MONITORING BIOSIGNALS WITH LOW COST WEARABLE SENSORS

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Outline

• Introduction
• System Design
• Signal Acquisition
• Testing and Results
• Conclusions
Motivation and Scope

Inversely Proportional
- Life Quality / Life Expectancy

Disregard for the users fitness. E.g.: Heart Rate, Temperature, Blood Pressure.

The aim is to develop/integrate the required components in order to realize the concept of proximity to the patient through continuous monitoring.
Motivation and Scope

• Aging has become an ever-growing social concern.
• The phenomenon of aging is common in modern societies.
• The continuous growth of the elderly population creates several types of addiction (social, economic and political).
• Consequences regarding the elderly population’s life quality must be dealt with.
System Design

Features

- Low Cost Devices with small footprint (volume, energy, ..)

- Measurements:
  - Heart Electrical Activity
  - Heart Rate
  - Body Temperature

- Textil Electrodes
- Bluetooth Communication
System Design

- Signals Acquisition System of the Heart’s Electrical Activity.
- Signal Conditioning “pre-amplified”
- Digital Signal Processing (DSP)
- Wireless Communication (Bluetooth)
SIGNAL ACQUISITION
**Signal Acquisition**

**Textile Electrodes vs Ag/AgCl**

- **Ag/AgCl Electrodes**
  - Ag/AgCl electrodes last less than a year,
  - They are not reusable,
    - They can only be used once during a whole life cycle.
  - The gel used in the electrodes can bring some dermatological concerns, which may ultimately cause problems when trying to obtain accurate data, due to the users discomfort after several days of use.

- **Textile Electrodes**
  - Studies regarding textile electrodes haven already shown some positive outcomes:
    - The quality of signal retrieved is influenced by the area covered by the fabric textiles conductor.
Signal Acquisision

Textile Electrodes vs Ag/AgCl

Signal retrieved by Ag/AgCl electrodes

Signal retrieved by textile electrodes
Signal Acquisition

Textile Electrodes

• During the testing phase, various sizes of textile electrodes were had into account.
• $4\text{cm}^2$ (1) and $2\times8\text{cm}$ (2) electrodes were inserted in a body self adjustable t-shirt.
TESTING AND RESULTS
BioSigMA platform

• Smartphones are increasingly common, its number is already higher than conventional phones.

• Take advantage of the features – such as processing power, communication interfaces and embedded sensors – available in smartphones to provide a Platform for Personal Monitoring (dual use of the device)

• The BioSigMA system targets the elder and as such delivers a friendly user interface. Nonetheless, it possesses some advanced features that can be accessed by users seeking to exploit the full power of the platform.

• BioSigMa features :
  • Sensor Communication
  • Bio Signal Processing
  • Geo-fencing
  • Fall Detection
KeepCare® is an innovative system that aims to improve the quality of life of elderly or patients with chronicall diseases.

The system has mechanisms for continuous monitoring of vital signals through wireless sensor networks, as well as an alert system in which is possible to configure actions in case of an emergency (based on threshold values for the bio signals)

KeepCare® has a module for:

- Clinical history of the patient like the results of appointments
- medical exams
- medication
- life habits, etc.
Assisted Living

- Mobile application with interface for the BioSigMA platform where user can:
  - Visualize data monitored.
  - Configure the monitoring parameters.
  - Define the limits in order to trigger the alarms.
  - Define the types of sensors allowed to connect with the smartphone.

- KeepCare application connects to a remote server and allows to:
  - Receive data from the smartphone and store it
  - Search the user’s monitoring history through a webpage.
  - The server also triggers alarms and delivers notifications to the user through the website.

- This data is received and shown in real time.
- Activity levels were tested by performing walks and runs, in order to adjust the thresholds at which we would consider an activity to be at a low or high level.
Testing and Results
CONCLUSIONS AND FUTURE WORK
Conclusions and Future Work

- To realize the “Assisted Living” scenario, several technologies were developed and were reused in other projects.

- The “Platform for Personal Monitoring” was developed in order to be a vital signs monitoring platform.
  - It was accomplished with the use of a smartphone which in turn receives input signals from the t-shirts textile electrodes.

- e-shirt is in its final development phase; a product based on the textile electrodes bio-sensor is being develop.

- Technology Transfer of the these results is currently under negotiation.
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