Ady Alhamdan

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Education

University of Waterloo - Candidate for BASc in Computer Engineering *September 2021– April 2027*
Courses: Algorithms and Data Structures, Embedded Systems, Real-Time Operating Systems, Computer Architecture

Skills

Software: C, C++, Python, Assembly, SystemVerilog, HTML, CSS, JavaScript, SQL, Bash, React, MongoDB, ExpressJS
Tools: Embedded Linux, RTOS, Git, GNU, STM32CubeIDE, Oscilloscope, Logic Analyzer, MATLAB, VS Code, PuTTY
Hardware: UART, SPI, I2C, CAN, ADC, DAC, PWM, GPIO, DMA, FPGA, STM32, Raspberry Pi, Arduino, PCBA Design

Experience

Firmware Engineering Intern – Onsemi *May 2025 – August 2025*

- Integrated **Zephyr RTOS** with an IP driver platform (UART, I2C, GPIO, DMA), enabling real-time communication.
- Developed **unit tests with Zephyr ztest**, ensuring driver bring-up, regression validation, and automated test coverage.
- Designed a **sensorless BLDC motor controller** in Zephyr using multi-channel PWM, achieving **real-time embedded motor control** with firmware–hardware co-design.
- Validated **system bring-up** on FPGA/STM32 with I2C, logic analyzer, and interrupt-driven APIs, improving concurrency, reliability, and performance.

Software Engineering Intern – Martinrea International Inc. *September 2024 – December 2024*

- Developed a real-time **computer vision** system in **Python/Linux** for object detection, tracking, and collision prediction in high-throughput, low-latency environments.
- Designed object **speed estimation** and **trajectory prediction** algorithms, using **Kalman** filters, achieving 95% accuracy.
- Built a **concurrent processing pipeline** on Linux with multiprocessing, multithreading, semaphores, and synchronization, ensuring zero frame drops.
- Configured **Nvidia Jetson AGX** Orin with CUDA, TensorRT, PyTorch, and Tensor Cores, reducing inference latency from **13 ms to 3 ms**.
- Debugged distributed systems and optimized dataflow for low-latency, high-throughput performance.

Electrical Engineering Intern – Martinrea International Inc. *January 2024 – April 2024*

- Improved production by **3.3%** jobs per hour by integrating **Raspberry Pi and relay circuitry** for PLC data transfer.
- Developed **HMI tracking system** using PLC ladder logic, SQL, and Python scripts, ensuring **system traceability**.

Projects

Real-Time Executive – C, ARM, STM32

- Built a **real-time executive** with pre-emptive scheduling, multitasking, and context switching on STM32.
- Implemented **EDF scheduler**, dynamic allocation (First Fit), and RTOS primitives for **deterministic execution**.

Audio Player – C, FPGA

- Designed an **audio subsystem** using an Altera FPGA and FatFS, enabling real-time stereo playback from MicroSD.
- Developed **audio drivers, buffering, and debouncing logic**, ensuring distortion-free performance.

Large Language Model Accelerator – SystemVerilog RTL Design

- Implemented **self-attention, GELU, LayerNorm, and softmax** modules for a **BERT accelerator** on an FPGA.
- Designed a **2D PE systolic array** for parallel matrix computation with low-latency, high-throughput pipelines.
- Developed **fixed-point buffering** for **real-time AI inference**.

Water Reservoir System Controller – C, STM32, Motors, Sensors

- Integrated **STM32** with motors, sensors, and LEDs, handling GPIO, UART, ADC, and PWM for real-time control.
- Developed dual-channel PWM signals to drive DC and servo motors with speed and direction using STM32 timers.