

2016 – 2019

PROFESSOR OF COMPUTER ENGINEERING

Federal University of Minas Gerais

Taught topics in Computer Architecture, Embedded Systems, and Digital Systems. Advised three master students. Researched on tools for Edge Computing and Verification of Computer Programs using Formal Methods like Model Checking.

l5x2c: Transcompiler of Ladder to C

l5x2c is a transcompiler (a source-to-source compiler) written in Python that translates Rockwell's ladder programs into a C program with the purpose of formal verification. It is a work-in-progress and, as of now, it supports complex rung structure, the most used ladder instructions, tag definitions, multiple programs and routines. l5x2c uses PLY to build a single pass transcompiler that translates the original ladder program into a C code that implements an Accumulator Machine that models the behavior of the Rungs. I have implemented the entire transcompiler. (See in GitHub)

Python / Compilers / Regular Expression / Context-free Grammars / Linux

Assessment of Bluetooth 5 mesh for IoT Devices

In this project, we evaluated the Bluetooth 5 standard with respect to its suitability to home automation. We analysed security, privacy, range, and energy consumption of the standard by using the Fanstel's BT832 module, based on the Nordic nRF52832 QFAA SoC with ARM Cortex M4F. A proof of concept was created using Embedded C and Bare Metal programming. I was the principal investigator of this project and advised a Junior developer. The project was a partnership between the Federal University of Minas Gerais and Neocontrol Home Automation.

C/C++ / Microcontrollers / PCB design / Board Bring up / Bare Metal / Networks / Encryption

Computer Architecture and Organization - Professor

I was the professor in charge of this course, that covers the entire computer stack up to the interface with the operating system, including processor, memory, peripherals, assembly language, interrupts, boot system, storage and bus interfaces, using the MIPS architecture as reference. I was responsible for both theory and practice portions of the course. Parallel with theory, the students were presented with a series of laboratory assignments where, under my supervision, they designed and implemented a custom processor using VHDL and FPGAs.

MIPS / VHDL / FPGAs / Assembly / Safe Boot / GPUs / Interrupts

Embedded Systems Design - Professor

I was the professor in charge of this course, that covers the embedded systems design process, from requirements to implementation using real devices. Topics included microcontrollers, embedded C, middleware, peripherals, embedded serial buses, basic networking. I was responsible for the practical portion of the course where the students used the STM32 microcontroller series with STM32CubeMX to implement personal projects.

C/C++ / Microcontrollers / Bare Metal / SPI / UART / I2C / CAN / Timers / Interrupts

Digital Systems - Professor

I was the professor in charge of this course, that is an introduction to Digital Systems and covers all aspects of digital systems from Logic Gates to RTL design, including how to implement high-level Finite State Machines in RTL. Topics also include memories, logic families, integrated circuits, FPGAs and VHDL. I was responsible for both theory and practice portions of the course. The students were presented with a series of laboratory assignments where they were gradually introduced to RTL design in practice. At the end, they built their own hardware accelerator.

Logic Gates / Memory / RTL Design / VHDL / FPGAs

2013 – 2014

POSTDOCTORAL RESEARCHER

École Polytechnique Fédérale de Lausanne (EPFL)

Awarded a Swiss Confederation Excellence Scholarship for Foreign Students for researching on biomedical signal processing techniques. Co-authored a patent, peer-reviewed papers and acted as technology consultant to the spin-off Smartcardia.

Estimation of blood pressure and pulse transit time using smartphones

In this project, we developed a new smartphone-based method to estimate Pulse Transit Time (PTT) reliably and subsequently Blood Pressure (BP) from the baseline sensors on smartphones. This new approach involves determining PTT by simultaneously measuring the time the blood leaves the heart, by recording the heart sound using the standard microphone of the phone and the time it reaches the finger, by measuring the pulse wave using the phone's camera. I was a key member of the team who developed the method and I was responsible for implementing algorithms for Android. Android NDK was used to allow native C code to be used in the signal processing algorithms and to improve the performance of the application.

C/C++ / Java / Android / Matlab / R / Git

2010 – 2016

PROFESSOR OF COMPUTER SCIENCE

Fumeuc University

Taught graduate and undergraduate level courses, in special Algorithms and Data Structures, Artificial Intelligence, Compilers, Automata Theory, and Introduction to Robotics. Researched on tools for Verification of Software and Hardware using Formal Methods like Model Checking.

C/C++ / Java / JavaScript / HTML / Bison/Yacc / Linux / Microcontrollers / FPGAs

Introduction to Robotics - Professor

I was the professor in charge of this course, that covers the use of embedded systems for robotics. Topics included microcontrollers, embedded C, middleware, peripherals, embedded serial buses, basic networking, sensors and actuators and basic control. I was responsible for the theory and practice of the course. After the theory, the students were presented with a series of laboratory assignments where, under my supervision, they solve common problems in robotics using the Texas Instruments' MSP430 microcontroller.

C/C++ / Microcontrollers / Bare Metal / SPI / UART / I2C / PWM / Timers / Interrupts

Algorithms and Data Structures - Professor

I was the professor in charge of this course, that covers the most used programming data structures and algorithms. The course was taught in C and in Java.

C / Java

Automata Theory - Professor

I was the professor in charge of this course, that covers the automata theory, grammars, and formal languages.

Finite Automata / Context-free Grammar / Formal Languages

Compilers - Professor

I was the professor in charge of this course, that covers an introduction to compilers.

Lexers / Parsers / Semantic Analysis / Code Generation / Bison/Yacc / Ply

2008 – 2016

SENIOR EMBEDDED SOFTWARE ENGINEER

Wisecomm Intelligent Sensors

Lead a technical team responsible for developing Wireless Sensor Network products.

Wasp: Wisecomm Advanced Sensor Platform

In this project, we developed a Wireless Sensor Network (WSN) platform for using in academia and on industrial environments. The platform is composed of three components: 1) main board with 4 layers of copper, featuring a TI's MSP430 microcontroller, a TI's CC2531 RF module, an onboard antenna; 2) sensor board, with different analog and digital sensors; 3) programming board, with USB and JTAG interfaces. I was responsible for defining the platform hardware requirements and manage the hardware development team, as well as bringing up the board and leading a team to develop the firmware. The firmware was developed using Bare Metal Embedded C.

C/C++ / Eagle PCB / Bare Metal / Board Bring Up / SPI / I2C / UART / JTAG / Java

EDUCATION

2008 – 2012

PhD in Electrical Engineering

Federal University of Minas Gerais

Developed a method for speeding up the verification of Chip High-Level projects using Heuristic Functions. The method was implemented in SystemC, which is a C++ framework for Chip descriptions. Lead a team of undergraduate students.

2005 – 2008

Master's Degree in Electrical Engineering

Federal University of Minas Gerais

Developed a method for measuring test coverage of High-Level Chip designs described using SystemC, which is a C++ framework for Chip descriptions.

2000 – 2005

Electrical Engineering Bachelor's Degree

Federal University of Minas Gerais

Participate on Scientific Initiation Projects funded by Brazilian agencies in the fields of Machine Learning and Embedded Systems

LANGUAGES

Portuguese - Native

English - Advanced (C1/C2 - IELTS)

French - Intermediate (B2/C1-TEF)

INTERESTS

Test and Verification

Static Analysis and Formal Verification

Embedded Systems and Edge Computing

Reconfigurable Architectures

Machine Learning

PUBLICATIONS

6 Academic Papers

1 US Patent