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Low power wireless ultra-wide band transmission of bio signals

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The main objective of this proposal is to design a system for transmission and reception of signals and biological parameters through dedicated radio circuits using a purely digital approach (asynchronous events). Each source of biomedical parameters will be translated into temporal events that can be transmitted and received without further processing. The system, in fact, thanks to its intrinsic use of events, allows controlling in an extremely efficient release of energy for the transmission of information, and therefore exploit an approach completely on-demand to minimize the consumption of power. The events are generated occurrence of particular patterns in the input signal (and then it is extracted the information content of the signal of interest) and efficiently (with respect to energy consumption, complexity, integration and flexibility) synthesized via a digital system asynchronously. The information is transmitted only when required, allowing for a longer battery life than traditional wireless processes. From the technological point of view it will be exploited the wireless transmission techniques that employs the Impulse Radio Ultra-Wide-Band, localized around 3-5 GHz, for transmitting and receiving signals by very reduced temporal pulses, resulting in very wide spectral occupation. As a consequence of that, we gain limited power consumption at the transmitter side.
This wireless system can find various applications in the field of medicine, allowing accurate measurements of various biological parameters detected from time to time by a single receiver (collector). The latter will have the task of reworking the received signals to identify the correct sequence and the source of information. The device must have reduced final dimensions to be integrated on a single microchip, which, after having amplified and processed the information of external sensors, must be able to transmit it at distances of the order of meters, possibly using an integrated antenna. The miniaturization of the system to use more sensors, perfectly compatible with low-consumption electronics, can meet the needs of medical applications such as the remote control of biological parameters or the construction of robotic equipment (exoskeletons).
The proposed mechanism will be developed in a prototype phase to discrete components in order to validate an initial feasibility study, and will then be integrated microchip in a final stage.
We have been able to mount in a preliminary data acquisition chain an amplifier for instrumentation, which we use to interface and read out the bio signals, a voltage controlled oscillator (VCO) to digitize the information and a wireless transmitter.

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