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Versatile Configuration and Control Framework for Real Time Data Acquisition Systems

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FPGA-based systems for real-time data acquisition in long-term experiments require an interface for hardware control if they do not act autonomously. Besides a low-level register interface, access to I2C and SPI buses is also needed to configure the complete device. Advanced control flows and calculations required for configuration and calibration are not possible without implementation on the FPGA. This demands for repeated device accesses from a client system or a complex hardware implementation. In the former case, the duration of the network accesses considerably slows down a software calibration on client side causing undesired down times for the measurement. By using SoC-FPGA solutions with a microprocessor, more sophisticated configuration and calibration solutions, as well as standard remote access protocols, can be integrated in software. A versatile control system has been implemented for the readout of superconducting sensors and quantum bits. This software framework offers a convenient access to Xilinx ZYNQ SoC-FPGAs via remote-procedure calls (RPCs). Based on the open source RPC system gRPC, functionality with low-latent control flow, complex algorithms, data conversions and processing, as well as configuration via external buses can be provided to a client via Ethernet. Furthermore, client interfaces for various programming languages can be generated which eases collaboration among different working groups and integration into existing software. This contribution presents the framework as well as measurement data regarding latency and data throughput.

Minioral

Yes

IEEE Member

No

Are you a student?

Yes

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