A LabVIEW Based Multichannel Recording Architecture for High Density Electrical Mapping

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Introduction. The goal of our work is to describe and test a novel multichannel recording equipment architecture for cardiac mapping based on LabVIEW: the Reconfigurable Architecture for Electrical Mapping (RAEM). Methods. The RAEM architecture implements the communication between a generic analog acquisition hardware and a computer (PC) by means of a Field Programmable Gate Array (FPGA) and a Real-Time Controller (RTC). The first step of a RAEM system involves the temporal storage of a certain number of samples acquired from the analog block into a temporal memory installed in the FPGA. The second step of a RAEM system involves sending the data stored in the temporal memory to a PC by the Transmission Control Protocol (TCP). The third step of a RAEM system is the reassembling of the information into the PC in order to store and to represent it. Evaluation of the performance, versatility and limitations of the presented architecture was done by using three different National Instruments (NI) hardware solutions (Single-BoardRIO-9631, Single-BoardRIO-9642 and the CompactRIO-9024+CompactRIO-9104). Throughput for each hardware solution will be measured for an increasing cadence in TCP packet generation, or Data Readout Period (DRP). Results. RAEM architecture programmed in LabVIEW was executable for the three evaluated NI solutions independently of the hardware. In order to obtain the maximum throughput, a compromise between temporal memory size of the FPGA, RTC processor capability and DRP is required. Maximum data throughput achievable for each hardware solution were 19, 22 and 51 Mbps, obtained for DRPs equal to 13, 20 and 30 ms, respectively. Conclusion. The design of the RAEM system, based on LabVIEW and RIO hardware, allows migration to new hardware platforms keeping the same architecture.