General Purpose Bioelectric Signals Acquisition Platform Combining FPGA and FPAA

by

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結合FPGA及FPAA的通用生物電信號採集平台

by

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Approved by _____
Supervisor

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ABSTRACT

GENERAL PURPOSE BIOELECTRIC SIGNALS ACQUISITION PLATFORM COMBINING FPGA AND FPAA

by MOU, Pedro Antonio

Thesis Supervisor: Prof. VAI Mang I & Dr. MAK Peng Un
Master of Science in Electrical and Electronics Engineering

Today, increasing number of people is caring their health more frequent. And, as a result, this leads to more research and development on processing and analyzing bioelectric signals. Nowadays, whenever a new algorithm or method is proposed, verifications usually need hardware dependent systems to be built. Also, there is no common platform available for researchers to perform quick iterative trials.

In this research, a novel concept for a general purpose bioelectric signals acquisition platform combining FPGA and FPAA is proposed. This platform is designed in a modular architecture with an adaptive analog frontend. The platform can accept new modules for system functions or data processing algorithms to achieve a simple, adaptive and flexible platform for testing and evaluation of different algorithms.

A demonstrative prototype is also built with certain basic system functions and a simple real time ECG QRS detection module migrated onto it. The demonstrative prototype helped to prove this new concept workable by providing satisfactory results on different bioelectric signals. This platform can provide researchers easiness to testify the validity of their various new algorithms/methods or directly to migrate ones' research into production in timely manner.

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LIST OF ABBREVIATIONS

ADC	Analog-to-Digital Converter
ADI	Analog Device Inc.
ASIC	Application-specific integrated circuit
CAB	Configurable Analog Block
CPLD	Complex Programmable Logic Device
DAC	Digital-to-Analog Converter
DSP	Digital Signal Processor
ECG	Electrocardiogram
EEG	Electroencephalography
EMG	Electromyography
FFT	Fast Fourier Transform
FPAA	Field Programmable Analogue Array
FPGA	Field Programmable Gate Array
GUI	Graphical User Interface
HDL	Hardware Description Language
IC	Integrated Circuit
IEEE	Institute of Electrical and Electronics Engineers
I/O	Input and Output
ISP	In System Programming
LE	Logic Element
LUT	Lookup Table
PAL	Programmable Array Logic

PC	Personal Computer
PDA	Personal Digital Assistant
PLD	Programmable Logic Device
sEMG	surface Electromyography
SPI	Serial Programming Interface
SRAM	Static Random Access Memory
SOC	System on a Chip
SOPC	System on a Programmable Chip
TI	Texas Instruments
VGA	Video Graphics Array
VHDL	Very-High-Speed Integrated Circuit Hardware Description Language
VLSI	Very Large Scale Integration
Vpp	peak to peak Voltage
WHO	World Health Organization

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