Alexei Solonari

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EDUCATION

- *University of Central Florida* — Orlando, FL | 2022 - Expected May 2027 (In Progress)
  - B.S. in Computer Engineering, GPA: 3.46

EXPERIENCE

Embedded Systems Research Assistant — Securing AI Applications & IoT

- *DRACO Lab*, Dr. Mike Borowczak (University of Central Florida) | Nov 2025 - Current
  - Perform side-channel analysis of AI model inference in embedded devices to evaluate model reconstruction and reverse-engineering vulnerabilities
  - Develop and maintain comprehensive **ChipWhisperer**-based model tracing pipeline to support power analysis and weight extraction experiments
  - Instrument and debug embedded **STM32** ML model firmware, isolating and mapping neural network inference computations within MCU power traces
  - Implement and maintain monitoring infrastructure for **FreeRTOS**-based ESP32 devices, allowing for visualization of data being exchanged and logged within decentralized IoT network

Systems Software Research Assistant — Kernel Testing & Security

- *APPLeSEEd Lab*, Dr. Paul Gazzillo (University of Central Florida) | Jan 2024 - Aug 2025 (1 yr 8 mo)
  - Independently designed and programmed new SAT-solving algorithm for surfacing Kconfig-dependent **Linux kernel** bugs. Compared to prior tool, new implementation improved driver/feature coverage uniformity by an avg of **66x** for Linux environments via new divide-and-conquer design, and reduced runtime up to **49x** with improved solver usage
  - Led lab's kernel configuration research on bootability; developed and validated a minimal set of Linux Kconfig options that increased boot reliability of randomized configurations from **0% to 93%** for improved kernel testing
  - Investigated Linux kernel-level bugs using **KGDB, ftrace**, KASAN sanitizer on Linux kernel code and fuzzer-generated C code to reproduce causes. Automated kernel build and boot testing (QEMU) with Python & Bash

SYSTEMS/KERNEL PROJECTS

Robinwaita — C-Based Linux Process Scheduler with Thread-Safe GTK 4 GUI

- Personal Project (2024) | *Technologies: C, Linux kernel APIs, Python, GTK 4, Libadwaita, systems programming*
  - Built userspace round-robin scheduler in C, managing process context switching with microsecond precision using **Linux kernel** timerfd APIs
  - Developed thread-safe GTK 4/Libadwaita GUI displaying live scheduling decisions, context switch statistics
  - Implemented comprehensive test suite with Python workload generators simulating CPU-bound, I/O-bound, and mixed workloads to validate fairness and performance
  - Achieved responsive and reliable GTK 4 GUI under load with ultra-low scheduling latency through timerfd

Embedded Temperature Sensor Driver — I2C Linux Kernel Driver w/ IoT Integration

- Personal Project (2025) | *Technologies: Linux kernel, I²C, Embedded C, HomeKit, Raspberry Pi, IoT*
  - Developed C-based Linux kernel driver for MCP9808 sensor via **I²C communication**, integrating with hwmon subsystem to enable automatic temperature monitoring as system metrics on boot
  - Bridged embedded hardware to Apple HomeKit via hwmon, allowing real-time temperature data access via iPhone/iPad/other Siri-enabled devices and automated home climate control
  - Validated driver stability with i2c-stub tests and **600+ hours** of panic-free operation of continuous home usage

SKILLS

- Languages: C, Python, C++, Bash, Z Shell, Java, Verilog, Assembly (MIPS), JavaScript, HTML/CSS, SQL, PHP
- Operating Systems: Linux, Windows, macOS, UNIX, POSIX-compliant systems, Debian, Ubuntu, Arch Linux
- Embedded Systems & Communication: Arduino, Microcontrollers, HID, I2C, GPIO, EEPROM, Bare Metal Programming, Internet of Things (IoT), ChipWhisperer, STM32, ESP32, FreeRTOS
- Tools: Git, GCC, Make, CMake, GDB, Valgrind, Docker, QEMU, VS Code, Vim, SSH, MATLAB, Oscilloscope, Multimeter, Logic Analyzer, Z3, SMT solvers, SAT solvers
- Frameworks: GTK 4, Libadwaita, React, TensorFlow, Tkinter, Tailwind CSS
- Kernel/Systems: Kconfig, Linux Kernel Development, System Calls, Memory Management, Process Scheduling, IPC, Multithreading, Concurrency
- Concepts: Real-time Systems, Embedded Linux, Computer Architecture, Digital Logic, Signal Processing, Data Structures, Object-Oriented Programming, Object-Oriented Design, Algorithms