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URUGUAY

An emerging world player in specialty design

Pablo Aguirre
Universidad de la República
& NanoWattICs
Montevideo, Uruguay
paguirre@fing.edu.uy

I. Introduction

Uruguay (official name: Oriental Republic of Uruguay, Spanish: República Oriental del Uruguay), is a country in the southeastern part of South America. It is home to 3.3 million people, of whom 1.8 million live in the capital, Montevideo, and its metropolitan area. An estimated 88% of the population is of European descent. With an area of approximately 176,000 square kilometers (68,000 sq mi), Uruguay is the second-smallest nation in South America by area [1].

Montevideo was founded by the Spanish in the early 18th century as a military stronghold. Uruguay won its independence between 1811 and 1828, following a four-way struggle amongst Spain, Portugal, Argentina and Brazil. It is a democratic constitutional republic with a government divided in legislative, executive and judiciary branches. The bicameral parliament and the president (head of state and head of government) are directly elected every 5 years.

Uruguay has a strong democratic tradition, characterized by political and social stability. It has an open, stable and rapidly developing economy with reliable and high level institutions and is one of Latin America's countries with highest GDP growth rates, partially driven by the recent growth in foreign investments that come seeking legal certainty, clear rules, macroeconomic stability and access to markets.

Uruguay has a high literacy rate (98%) and the state provides free education, including University, investing 4.5% of its GDP in education. In 2009, Uruguay became the first country in the world to provide a laptop for every primary school student, as part of the "Plan Ceibal" (One Laptop Per Child, OLPC).

II. Chip Design Industry

Since the '90s a vigorous ICT sector has emerged. In particular, some highly specialized design houses leverage from academic research.

A. *NanoWattICs*

NanoWattICs [2] provides unique expertise in custom IC design for ultra-low-power, safety-critical, analog and mixed-signal applications. This design house has the experience needed to steer any IC development project through the entire product design cycle from feasibility studies to production and testing management. Its funding members have been performing industrial IC designs for medical devices since 1996.

Examples of past projects for clients in Europe and North America include: a custom cell for aeronautic application, an ultra-low-noise, low-power sensing and signal processing custom ASIC for an implantable Class III closed-loop nerve stimulator, an ultra-low-power voltage reference cell in a pure digital 130nm process and many others.

B. *ChipMate*

Chipmate [3] is a spinoff dedicated to design and provide turnkey solutions in the field of integrated circuits and electronics for medical devices. The company has developed products like minimum noise per uW amplifiers, a scalable ASIC for electrical stimulators fulfilling highest safety and reliability standards, and bi-directional 6 kV ESD tested composite MOSFET switches. Chipmate has tested IP blocks aimed at medical devices that enable 6-9 months time from specs to prototype.

Capital	Montevideo
Largest city	Montevideo
Language	Spanish
Area Total	176,215 km²
Population (2011 census)	3,286,314
Currency	Uruguayan Peso ($, UYU)
Time zone	**(UTC +3)**
Internet TLD	.uy

C. WalterD.Gallegos

WalterD.Gallegos [4] was founded in 1996 to provide engineering services to the medical area, X-Ray, Computed Tomography and Ultrasound; is now also center of electronic design, consulting and training for engineers in programmable logic design (FPGA and CPLD) and mixed-signal systems (Analog-Digital Systems).

Over 30 years of industry experience enable the company to offer solution to partners and clients that are robust, efficient and as simple as possible. Some examples of the designs developed include Modulators (DVB-C/S, ISDB-Tb) for the Spartan FPGA family, high-speed scanners (> 1400 mm/sec) for desktop and ATM modules and an all-in-one FPGA PBX solution for low cost phone systems.

III. Academia

Most universities offer curricula in Engineering areas. The following have programs directly related to chip design.

A. Universidad de la República

Universidad de la República (UdelaR), the national public university founded in 1849, is the main institution in higher education and research in Uruguay, covering most areas of knowledge. Each year, more than 5000 students are graduated, over 300 of them receiving Engineering degrees. Around 50 graduate students a year complete their MS or PhD degrees in engineering related areas. There is a long tradition of higher education in Engineering dating back to 1885 while the Electrical Engineering Department was created in 1936.

Based on that historical background, in 1991 the Microelectronics Group at UdelaR [5] was created. Its research area revolves around Application Specific Integrated Circuit Design in CMOS technology. Its main focus lies in custom design of Analog, Mixed Signal and Radiofrequency ICs for Ultra Low Power applications such as (Power) Optimization of Analog and RF CMOS, Analog signal processing (filtering and amplification), Biomedical Applications, Ultra Low Power Temperature sensors, Photodiodes, (Low Power Short Range) RF Circuit Design, Voltage Multipliers, DC/DC Converters.

While researching these areas, the Group routinely develops Design Methods involving Algorithms for Optimizing Design Parameters.

The Microelectronics Group at UdelaR completed some Projects for Industrial Applications including an Integrated Circuit for an Implantable Cardiac Pacemaker. The Group has become a regional reference in the field of analog and ultra low power microelectronics.

This research backs teaching activities spanning from undergraduate courses to PhD degrees.

B. Universidad Católica del Uruguay

uDIE [6] is the microelectronics research group at Universidad Católica del Uruguay. The group has a strong focus on analog and mixed mode design, with active research projects in micropower and low noise amplifier design, micropower buck converters, HV current sources and stimuli delivery circuits for medical devices, and cyclostationary noise modeling in the MOS transistor. uDIE is a small group with 3 staff professors and several graduate and postgraduate students.

IV. Government Programs and Other Organizations

A. ANII – National Agency for Research and Innovation

The National Agency for Research and Innovation is a state organization that promotes research and application of knowledge to solving production and social issues. It offers funding opportunities from grants for research projects and postgraduate scolarship awards to programs that foster innovation culture and entrepreneurship. Some programs are addressed to innovations in businesses, both backing startups and innovative ventures inside corporations.

B. CUTI – IT Uruguayan Chamber

CUTI represents IT industry in Uruguay, gathering over 300 IT companies and organizations which operate from Uruguay in over 52 different markets and in all five continents. It is also a reference and an active partner in every IT related institution, such as incubators and technology parks.

C. Businesses Parks and Free Zones

There are several Business Parks focused on Technology and Services in the Montevideo area. All of them enjoy a special Free Zone tax regime: 100% exempt of corporate income tax, net wealth tax and import duties.

References

[1] Uruguay. (2013, May 17). In Wikipedia, The Free Encyclopedia. Retrieved May 17, 2013, from http://en.wikipedia.org/w/index.php?title=Uruguay&oldid=555506165

[2] http://www.nanowattics.com/

[3] http://www.chipmateic.com

[4] http://www.waltergallegos.com/index-in.html

[5] http://iie.fing.edu.uy/vlsi

[6] http://die.ucu.edu.uy/microdie

Pablo Aguirre has over 10 years of experience in analog and mixed-signal IC design and development of electronic systems (both hardware and firmware), particularly for medical and other ultra-low-power, high-reliability applications. As Co-Founder and Chief Design Manager at NanoWattICs, he has led the Design Team in charge of several ICs and IC modules for companies in North America, Europe and Brazil. He holds an E.E. and a M.Sc. degree, both from Universidad de la República, Uruguay, where he is a part-time Adjunct Professor lecturing in under graduate and graduate EE courses with emphasis in IC design. He is also a member of the IEEE.