



Biosensors for m-health

Instrumentation, Sensors and Interfaces Group

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1. High-income countries

1. Increasing percentage of GNP: **sustainability?**
2. Limited access to private health insurance

2. Emerging economies and developing countries

Harmonic social development \Rightarrow Better medical services

3. Less-developed countries

Current technology: almost unaffordable



- Many medical devices are **very expensive** as compared to commonplace electronic gadgets
 1. Reliance on the latest technology advances
 - Result from research **not oriented to mass market**
 2. Focus on life-threatening scenarios
 - Clinical oriented: stringent **functional** and **safety** requirements
- But a large demand (and expense) arise from **long-term conditions**, **permanent disability** and **ageing**



- **Wellbeing** is an essential personal **right**... but **not a final condition**
- **Lifestyle** is a personal matter... but has a strong impact on health: **prevention**
 - Nutrition and weight management
 - Physical activity
 - **Blood pressure** management
- **Health care** is a “free”...but **exhaustible** public service



1. More emphasis on **prevention**
 1. Physical activity programs
 2. Fast check-ups of large groups
2. Telemedicine and **home health care**
3. **Health kiosks/Pharmacies** as alternative to primary healthcare centers
4. **m-Health**: health control **everywhere** at **any time**

Noninvasive biosensors

1. Images: skilled user, limited information
- 2. Surface signals**
 - Bioelectric signals: biopotentials, bioimpedance
 - Biomechanical signals
 - Optical signals (PPG, SpO₂)
 - Temperature
3. Chemical measurements on body fluids (saliva, tears, sweat, urine)

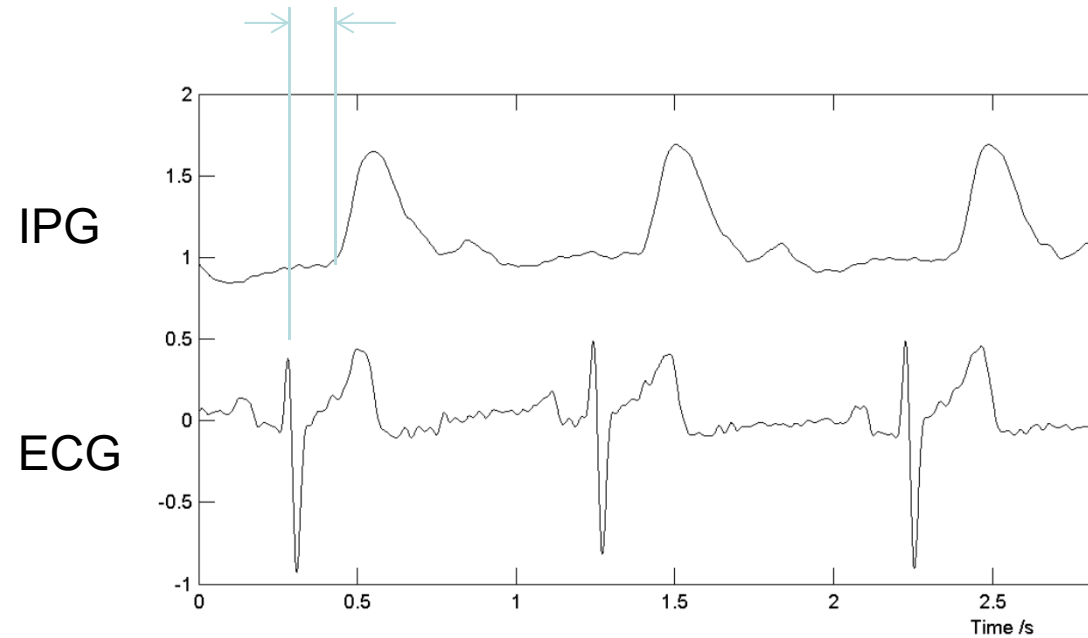
ECG + IPG



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PAT: Pulse Arrival Time \rightarrow Systolic Blood Pressure

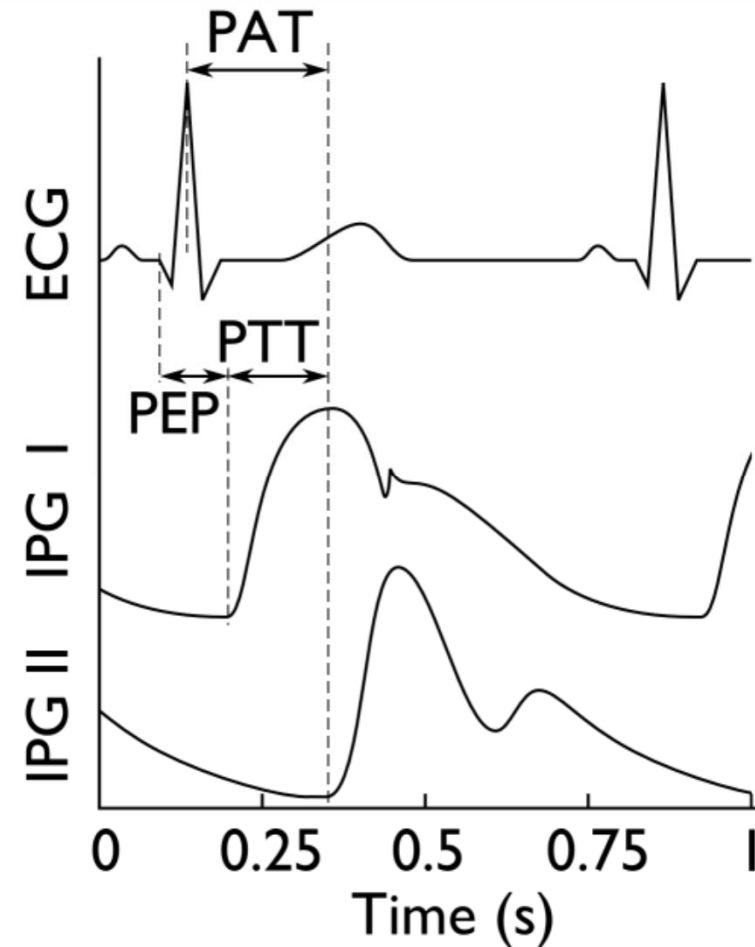


Patent ES2398439-WO2013/017718A2

ECG-IPG-X



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PEP: Pre-Ejection Period

PTT: Pulse Travel Time

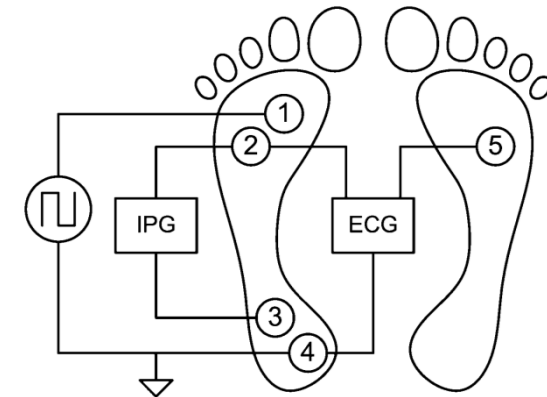
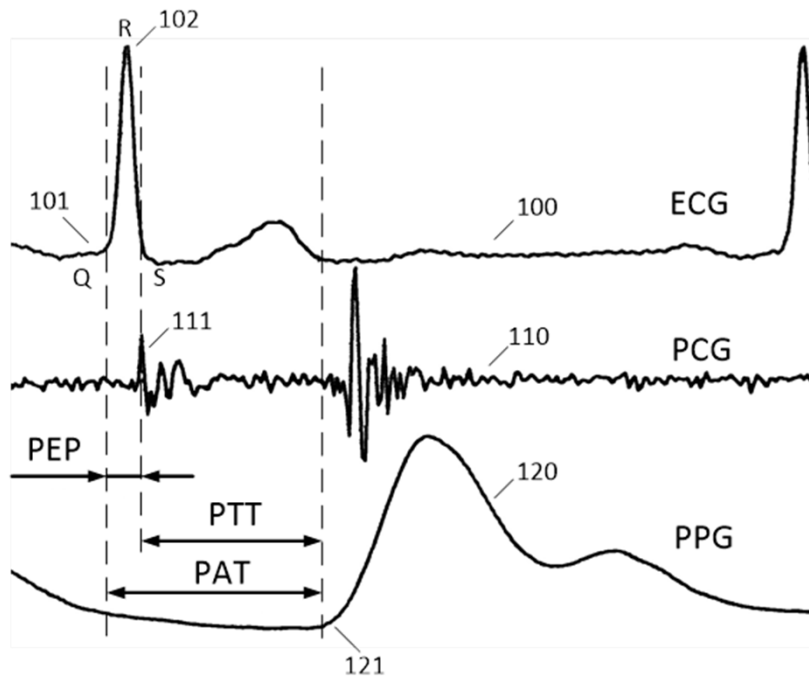
ECG-BCG-IPG



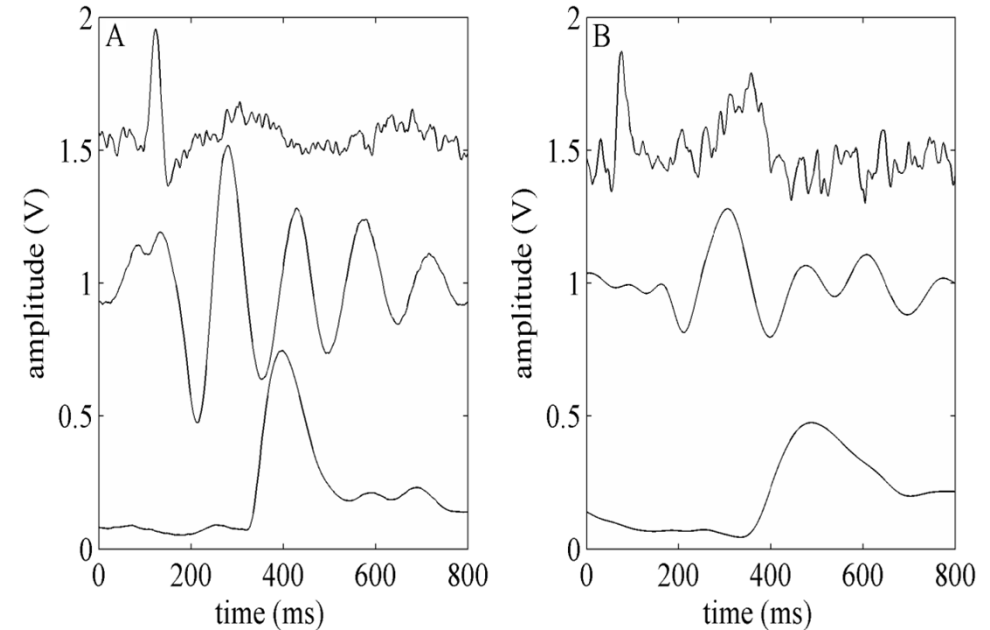
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- Alternative to ECG – PCG – PPG



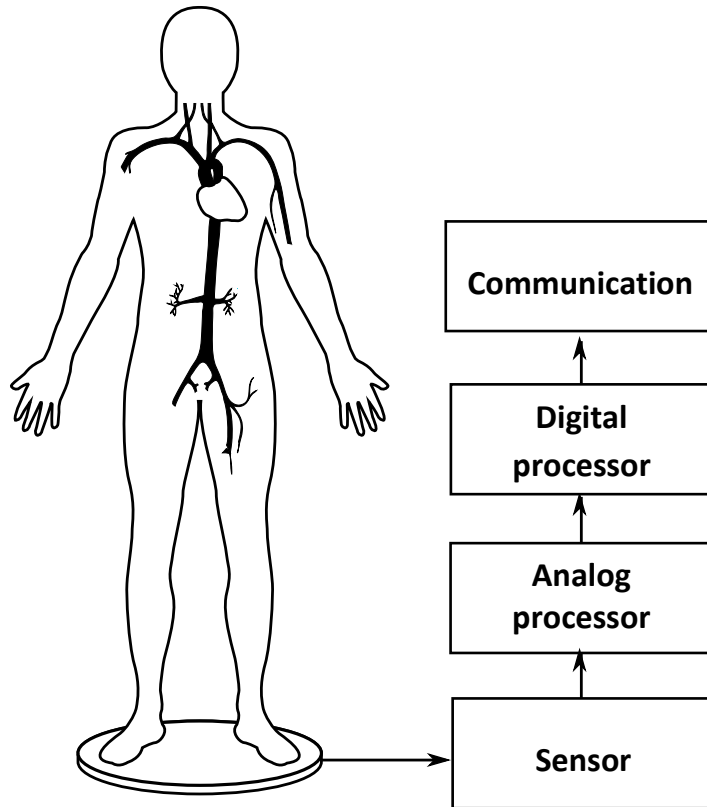
5 samples averaged



BCG: weight scale

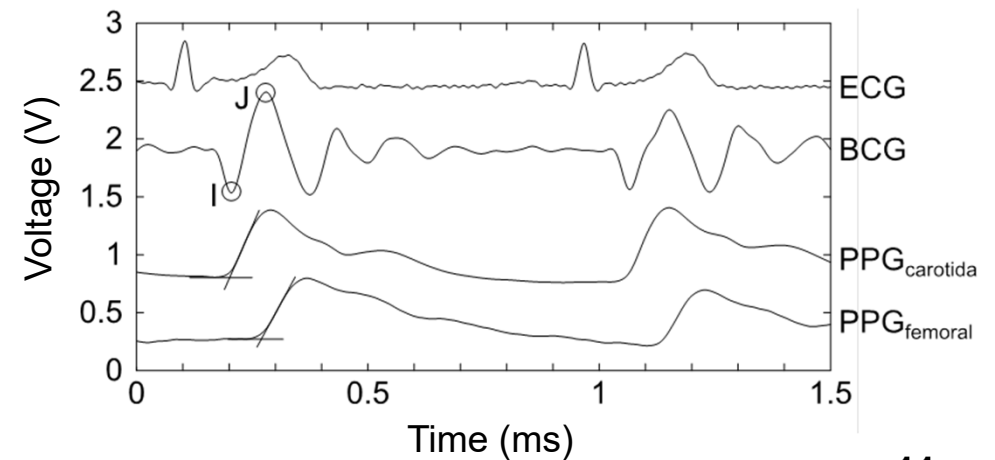
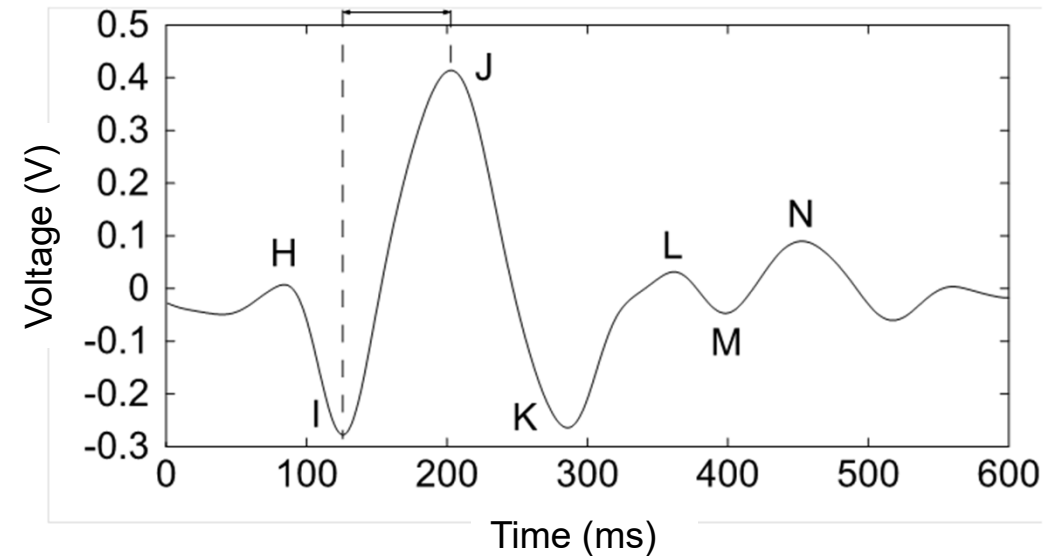


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Mechanical contact only

IJ interval: PTT_{aorta}



Fast cardiovascular assessment

- Vital signs: HR (beat-to-beat, HRV), ECG, PAT, PEP, PTT, respiration
 - Cardiac diseases, hypertension, diabetes, stress, pshychophysiology...

- Aim

Prevention

Early
diagnostic

Surgery

Post
surgery

Chronic
Monitoring

- Market

Healthy lifestyle
Fitness, sports

Health centers
Pharmacies

Hospitals
Clinics

Home health care, e-health
m-health, Telemedicine

- Devices

Smartwatches
Handlebars
Wristbands
Armbands
Weight scales

(Exercise) bicycles
Handheld monitors
(ECG, Body fat monitors)
Armrests (chairs)
Pedestal scales

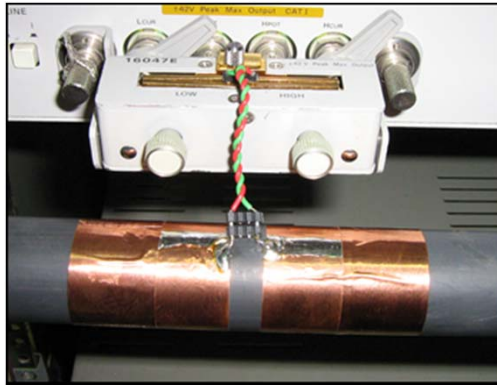
ICU

Smartphone cases
Smartwatches
Personal health devices
Steering wheels
Wheelchairs, seats
Weight scales

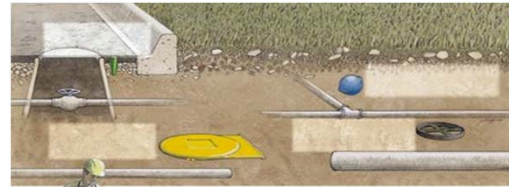
Smart cities/mobility



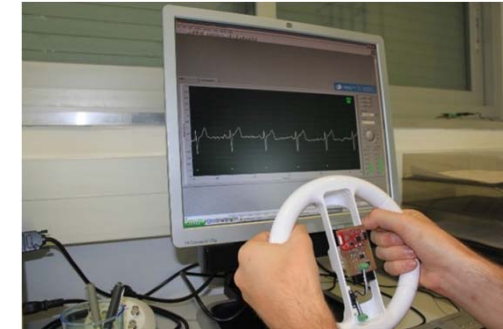
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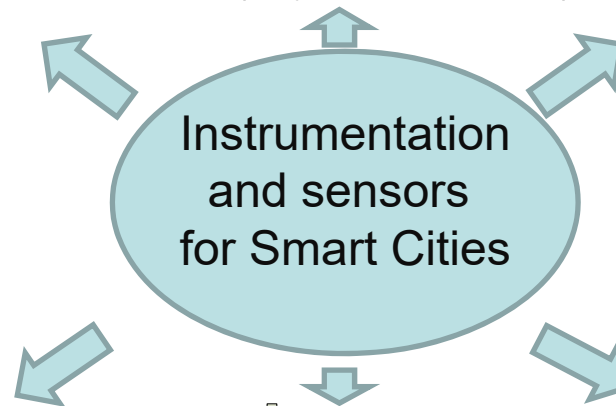
Non-invasive sensors for
water quality (conductivity)
(City Infrastructures)



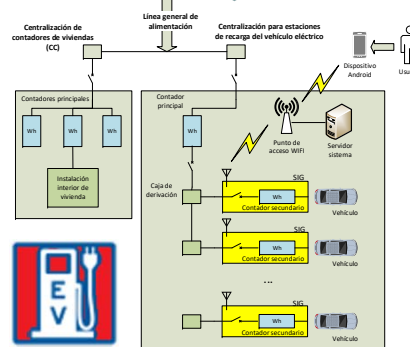
Supervise underground
facilities
(City Infrastructures)



Portable, fast-to-use, low-cost
vital signs monitors
(Emergency & security)



Self-powered vehicle sensor
(Smart mobility)



Charging electric vehicles
(Smart mobility)



UPC

Ford Motor Co.

Vital signs monitoring
Seat occupancy detection
(Smart mobility)



Thank you!

