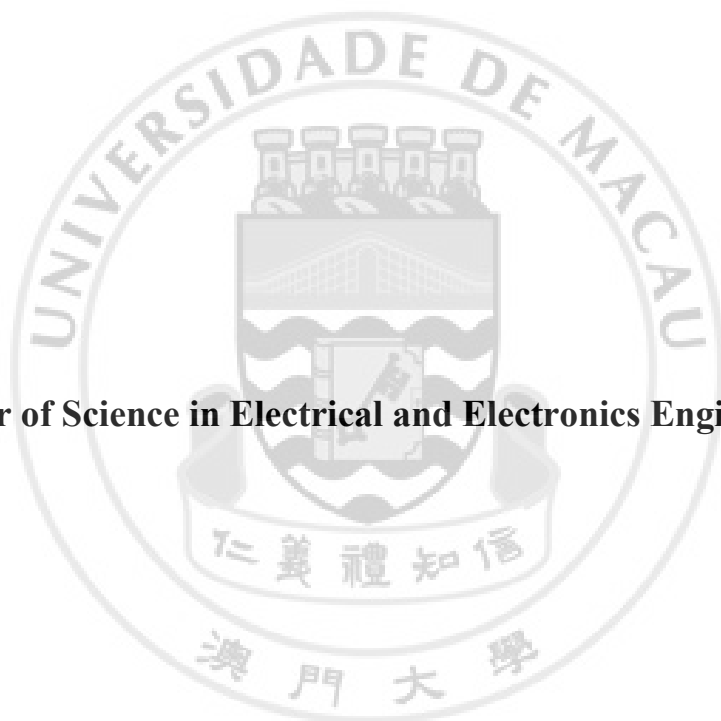


**General Purpose Bioelectric Signals Acquisition  
Platform Combining FPGA and FPAA**

by

**MOU, Pedro Antonio**

**Master of Science in Electrical and Electronics Engineering**



**2009**



**Faculty of Science and Technology  
University of Macau**

General Purpose Bioelectric Signals Acquisition Platform  
Combining FPGA and FPAA

結合FPGA及FPAA的通用生物電信號採集平台

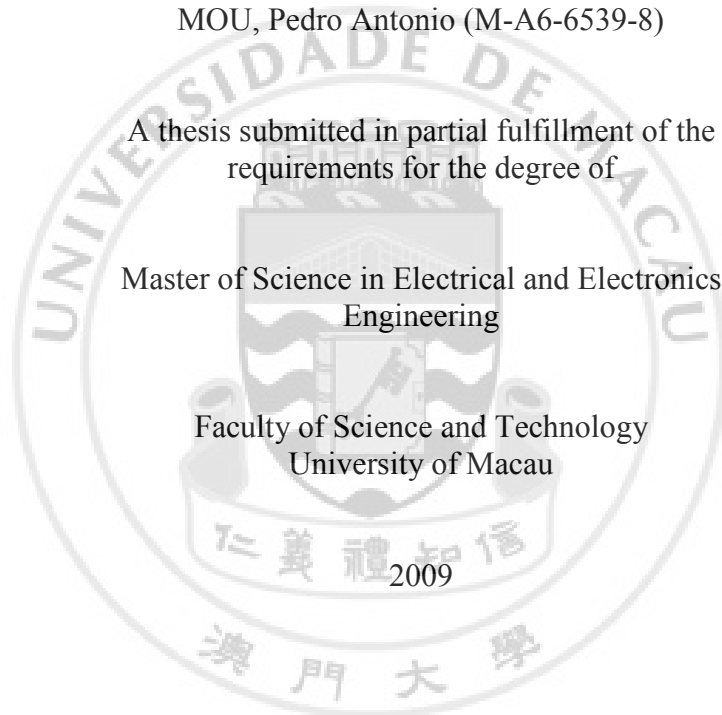
by

MOU, Pedro Antonio (M-A6-6539-8)

A thesis submitted in partial fulfillment of the  
requirements for the degree of

Master of Science in Electrical and Electronics  
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Approved by \_\_\_\_\_

Supervisor

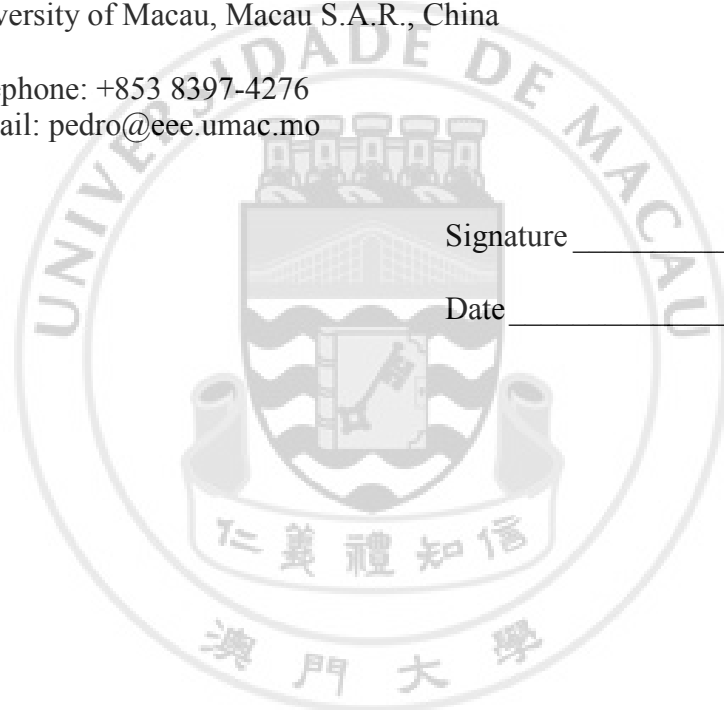
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ABSTRACT

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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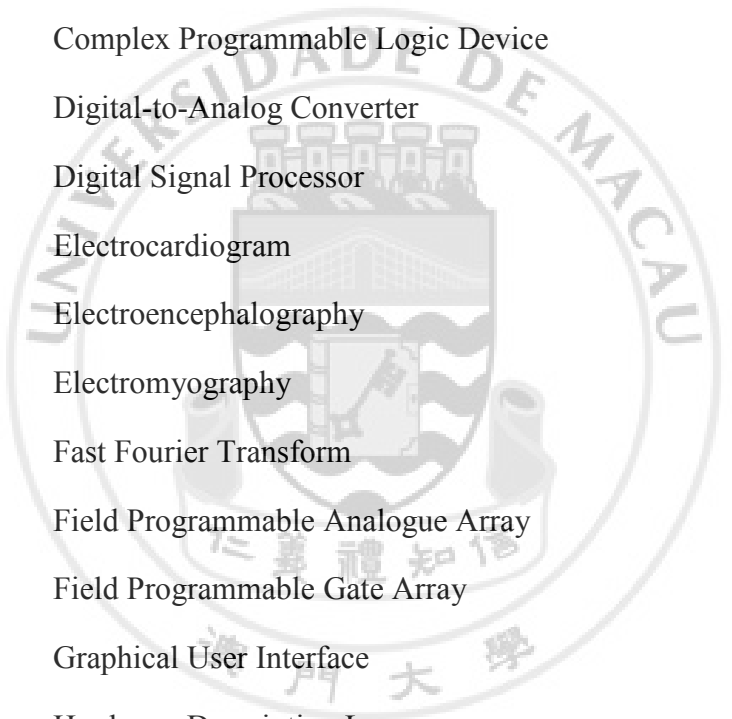


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## LIST OF ABBREVIATIONS



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

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



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