Technologies 2
Telemedicina e e-Saúde
2016/17
Pedro Brandão

References

- Sources are indicated by [RefSource] where the complete citation will be at the end
- Insite citations will be From: CitationSource
Acquisition

Technologies

Intel Health Guide PHS6000

- Two way video calls
- Specific devices connectivity
  - blood pressure monitors, glucose meters, pulse oximeters, peak flow, weight scales
  - Wired: 4 USB 2.0 ports;
  - Wireless: Bluetooth v2.0, Class 1
  - RJ 45 connector (broadband access)
- Multimedia content
- History
- Reminders
**iKnife**

- Detects cancer cells in tissues
- Uses bio-product of normal knife that “burns” tissue
- The smoke spectrometric is analysed
- **Brain surgery for cancer removal**
- From Imperial College London

From [AAAS](https://www.aas.org)

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**Microscope for the Phone**

- **Aydogan Ozcan** aims for mobile microscope
  - LUCAS (Lensless Ultra-wide-field Cell Monitoring Array platform based on Shadow imaging)

From [MIT Tech Review](https://www.mit.edu)

From Physorg
Phone Food allergen test

- “A personalized food allergen testing platform on a cellphone”, *RSC Lab on Chip*
  - “test and control tubes are inserted from the side and are vertically illuminated by two separate light-emitting-diodes”
  - incubation time of \( \sim 20 \) min per test
  - digitally processed within 1 s

- Other allergenic detectors projects in MobileHealthNews

Gluten detection – *Nima* from 6SensorLabs

1. Fill a disposable Capsule with a bit of food
2. Screw the lid shut to grind the food
3. Mixture in the capsule reacts with food
4. The mixture is released to the test strip in the capsule
5. Nima uses sensors to analyze and read the test strip
6. Results are displayed on the front of Nima
NETRA – Near Eye Tool Refractive Assessment

From Camera Culture, MIT Media Lab

See also EyeNetra

Cheap phones as stethoscope

• Developed by Oxford University and South African researchers

• Record and analyse their own heart sounds using a mobile phone microphone.

• Send the recordings to medics

From Oxford news
Portable ultrasound – Vscan (GE)

- PC software to act as a gateway between Vscan, customers’ PC tools and GE hotline service.

Vscan Specifications

- Clinical Applications
  - Cardiac
  - Abdomen
  - Urinary bladder
  - Obstetrics and gynaecology
  - Paediatric
  - Selected peripheral vascular applications
  - Thoracic/pleural fluid and motion detection

- Imaging
  - Black and white mode for displaying anatomy in real-time
  - Colour-coded overlay for real-time blood flow imaging
  - Field-of-view for black and white imaging: up to 75 degrees with maximum depth of 25 cm
  - The colour flow sector represents blood flow within an angle of 30 degrees
**Evena Medical Eyes**

- “helps clinicians see vasculature below the skin and deliver needles safely”

**Alive ECG**

- iPhone portable ECG
- One lead ECG, for basic rhythm
- FDA approved
Mobile Phone Spirometry

- **SpiroSmart**
- Detect lip reverberation with the smartphone’s microphone to assess lung functions
  - FEV1, FVC, PEF
- “mean error when compared to a clinical spirometer is 5.1% for common measures of lung function”

Lifebot Ambulances for telemed

Source: LifeBot telemedicine ambulances
Ocular changes - Sensimed

- **Triggerfish**
  - “Automated recording of continuous ocular dimensional changes for 24 h”
  - Glaucoma patients
  - Contact lens transmits wirelessly
  - Not yet approved for sale in the U.S.A.

D-Eye - Digital Ophthalmoscope

- “ophthalmic camera for vision care screening and evaluation”, from D-EyeCare
  - iPhone 5/5S/6
  - Samsung S4/S5

- See the review from Medgadget
**Cellscope**

- Digital otoscope for the iPhone

Image from [Cellscope](#)

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**Super-Cheap Health Tests**

- **From George Whitesides’ Lab**
  - Paper based tests with chemical reagents that colour differently according to enzyme concentration
  - “stamp-size square of paper with wells that change colour when a drop of blood is applied”
  - Testing liver function

- **George Whitesides’ TED talk**

Source: [TechReview, David Talbot](#), Images also from article

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Others

Technologies

ECG on the run

- Blackberry application to receive ECG reports
- Use/development of eUNO R 10 technology
  - With Maestros Mediline Systems

From HealthAge
Mobile Devices

• Sending high definition images to mobile devices (Smartphones)
  • Prototypes using Waaves compression program to send the images using GSM

Imaging – Mobile MIM

• FDA cleared for viewing and making diagnoses on:
  • Computed Tomography
  • MRI
  • PET

Source: MobileHealthNews
Mobile MIM for iPhone, iPad
Proteus/Raisin

- Ingestible technology
  - Pills with micro sensors that “tell” when it was taken
- Implantable technology
  - Enabling longer life for electronics inside the body

Figure 1. Edible sensor for electronically confirming adherence to oral medications. (a) A closer view of an edible sensor; (b) Edible sensor attached directly to a tablet. (c) Edible sensor co-encapsulated with a drug product using a sensor-enabled capsule carrier.

Source: Novartis Proteus Biomedical

Applications

Technologies
**Dr. SMS**

- Kerala region in India
- User sends a text with:
  - Needed facilities
  - Pin-code identifying the centre (location) where the facility should be situated
- User receives:
  - details of nearest centres with the requirement

**Tele Psychiatry**

- **Dept of Mental Health in South Carolina** (USA)
  - “develop a telepsychiatry network for all South Carolina (SC) hospitals operating emergency departments (ED)”
  - “The objective of the grant is to make psychiatric consultation available in all SC EDs at all times.”

- Portugal = 92 090 Km²
- South Carolina = 80 780 Km²
- **Development Map**
Telerehabilitation for speech

• Patients with
  • Aphasia, dysarthria, apraxia of speech, cognitive-linguistic disorders.

• Resulting from:
  • stroke, traumatic brain injury, Parkinson’s disease, multiple sclerosis

• Consultations are based in audio-visual interactions
  • ➔ Use of video-conference or telephone

• Swallowing treatment
  • Assessed (experimental) using real time video-fluoroscopy

Telerehabilitation – Physical

• Patients with
  • muscular-skeletal problems, stroke-induced paralysis, cognitive deficits.

• Consultations use Virtual Reality environments
  • “teaching by example”, “video-game like”, “exposure therapy”

• Advantages
  • Ability to multiplex treatment
  • “more fun” ➔ patient motivation
  • Access to detailed patient “performance” data
  • Easy reuse of software and hardware
VR Rehab examples

The VR-based orthopaedic rehabilitation using a haptic glove during a pegboard exercise. © IEEE 2000

Teaching by example, © Lawrence Erlbaum 2002

Virtual scene used in desensitizing Vietnam veterans © Virtually Better 2000

Uses of video-conference

- Tele-psychiatry
- Tele-paediatrics
- Tele-dermatology
- Acute care
- Remote consultation of stroke patients
- Telemergency (UMississippi)
- Family-Link (UCDavis)
- Etc...

©Technical Innovation
Neuro feedback/monitoring

- Enables Electro Encephalogram reading
- Software for training/feedback, managed remotely by doctor
- Skin potential/impedance, temperature
- Photic, vibratory and auditory feedback

From BrainMaster Discovery Brochure

Emotiv EEG neuro headset

- Raw EEG
- Channel names based on the International 10-20 locations are: AF3, F7, F3, FC5, T7, P7, O1, O2, P8, T8, FC6, F4, F8, AF4
Triage – example Aid-Network

- Objective: replace the paper based triage systems
- Uses
  - Bio-sensors
  - Mesh networks
- To enhance the normal disaster 1st responder architecture

Aid-N – Components

- miTag
  - heart-rate and pulse oximeter
  - Led with triage level/priority
  - LCD with HR, O2 sat
- PDA
  - Real time info of patients
- Central control (miView)
  - Real time view of every patient triaged
Aid-N – Architecture

- Level 1: Embedded Systems
- Level 2: Personal Servers
- Level 3: Central Server

Aid-N (cont.)

- Forms a Mesh Network
  - Uses 802.15.4
  - Can have repeaters

- Long term wear carrier
  - Use in hospitals
• Monitoring fire-fighters in action
• Assess stress/exhaustion levels
  • Vital Jacket sensory shirt (1 or 5 lead Holter system + accelerometer)
• Positioning
  • GPS to be embedded in Vital Jacket

Remember? Dermatology consult
• Use of special cameras for acquisition
• Triage, diagnosis
• Wounds, skin cancer.
Dermatology: other

- Web sites for discussion of diagnosis
  - Upload of images
  - Telederm.org
  - Dermatlas (image database)
  - Virtual Grand Grounds in Dermatology

Example of sharing knowledge to increase it

Remember: Tele Consultation

- From Medical Centre Kansas University
- Uses:
  - Digital stethoscope
  - Otoscope Camera
  - Dermascope
  - Intra-oral camera
The art of medicine consists of keeping the patient amused, while nature heals the disease. ~ Voltaire

End of Telemedicine tech
References – Applications


Acronyms

• CABG – Coronary Artery Bypass Grafting
• CT – Computed Tomography
• FDA – Food and Drug Administration
• MRI – Magnetic Resonance Imaging
• PET – Positron Emission Tomography