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Performance **AN**d **AC**curacy in **E**lectrical Bio**A**ctivity Recordings (**PANACEA**): A High-Performance, Wireless, Multi-instrument for Potentiometric and Amperometric Recording of Biosignals

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Abstract

This paper presents the design, testing and quantitative evaluation of a high-performance, low-power, portable multi-instrument ($107x79mm^2$), capable of recording important biosignals accurately and in real-time. This highly versatile system has the ability to transmit the captured bio-data back to the user either in a wired (HDMI cable) or wireless (ZigBee protocol) manner, depending on the targeted application. The biological information that can be recorded by the proposed instrument spans a wide range of bio-potentials and bio-amperometric signals. The proposed instrument is split into two complementary "sub-instruments", where one is operating as the front-end device, responsible for the accurate, low-noise signal detection and transmission, while the second "sub-instrument" is operating as the "base station", responsible for the collection and further processing of the captured data. For wired transmission (e.g to the user's PC) the front end module can operate independently, however, for wireless transmission both "sub-instruments" are required (transmitter-base station architecture). For wireless transmission, each of the two "sub-instruments" is equipped with dedicated 2Mbps ZigBee radio transceivers and both parts are controlled by a small area embedded FPGA module. The front-end device features two distinct sections: (a) a current/voltage to voltage section comprising six potentiometry and two transimpedance amplifier-based amperometry channels. These eight in total analogue channels are converted into digital form by means of a 24bit, voltage input, Analogue-to-Digital Converter (ADC) and (b) a four channel, commercially available switched-capacitor-based ADC Integrated Circuit (IC), which converts input charge to digital data with

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