Abstract: With the infusion of smart phones and ubiquitous wireless connectivity in our daily lives, wearable body sensors can be perceived as a pervasive tool for neuro-physiological data recording, monitoring and contextual interpretation for a multitude of applications extending from critical clinical needs to regular monitoring of individual’s physical activities. Collecting these data with plug-and-play, fully reconfigurable, low power, and smart sensors operating unobtrusively and for long duration in natural environments is essential for transformative personalized healthcare and assistive technologies, as well as to understand brain functionality and connectivity in real-life scenarios. Towards this goal, we have developed a minimalistic, 2-channel wireless wearable ambulatory Electroencephalography (EEG) device, NeuroMonitor. The software-hardware co-designed device can be concealed within a cap or a headband to collect EEG signals from the subject performing daily routines. The hardware is designed on a small 11.35 cm² 4-layer PCB containing a programmable system-on-a-chip (PSoC3) microcontroller, coupled to an analog front end for 2-channel bipolar or referential montage EEG data collection. The device has a Bluetooth module for online data collection and a microSD card for offline data storage. The on-board processing capability can allow real-time constrained data processing algorithms such as fully automatic artifact removal and identification of noteworthy events. NeuroMonitor hardware eliminated Driven Right Leg (DRL) circuitry that motivated us to pursue Body-worn Reconfigurable Architecture of Integrated Network Sensors (BRAINsens) having plug-and-play sensor blocks. We are further investigating development of a novel dry interfacing impedimetric electrode with Patterned Vertically aligned Carbon NanoTubes (pvCNT) for long duration monitoring, and a fully passive sensing system with novel Resistive Wireless Analog Passive Sensors (rWAPS) that uses ultra-low wireless power.

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