RING SENSORS FOR NON-INVASIVE, HIGH PERFORMANCE RECORDING OF BIOELECTRIC SIGNALS ON THE SURFACE OF THE BODY

PRODUCT DESCRIPTION

There is currently a wide variety of systems for capturing, preconditioning and monitoring bioelectric signals. This invention consists of a system for the non-invasive recording of bioelectric signals made up of different ring-shaped electrodes and a disk electrode, using digital and analogue circuitry to amplify and filet the signals. It also includes a wireless communication interface for transmitting the signals recorded by the receiver.

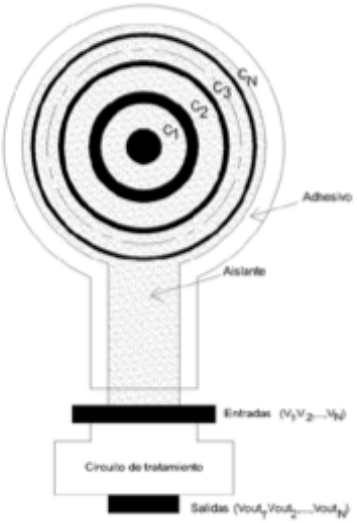

Figure 1: Diagram of the active modular sensor, consisting of a flexible uptake stage formed by N-1 ring conductors (c2, c3,..,cN and a disk conductor (c1), and of the processing circuit of the recorded signals.

Among the most important characteristics of the equipment designed by researchers at the UPV (and which differentiate it from the other devices that use ring electrodes) is that it has several outputs, making the weighting of the tensions recorded by the conductors configurable with regard to each of the outputs.

This allows for more detailed information to be recorded on the different areas of the organ(s) under the electrode. In this way, bioelectric recordings are obtained that combine high performance (high signal/noise relation with spatial distribution of configurable sensitivity) with greater comfort for the patient and simplicity of use in clinics and/or health centres.

RING SENSORS FOR NON-INVASIVE, HIGH PERFORMANCE RECORDING OF BIOELECTRIC SIGNALS ON THE SURFACE OF THE BODY

APPLICABLE BUSINESS SECTORS

The technology developed here is of interest to manufacturers of medical devices, mainly for use in hospitals.

The first application is aimed at the recording, conditioning and wireless transmission of the electrocardiogram (ECG), as this is a widely studied and well-known bioelectric signal that currently represents an essential tool in cardiac electrophysiology, with a vital function in screening and diagnosing cardiovascular pathologies or metabolic alterations.

It can be used as an ECG monitor for at rest recordings aimed at diagnosing cardiac pathologies (traditional electrocardiography); and for longer ambulatory recordings (holter) in which the patient must wear the electrodes for several hours. In this case, being able to capture the ECG with just one sensor that includes different conductors implies eliminating the need for wires, and thus greater comfort for the patient. It can also be used as a means of monitoring endurance/stress tests.

Another area where this prototype has been evaluated is in the non-invasive recording of the uterine myoelectric signal during pregnancy and birth (electrohistogram, EHG). Currently, the clinical application of this technique for the study of uterine dynamics and patterns of propagation (directly related with the time horizon of the birth) is limited because conventional techniques for capturing signals are not of high enough quality. This new technology allows for relevant data to be obtained for diagnosing premature birth.

The system can also be applied to monitoring myoelectric intestinal activity, called an electroenterogram (EEnG). This signal is also very weak in comparison with the heart and breathing, and a high quality recording would allow for a quick, inexpensive non-invasive diagnosis of pathologies that currently have a high mortality rate due to the diagnosis time.

Other possible uses would include the recording of the electromyogram (EMG), the electrogastrographic signal, the diaphragmatic signal, as well as the encephalographic, oculagram and retinogram signals.

TECHNICAL ADVANTAGES AND BUSINESS BENEFITS

The advantages compared to other techniques used for the same purposes are:

• Greater sensitivity and spatial resolution on locating potential bioelectric sources with regard to conventional monopolar/bipolar electrodes.

• The sensors that make up the system have a signal capturing stage consisting of ring and disk electrodes developed on flexible substrates that adapt perfectly to the shape of the body. This is totally new and offers a better quality recorded signal in comparison to other prototypes of ring electrodes developed on rigid substrates.

• The designed sensors have multiple outputs, and the weighting of each of the tensions captured by the conductors at every one of the outputs is configurable. This is a particularly relevant advantage offered by this system that differentiates it from other capturing devices with ring electrodes, as it implies the possibility of obtaining different output signals corresponding to different spatial distributions of the sensitivity to capturing bioelectric potentials with a single sensor.

BANCO DE PATENTES
Connecting knowledge

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

RING SENSORS FOR NON-INVASIVE, HIGH PERFORMANCE RECORDING OF BIOELECTRIC SIGNALS ON THE SURFACE OF THE BODY

• It is possible to capture weak signals that until now were unable to be recorded with sufficient quality.

• The sensor developed here is modular, so that the electrodes can be replaced by new ones. It is the only system that allows for bioelectric signal recording that has this characteristic, and is especially pertinent for clinical/health, thereby lowering the cost of product exploitation.

• The system allows surface bioelectric signals to be mapped using several sensors embedded in a flexible, adhesive matrix. Different maps of potentials can also be obtained according to the spatial distributions of sensitivity to capturing the bioelectric potentials configured by the weightings given to the conductors of each of the sensors ion the matrix.

DEVELOPMENT STAGE OF THE TECHNOLOGY

Sensor prototypes have been developed in the laboratory with ring electrodes in flexible substrates, employing silk screen techniques. Tests have been done using tripolar flexible electrodes with a bipolar configuration. A test project is being introduced for the development and clinical trial of a compact, portable, wireless prototype, applied to registering cardiac signals, which can be mass produced at a low cost with the necessary certificates to obtain the CE stamp.

INDUSTRIAL PROPERTY RIGHTS

The technology has been patented by the UPV, with a registered Spanish patent pending number P201230374 with a priority listing dated 13/03/2012.
The Spanish patent has been extended via PCT (ES2013/070156).

COLLABORATION REQUIRED

The UPV is looking for a medical device manufacturer interested in undertaking (under license) the pending developments and exploitation of the patent.

CONTACT
Elsa Domínguez Tortajada
Centro de Transferencia de Tecnología
eldotor@ctt.upv.es
Tel. +34963877409