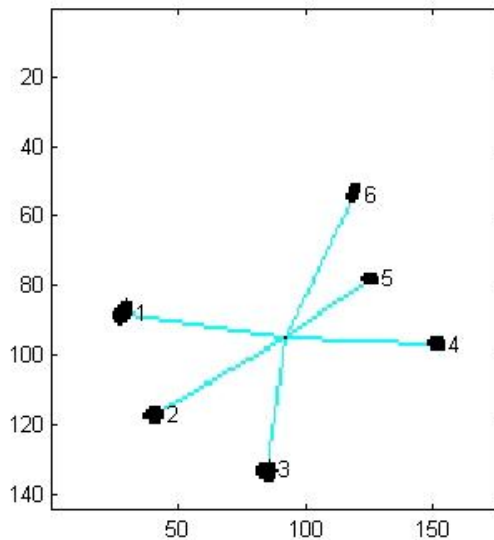
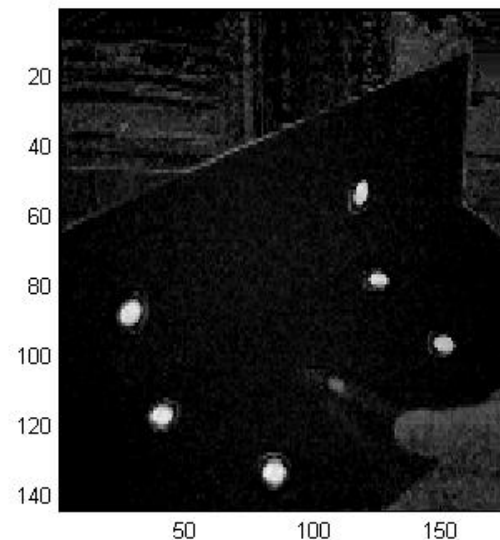
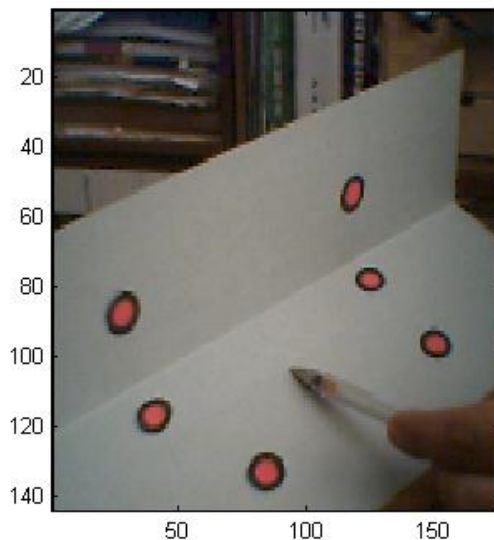


Some Results: Image projection over a 2D pattern

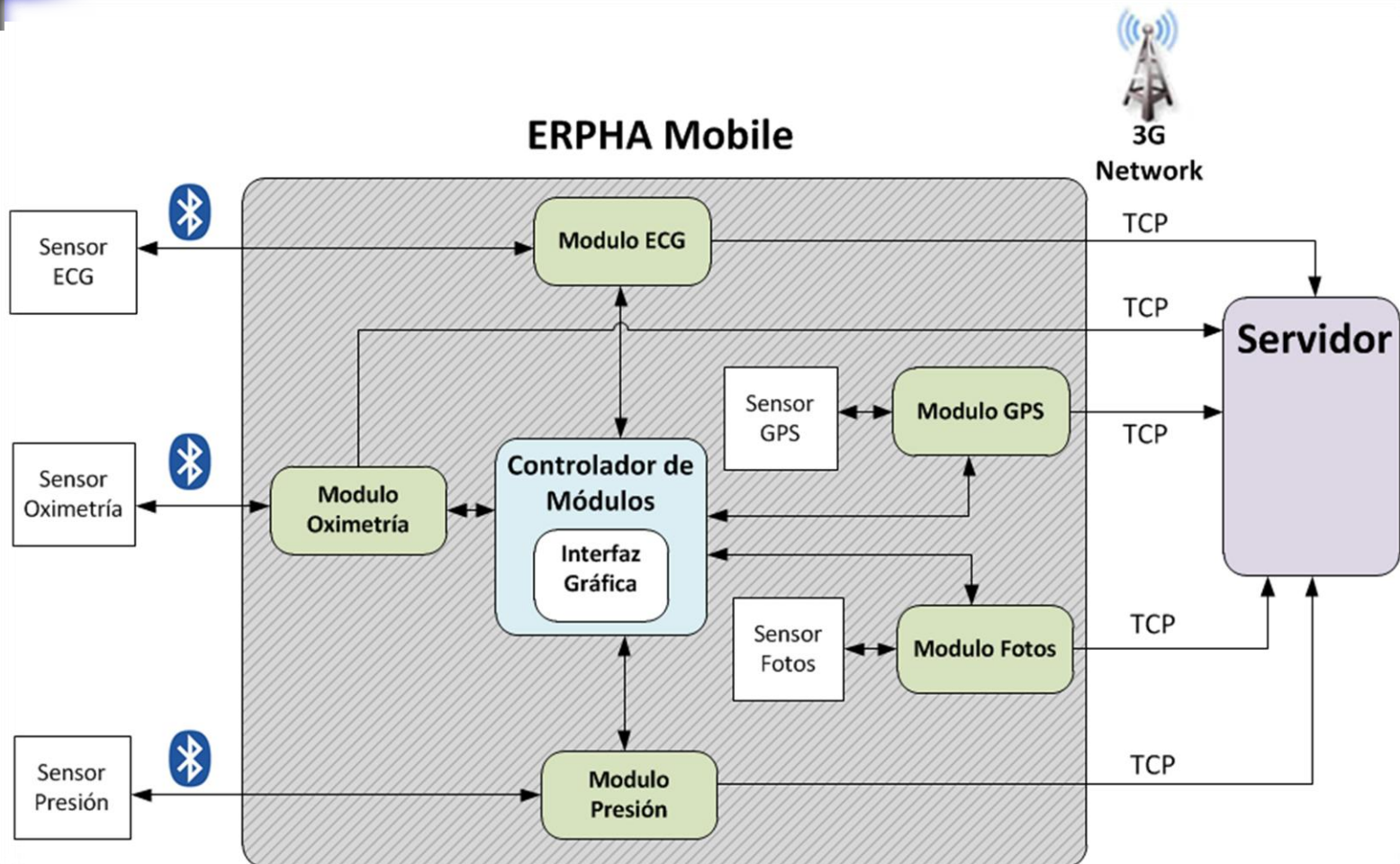




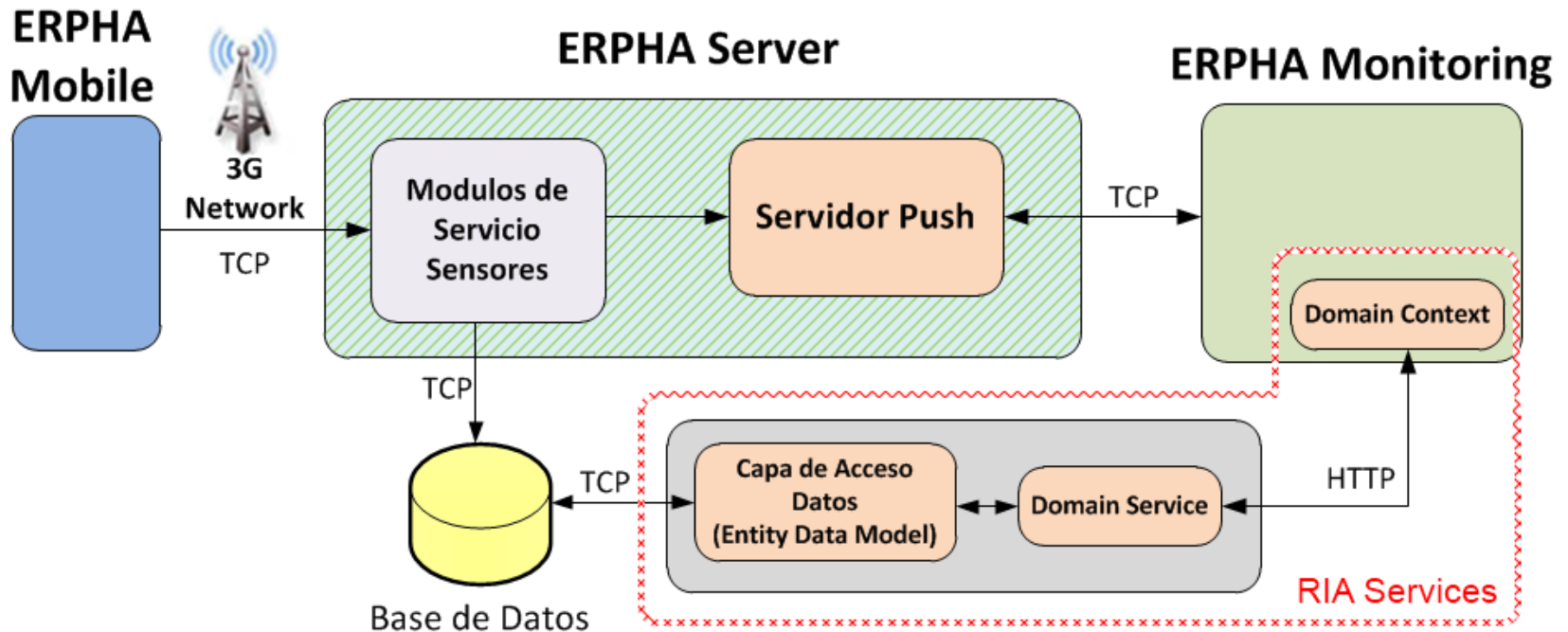
Now 3D projection



ERPHA Mobile Architecture



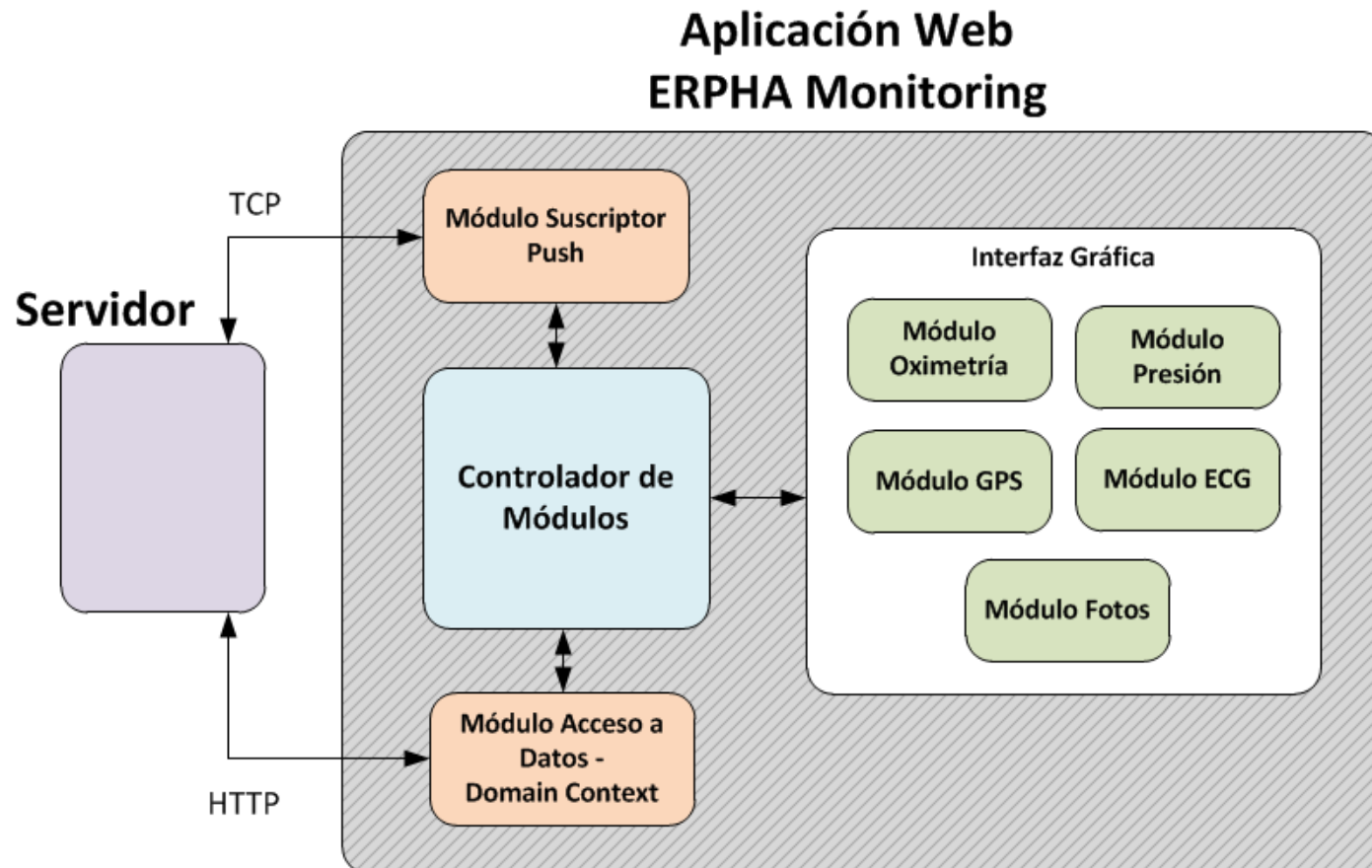
ERPHA Servers



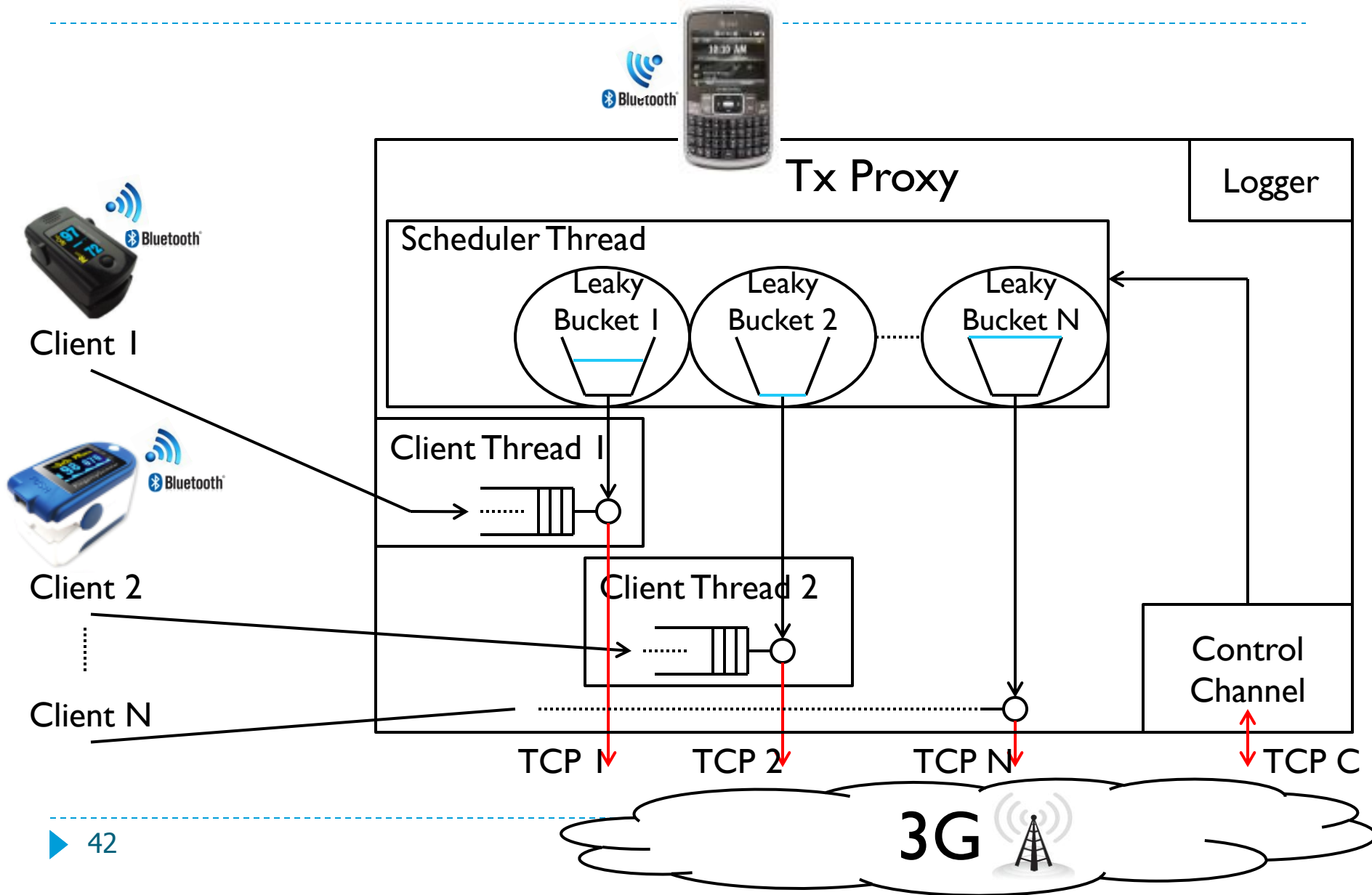
Base de Datos

RIA Services

ERPHA WEB Monitoring



Tx Proxy - Architecture



Rx Proxy - Architecture

