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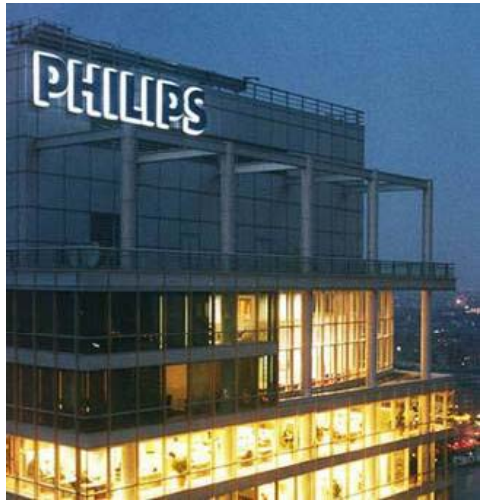
sense and simplicity



The development of E-Health in the field of cardiovascular medicine

The role of SMART TEXTILES

EHRA SUMMIT 2010

Harald Reiter Philips Research Europe

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Content

- Trends in health monitoring
- Smart textiles
- Applications for smart textile systems
  - The cardio vascular domain
    - Prevention - On demand
    - Fast access
    - Disease management
- Example projects of the European framework programmes

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Analogy – Technology Trends

Communicate

anytime, anywhere

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Analogy – Technology Trends

Monitoring anytime, anywhere

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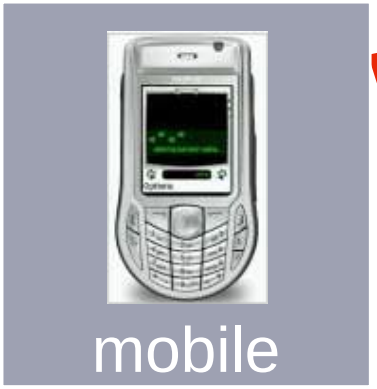
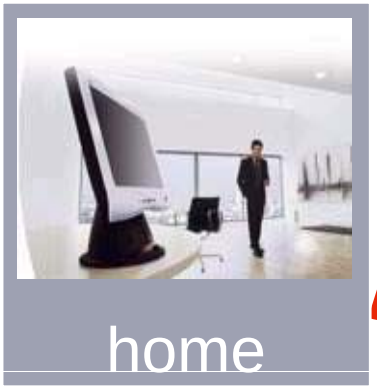
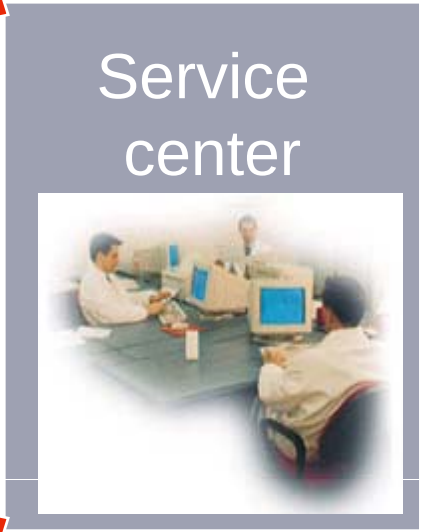
Example system from EU FP6 project MyHeart

From preventive healthy living to living with chronic condition







Monitoring

Diagnosis

Therapy support

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Smart textiles for Cardio-vascular applications

- Seamless integration of monitoring sensors and wearable electronics embedded in textiles
  - Smart Textiles are the carrier of sensors and electronics
- Measurement: Standard vital body sign parameters
  - ECG, HR, Breathing, Activity, SpO2, temperature, …..
- Measurement: Advanced parameters
  - Bioimpedance, heart sounds, …→ lung fluid, cardiac output, …
- Benefits:
  - Allow integration in daily life
  - Allow for ease-of-use
  - Allow reliable self-measurements
    - Positioning of sensors for daily measurements

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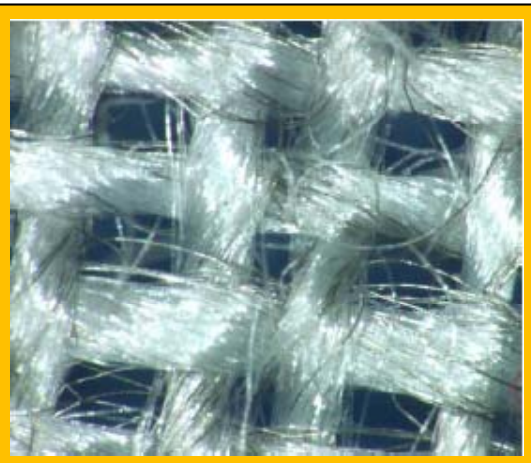
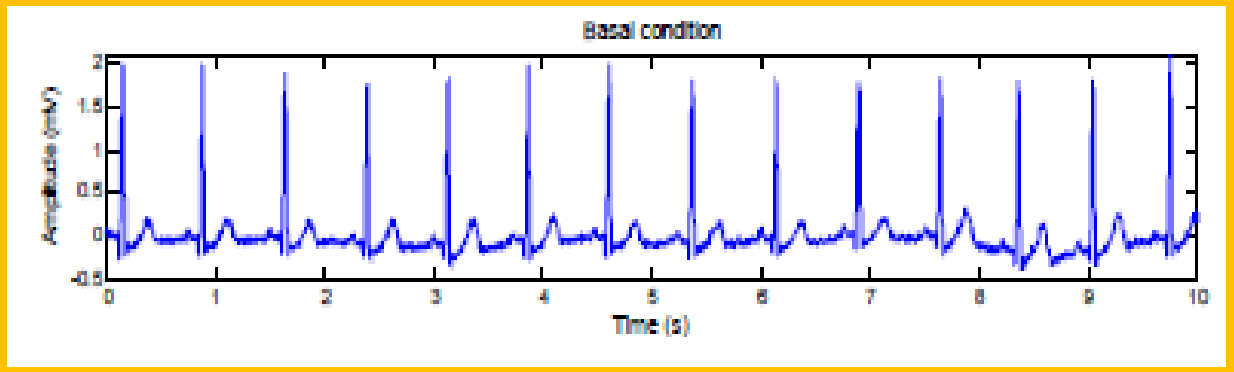
ECG detection in smart textiles





Avoid glued electrodes → Textile electrodes allow skin contact without skin irritation for daily use

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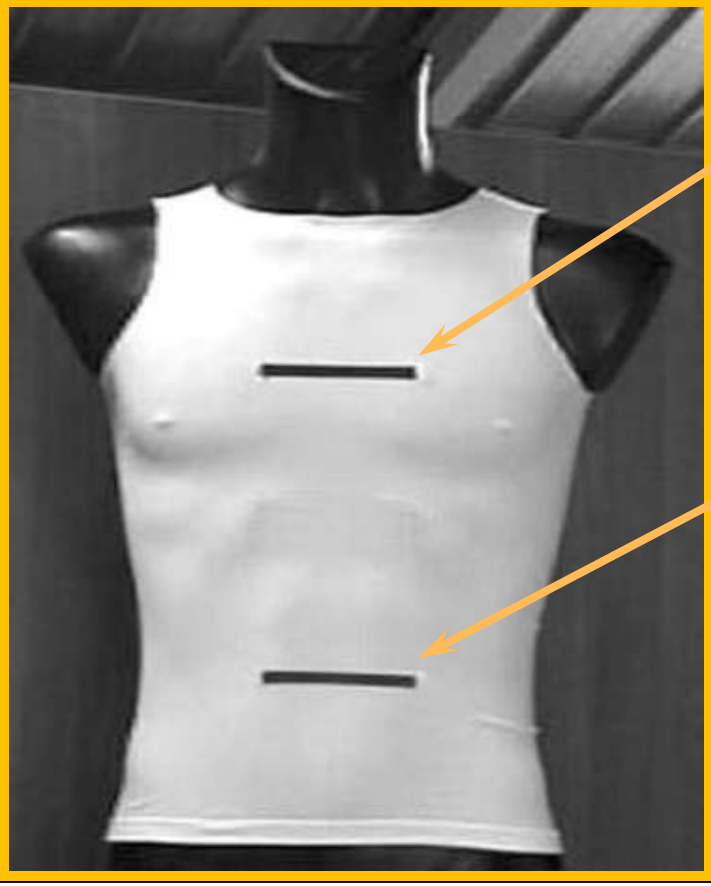
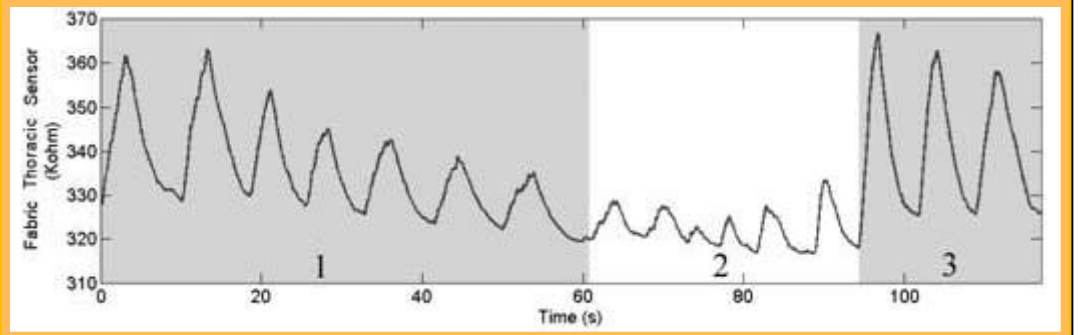
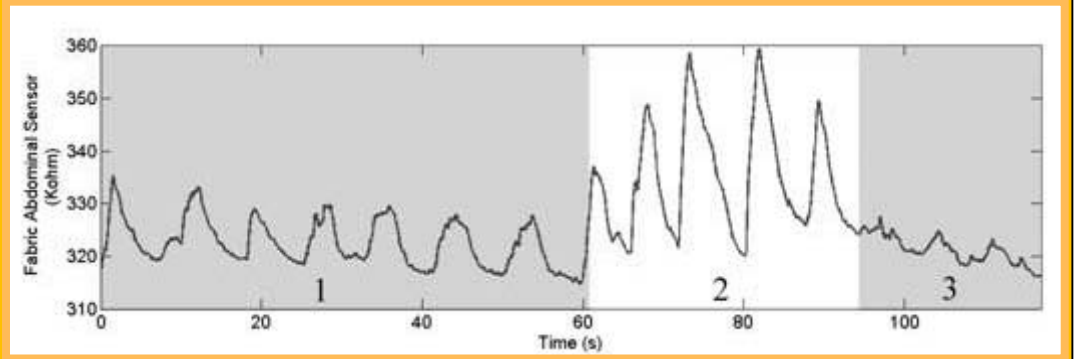
Breathing detection in smart textiles







Two piezoresistive fabric sensors integrated in a seamless shirt provide information about thoracic and abdominal respiration (Smartex)

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Smart textiles for elderly

- Requirements for medical textiles dedicated for elderly does not allow the use of tight shirt solutions
  - Dressing is major problem
  - Easy-to-dress is necessary to allow accurate and repeatable positioning of the textile sensors on the body
  - A tight textile solution is uncomfortable and therefore not accepted by the users

- Usability testing of textile solutions is a must



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Motivations for medical services

Prevention

- cardio fitness
- cardiac rehab
- change of habits
- on demand

Prevent disease!

Fast Access

- reduce time to treatment
- early admission

Save lives!

Disease management

- medication compliance
- early warning
- consultation of specialists

longer lifetime!

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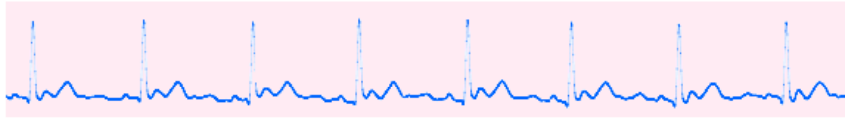
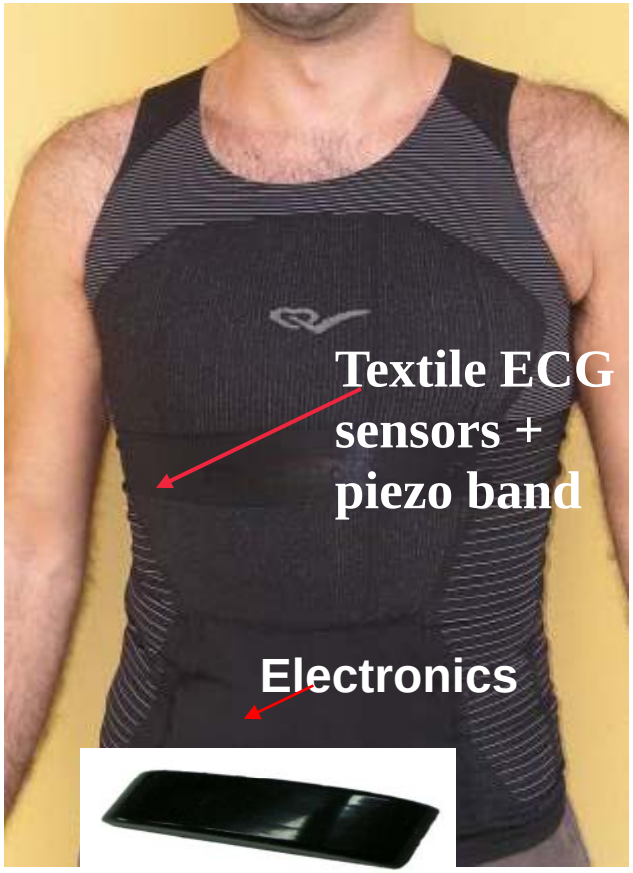
Cardiac Rehabilitation:

Shirt for monitoring ECG + Respiration + Activitv



- **To measure during physical activity**
- **To guarantee comfort during the rehabilitation training**



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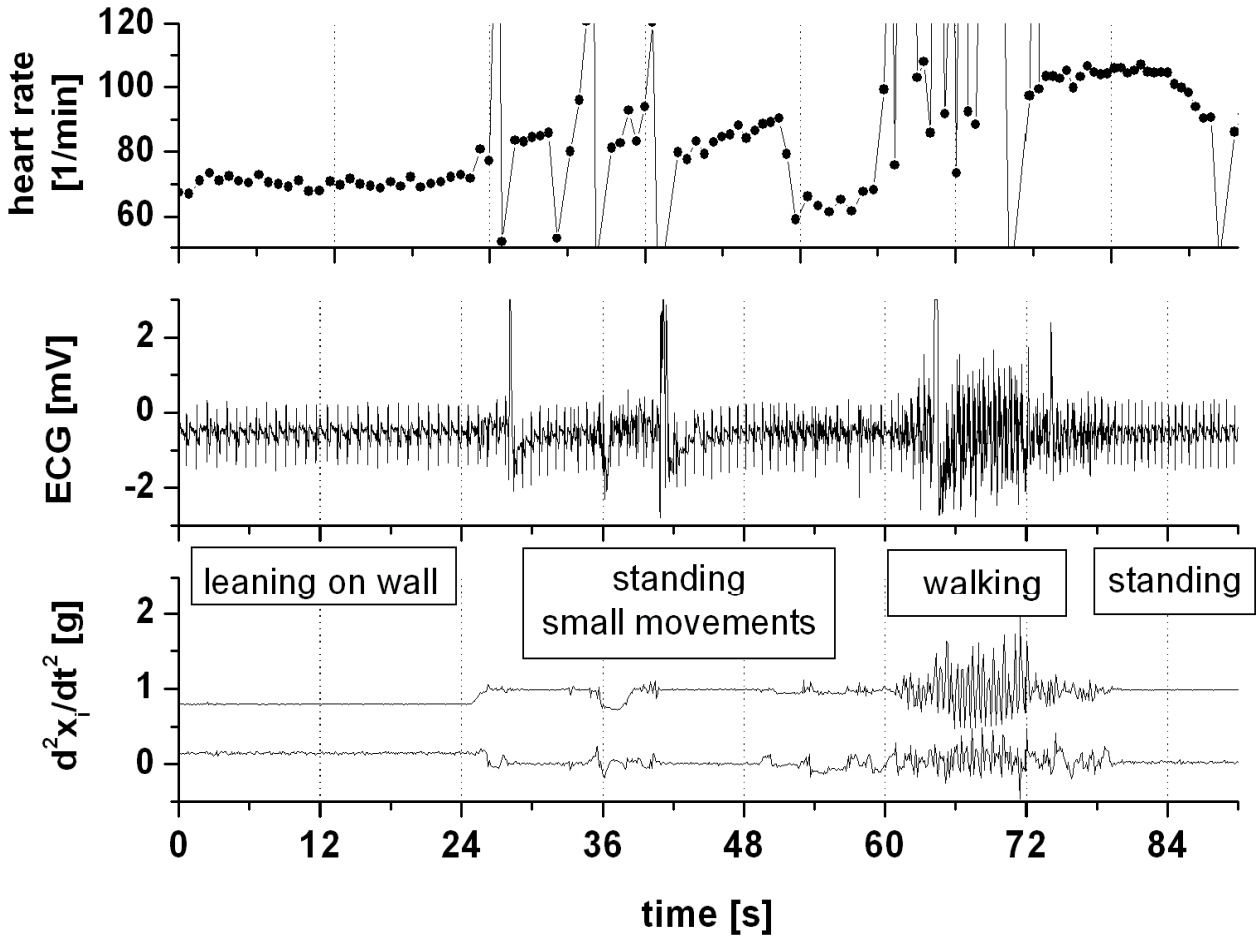
Intelligent Data Interpretation



Shirt for cont' HR and activity monitoring

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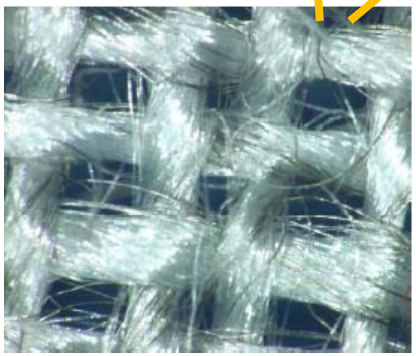
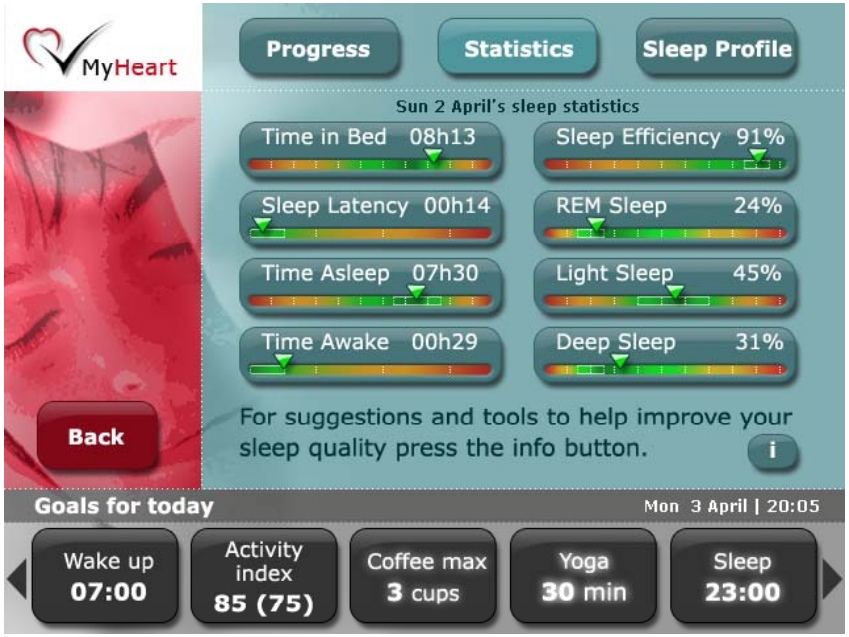
Sleep Management

- Aim: Detect/manage sleep problems at home
- Solution: System for monitoring vital parameters in bed





Sensors:

- Textile ECG and piezo foil sensor system (below bed-sheet)
- Textile sheets in collaboration with MyHeart partners

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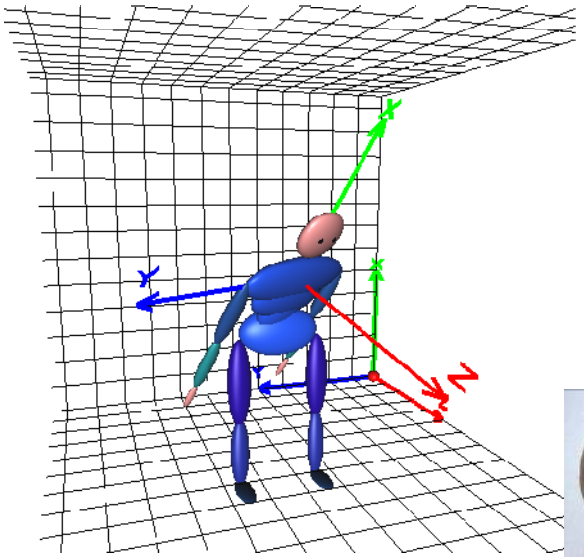
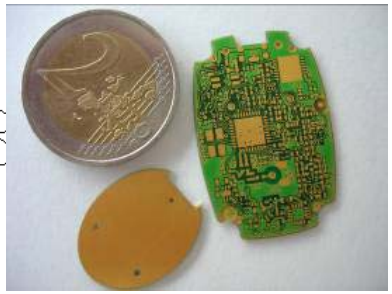
Stroke Rehabilitation: Movement analysis

Catsuit (by Smartex):





Textile solution +

hard-sensor system

On-body network:

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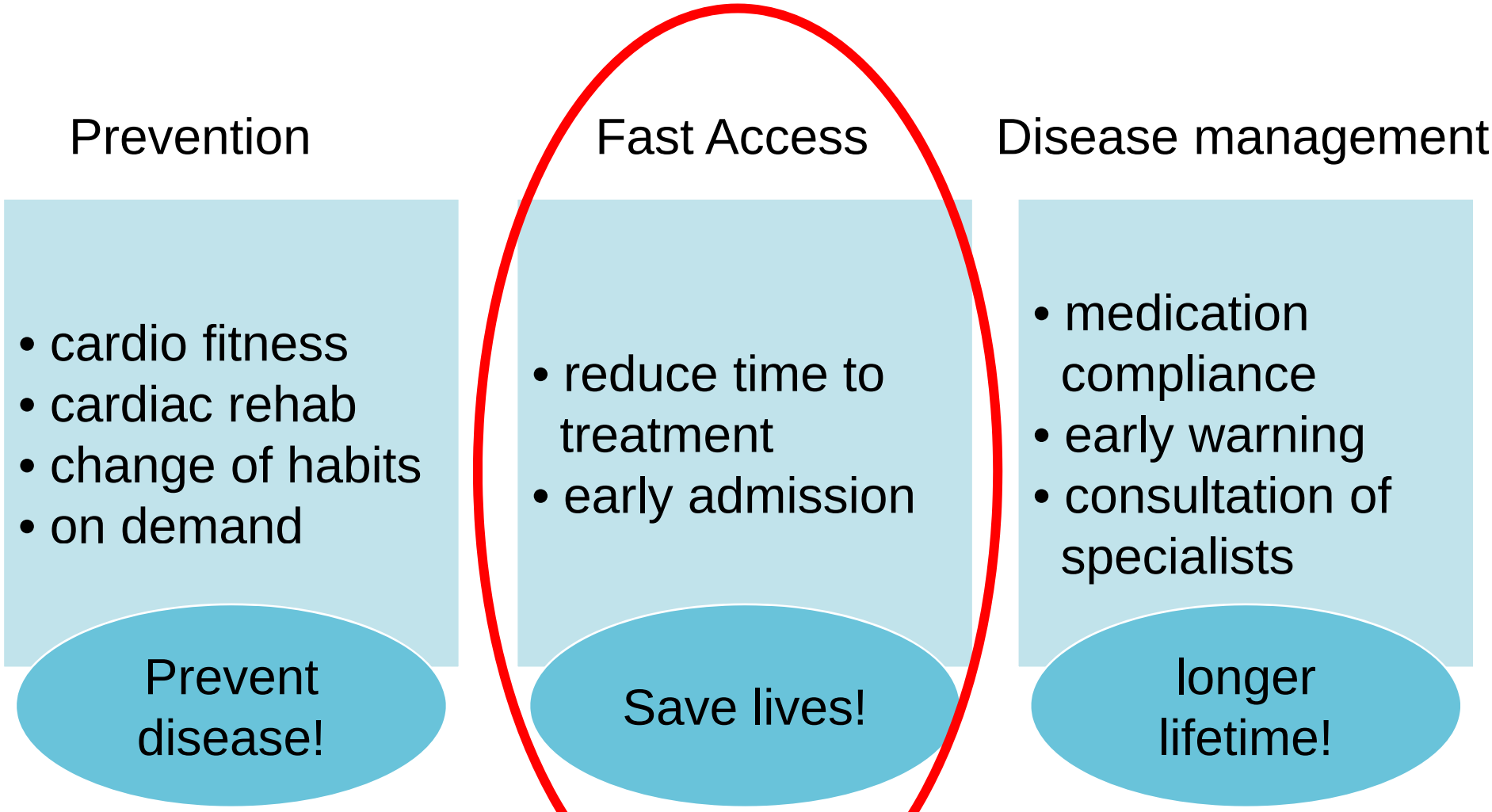
Motivations for medical services



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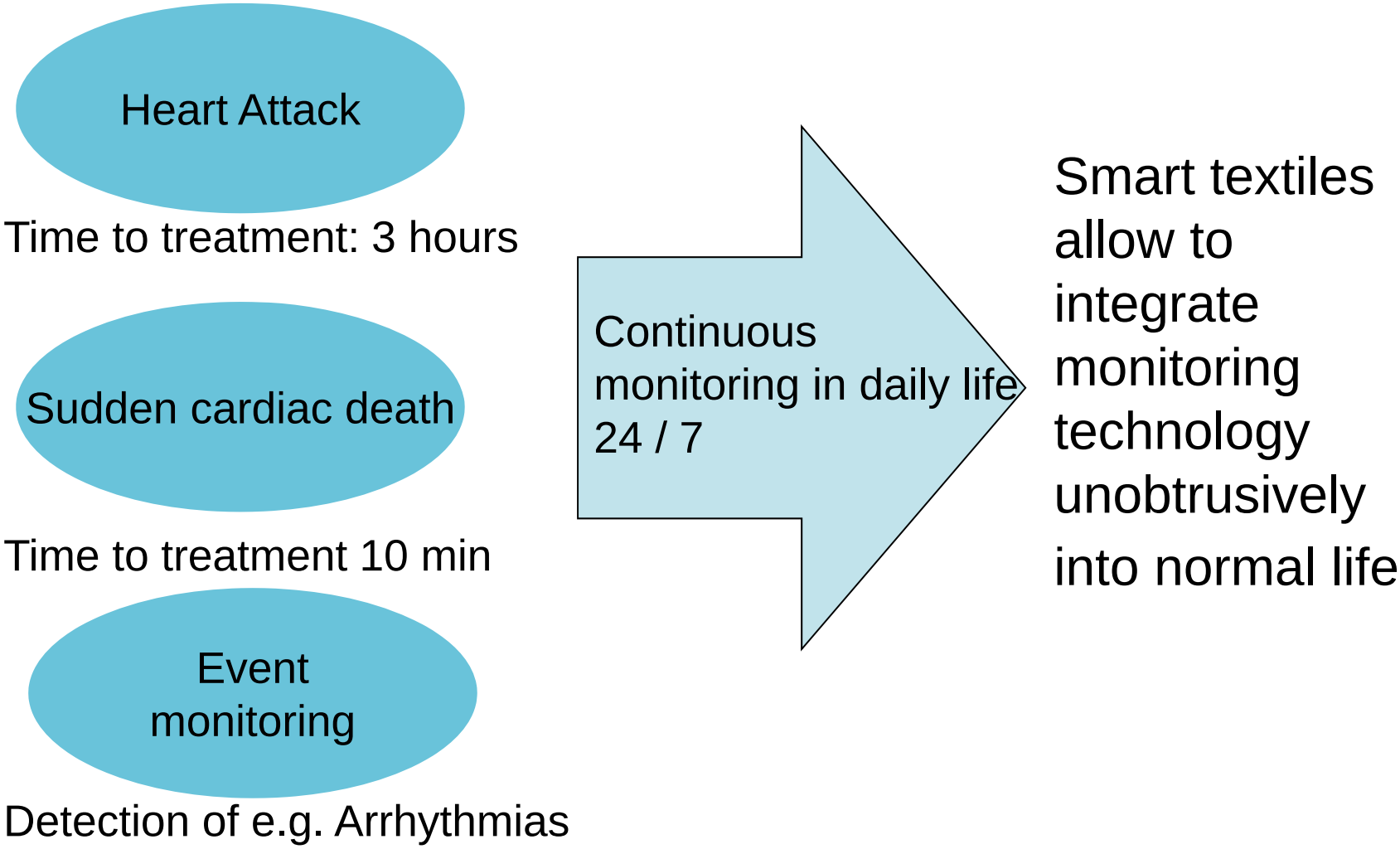
Fast Access → Cardiac Monitoring

Applications:



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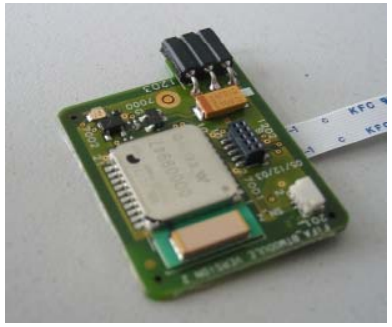
Unobtrusive continuous monitoring e.g. in underpants



Wearable Health System
EU project *Wealthy*

- **Small and Lightweight**
  Only 145g, small PDA size
- **Easy user interface**
- **Data transmission over GPRS link**
- **Sensor interfaces** for:
  - 5-lead ECG
  - Impedance measurement (respiration)
  - Piezo-resistive bands (movement)
  - Skin temperature
  - Standard oximetry sensor
  - Integrated accelerometers
- **Signal processing**
  - Heart rate
  - ECG enhancement
- **Powered by a Li-Ion battery**
  - Autonomy up to 4 hours with real-time streaming of all signals over GPRS

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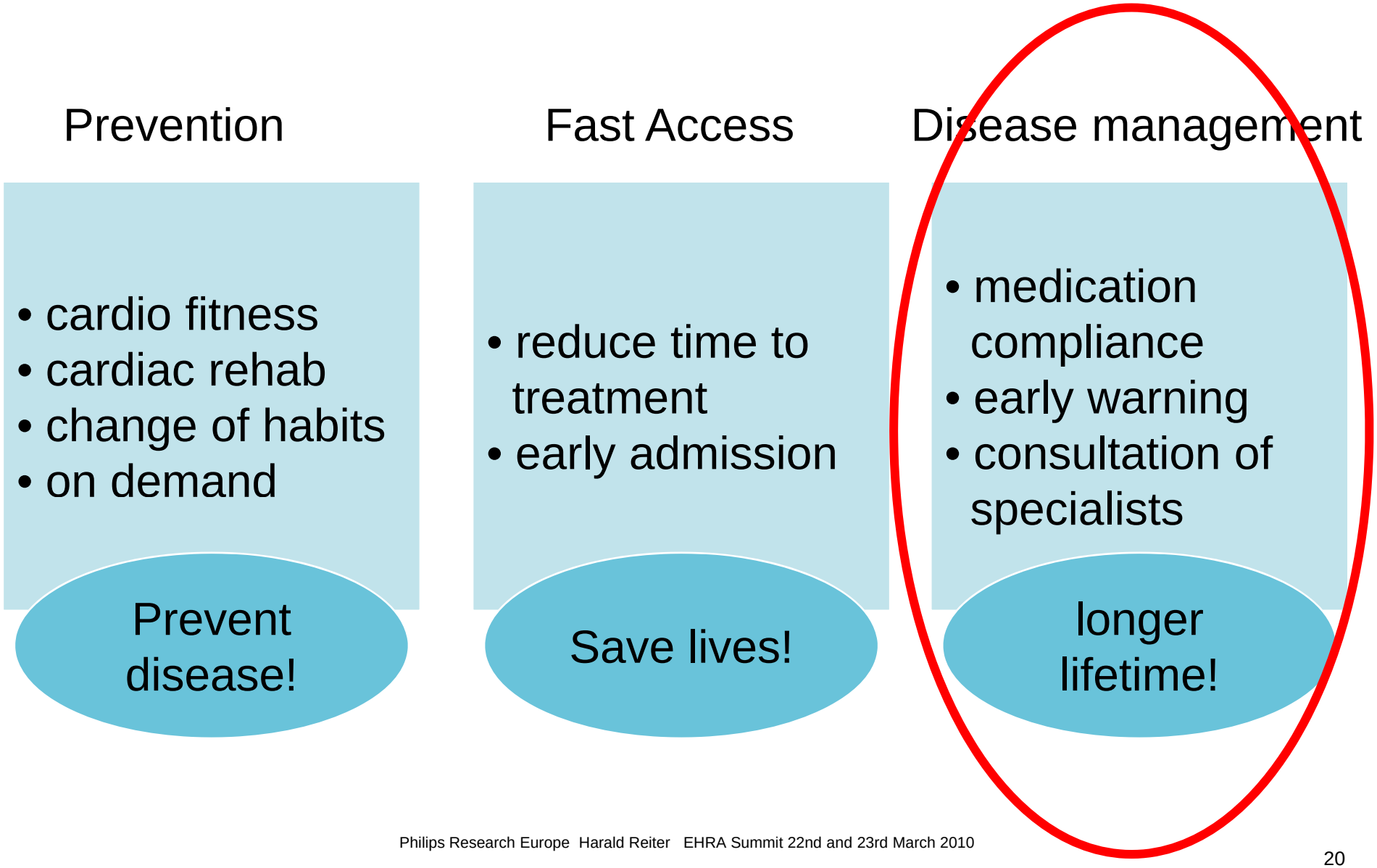
Motivations for medical services



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Focus on

Tele-monitoring

Managing the disease of cardiac patients at home

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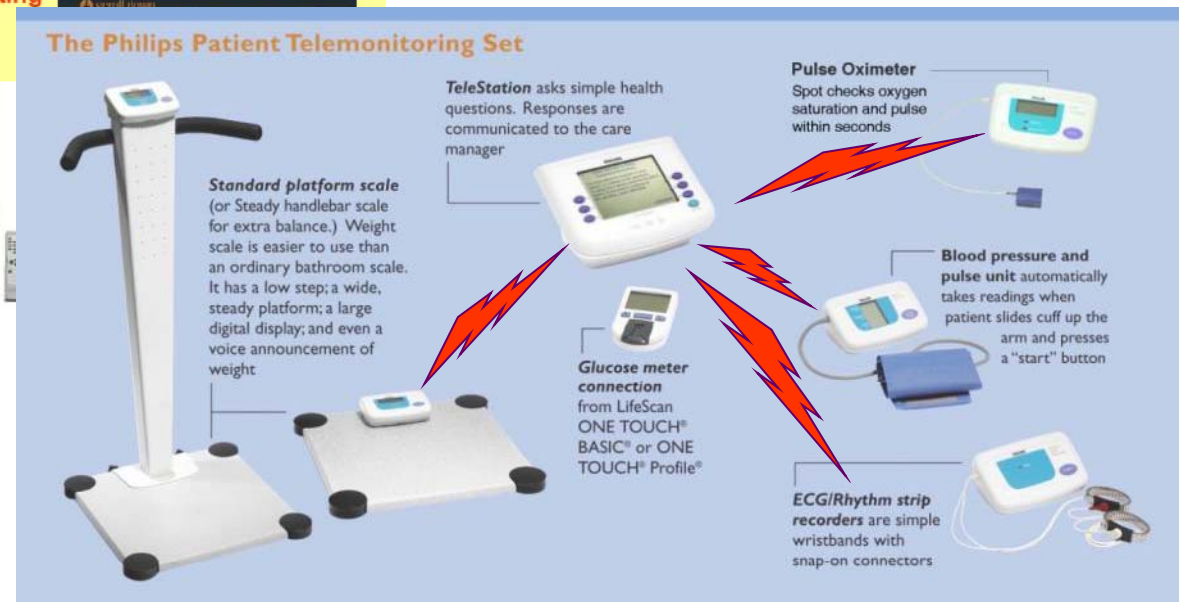
Philips Technology for tele-monitoring:

Motiva

PTS system

Award-winning Vital Sign Measurement Technologies



Wireless, Accurate, Reliable, Unobtrusive, and Easy to Use

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Innovations enabled by Smart textiles

- Advanced sensor for home monitoring
  - Lung fluid detection by Bio-impedance measurement
    - Early decompensation detection

  - ECG and respiration monitoring during night
    - 6-8 hour continuous monitoring at night to detect trends

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Disease Management

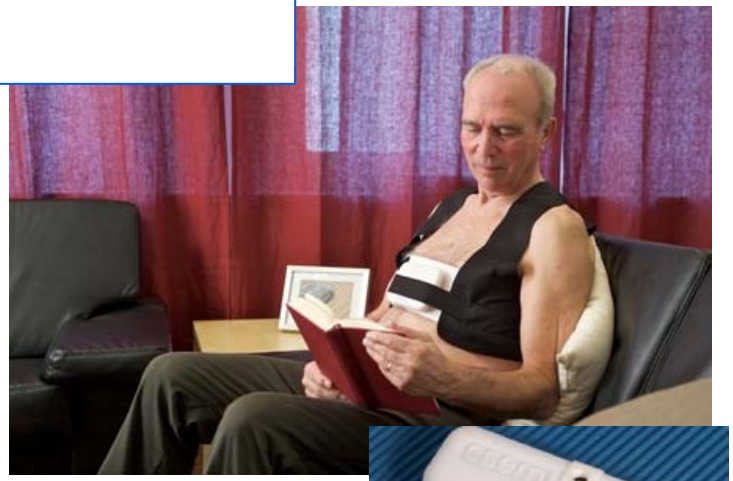
solutions developed in MyHeart and HeartCycle

Two prominent European Integrated projects

Measurements of vital signs
for patients per day only twice:

- 15 min morning session
- 15 min evening session

→No 24/7 monitoring required



→Advantage

- →Adjusted for patient
- →Ease of use
- →Reliable self-measurements
- →Easy positioning of sensors for daily measurements

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Smart bed: ECG, respiration, activity, sleep assessment during night

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BioImpedance Monitor: ECG, lung fluid, activity

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MOVIE How the future should be

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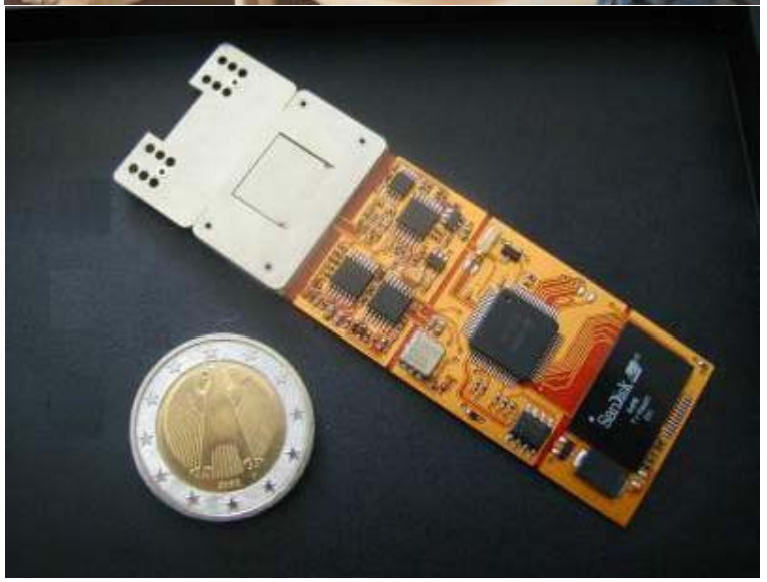
MyHeart

EU FP6

Fighting CV diseases by prevention and early diagnosis



Smart clothes, Textile sensors, Wearable electronics, Patient interaction, User devices, Professional platform

\+ medical validation

European project
IST E-health (6th framework)

- Start: 31.12.2003
- Duration: 60 months
- Partners: 30 (10 countries)
- Total manpower: ~75 people
- Total budget: ~33 M€
- EC-funding: ~16 M€

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vodafone

Medtronic
When Life Depends on Medical Technology

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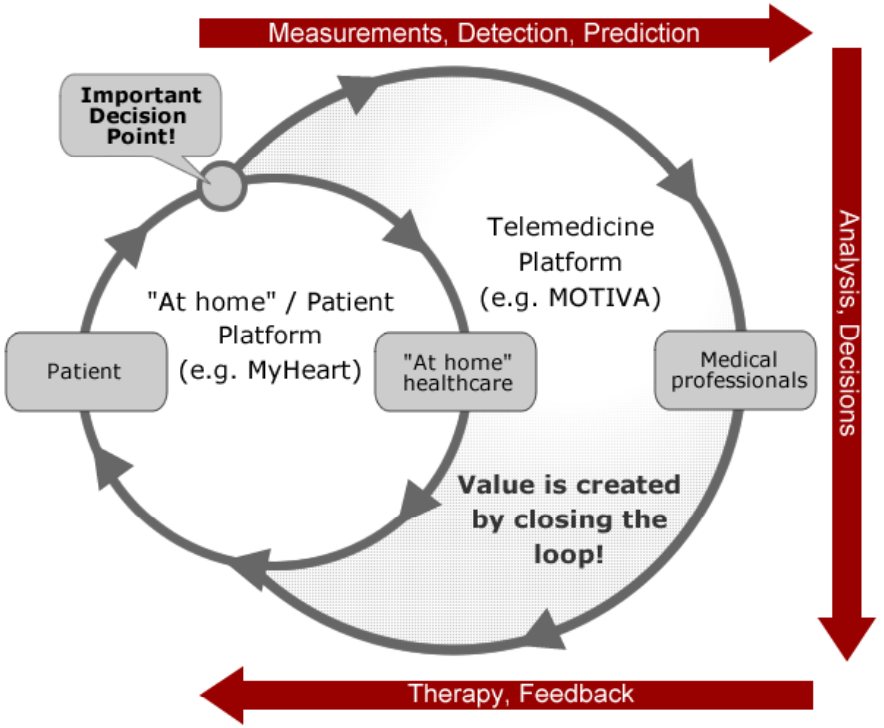
HeartCycle EU FP7

Compliance and effectiveness in disease management

- HeartCycle is one of the largest Integrated Project (IP) in the ICT for Health sector of the 7th Framework Programme of the European Commission

HeartCycle addresses challenges of tele-monitoring:

- Technology development, but also:
  - Patient needs
  - Reimbursement
  - Legal framework
  - Medical validation
  - Quantitative indicators of added value and potential impact
  - Integration in healthcare processes



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Medical experts in HeartCycle

guarantee that all application aspects are based on clinical excellence and the medical expert knowledge

Prof. John Cleland
University of Hull
Chief Medical Officer HeartCycle
Key opinion leader for tele-monitoring in Europe
Former Chairman of ESC (European Society of Cardiology)

Prof. Patrick Schauerte
Medizinische Klinik I, UK Aachen

Prof. Christian Zugck
University Clinic Heidelberg

Dr. Ramon Bover
University Hospital Clinico San Carlos, Madrid

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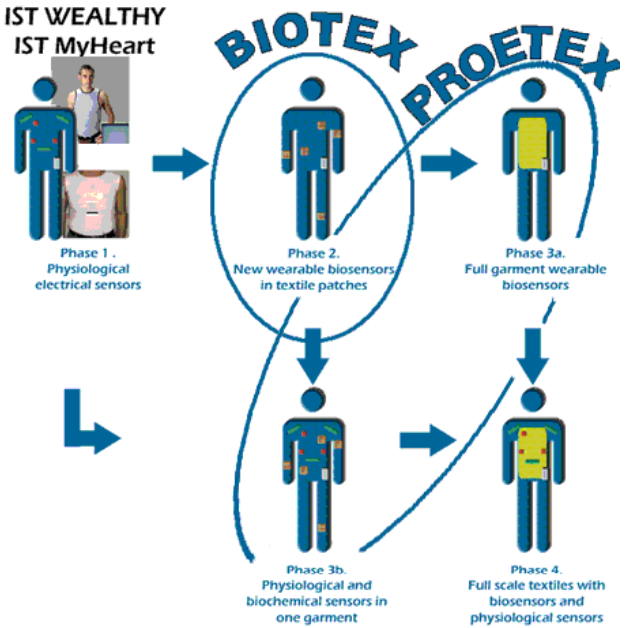
Information Society Technologies

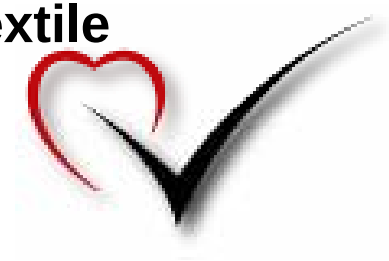
Without EU support not such progress →

Framework programmes bring together the different partners from academia, medical and industry

SFIT cluster allows cooperation and information exchange between EC co-financed projects

SFIT = Smart fabrics, interactive Textile





heartcycle

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- The HeartCycle project is partly funded by the European Community's Seventh Framework Programme under grant agreement n° FP7-216695

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Outline

- Smart textiles will enable new innovations in the delivery of healthcare in the cardio vascular domain
  - they allow to integrate these new technologies into the daily routine of the patients
  - they improve patient acceptance, ease of use for patients, reliability of self-measurements, and allow new advanced sensor measurements
- Smart textiles are only a part of the total management system but can play an important role
- EU-projects involve medical experts and provide research and medical validation of smart textile solutions
  - Medical endorsement
  - Cost benefits

Contact: **Harald Reiter** **harald.reiter@philips.com**

Disclaimer:

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