



Haute Ecole de la Province de Liège

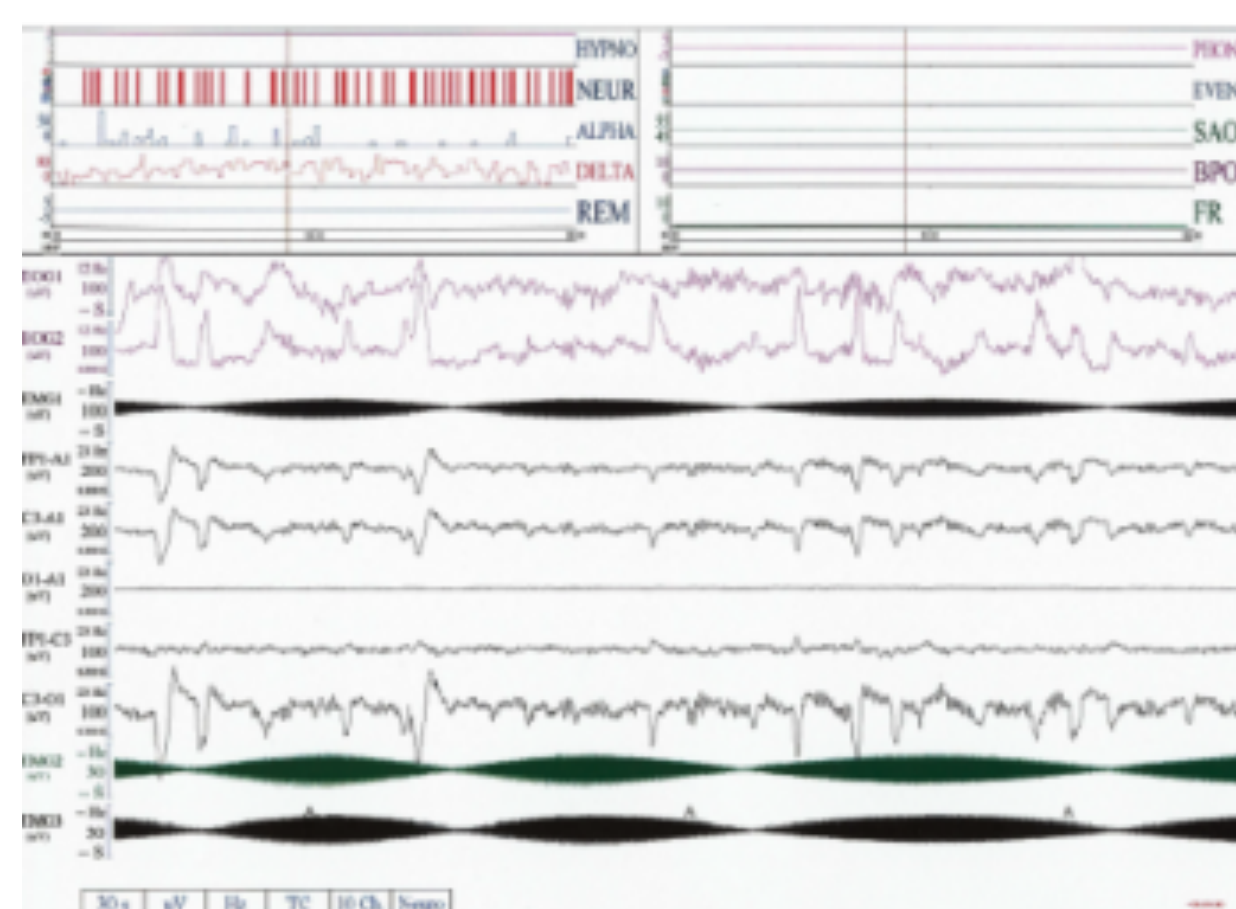
Non-Invasive sleep monitoring

Background

Sleep disorders are numerous and can have multiple origins. Performing accurate sleep analyses is crucial to diagnose properly their underlying causes. A stay in hospital is generally required as particular devices must be used. The unusual environment and the use of uncomfortable probes makes observations poorly representative of a typical night. Moreover, these studies are time consuming and expensive, both in human or material resources.

Applied research project

SURNISOM is an applied research project that aimed to develop a portable and easy-to-use solution to perform both EEG and EOG analyses at home. There is no more need for the patient to sleep in a hospital to perform those tests. Since the integrated designed device registers the EEGs and EOGs on a memory card, no disturbing wire are required and a careful analysis of the results can be performed afterwards.



An illustrative EEG recorded with the headband.

Innovative application of smart textile

The key point of this project was the use textile electrodes made of silver coated polyamide fibers.



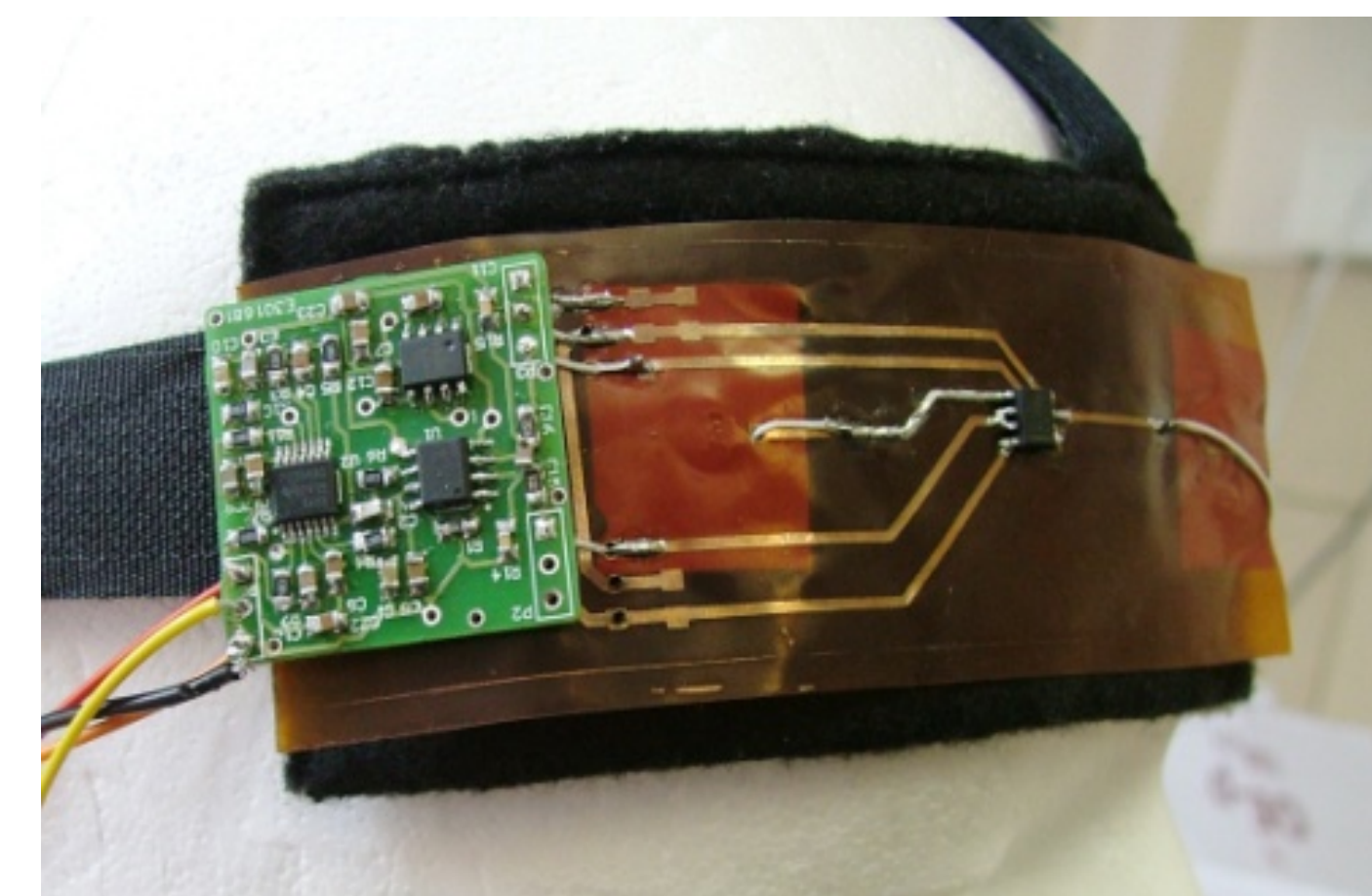
A simple textile electrode, composed of knitted silver fibers.

The so developed headband is thus what can be called a smart textile. **The biggest part of the work** was to interface the electronics with the textile, always targeting the comfort of the patient and quality of recordings.

Field oriented approach

Practical tests were performed in order to address the problems inherent to real conditions. This led to an improved electrode concept which allows long lasting recordings.

Electrode positioning was also **optimized for the targeted type of recording**, resulting in a tradeoff between simplicity of use and good acquisition of the desired signals. **A clinical test was carried out and practitioners said that the headband is faster and more easy to install than the classical set of electrodes.**



An early implementation of the prototype. Flexible PCBs were used for a better fit the curves of the forehead.

Features of final prototype

The final version of the prototype exhibits the following features:

- **Optimized positioning of electrodes** – A reduced number of electrodes positioned on the forehead, behind the mastoid and the neck.
- **Textile integration** – Use of conductive fibers, snap connectors and flexible PCBs.
- **Innovative textile electrode design** – A foam rubber compartment is used as a tank for electro-conductive gel. An outer impermeable layer prevent the evaporation of the gel.
- **Washable device** – Because the electronic parts can be totally removed from the headband, **it can be easily machine-washed and thus used with several subjects.**

Patent pending

This applied research led to the application for a patent (reference) regarding the textile electrodes. (TO BE DONE)

Contact Info

This research was funded by a FIRST grant of the Walloon Region (DGO6)



Final textile prototype. The miniaturized electronic part come to clip on the snaps.