M.Eng Robotics

RAYNHARDT VAN ZYL

Firmware Engineer — Lightsense (Azoteq)

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Paarl, South Africa raynhardt-van-zyl.github.io/pages/index.html

EXPERIENCE

Firmware Engineer

Lightsense — AZOTEQ (PTY) LTD

May 2024 – Present Paarl, ZA

- Senior firmware engineer for the Lightsense product line: system architecture, release process and mentoring.
- Designed and shipped DFU/OTA pipeline (A/B images, SHA-256 verification, rollback guard) with USB DFU and BLE SMP recovery.
- Migrated and refactored legacy HAL to embedded Rust (`no_std`, `defmt`, `probe-rs`); improved boot time and reduced RAM usage.
- Built CI-on-hardware (GitHub Actions + J-Link RTT + automated test rigs) to run smoke and regression tests on each PR.
- Work with hardware and product teams to optimise low-power modes and system-level power budgets for high-volume devices.

PSG Head Consultant

PSG Head Consultants

Jan 2023 – Jul 2023

- Collaborated with a team of engineers and professionals to provide engineering consultancy and solutions.
- Participated in project planning, design and implementation under senior guidance; performed research, data analysis and simulations to support project decisions.
- Assisted in technical reporting, proposals and presentations; contributed to continuous improvement initiatives through industry best practices.

Visiting Scholar

KU Leuven

Oct 2022 – Dec 2022 Leuven, BE

- Visiting scholar at the Faculty of Engineering Science; helped the research team develop FPGA programs to accelerate CasADi workflows and numerical optimisation.
- Produced prototype implementations and collaborated on integration and performance evaluation.

Cloudline

Cloudline

Jan 2021 – Oct 2022

- Participated in airship testing activities: flight tests, instrumentation setup and data collection; performed system performance evaluation and troubleshooting.

EDUCATION

B.Sc., Electronic Engineering

Stellenbosch University

2017 – 2020

- Course: Bachelor of Science in Electronic Engineering.
- E&E Top 20: 2017, 2018, 2019, 2020.
- Golden Key member (ID: 16653479).

M.Sc., Electronic Engineering

Stellenbosch University

2021 – 2023

- Course: Master of Science in Electronic Engineering.
- Research: Low-Cost Autonomous Rover with Heterogeneous Compute (prototype + article).

TECH STACK

C/C++ (bare-metal) Rust (`no_std`) Python C# JavaScript

Real-time / RTOS (FreeRTOS) / Embassy-rs	●●●●●
Bootloaders / DFU	●●●●●
Drivers: I2C, SPI, UART, CAN, USB, PWM, ADC, DMA	●●●●●
Wireless: BLE, Wi-Fi	●●●●○
Low-power / LPM	●●●●●
USBPD	●●●●○
FPGA (Verilog/VHDL)	●●●○○

TOOLCHAINS & DEBUG

CMake cargo probe-rs OpenOCD J-Link STM32CubeMX nRF Connect CMSIS-DSP defmt GDB RTT Logic Analyser

- Assisted with calibration of equipment and analysis of flight data to ensure reliable measurements.

Green Link Solutions

Green Link Solutions

Jun 2021 – Dec 2021

- Designed and developed sensors and sensor systems with emphasis on PCB design and embedded firmware.
- Prototyped, tested and analysed sensor designs and provided actionable recommendations for improvement.

Enerdyne

Enerdyne

Apr 2021 – Dec 2021

- Contributed to product prototyping and software development, including OpenGL components and mainframe integrations.
- Performed testing, validation and produced technical documentation for prototypes and releases.

Software Engineer

Hexabyte

June 2019 – Dec 2019

- Assisted in software development, design, testing and maintenance; collaborated with development teams to deliver projects on schedule.

SELECTED PROJECTS

Heterogeneous Computing for Low-Cost Robotic Platforms

Research / FPGA + ARM

2023

- Developed a heterogeneous compute architecture and prototype rover (sub-R50k); demonstrated avg. speed 0.5 m/s, energy 0.2 kWh and decision error <5%.
- Publication: see Publications section (MATEC Web of Conferences, 2023).

Robotic Arm Design

Mechanical & Embedded

On hold

- Designing a modular robotic arm platform for general manipulation; focus on mechanical design, embedded motor control, and jerk-limited trajectories.

Asynchronous Impulse-based SNN Framework

Rust / Neuroscience

In progress

- Implementing an asynchronous impulse-based spiking neural network framework in Rust with emphasis on concurrency, memory safety, and performance; exploring GPU acceleration.

Oscilloscope | FMD IDE | MounRiver Studio - WCH | CDK - APT | Keil uVision - HopeRF

MCUS & BOARDS

STM32 | nRF52 | RP2040/RP2350 | ESP32-S3 | FMD | WCH | APT | HopeRF

HARDWARE

Altium | EAGLE | Power profiling

ACHIEVEMENTS

- Shipped firmware to **> 1M** devices in production.
- Reduced system idle current by **38%** through rust async functionality to keep core asleep longer.

LANGUAGES

Afrikaans ●●●●●

English ●●●●●

Dutch ●●●○○

INTERESTS

Squash, CrossFit, Cycling, 3D printing, Rock climbing

Self-Sufficient Aquaponics System

Precision Agriculture / Embedded

On hold

- Building a closed-loop aquaponics system with vertical farming, tailored lighting and real-time nutrient/moisture sensing for precision agriculture.

Solar Tracking System

Renewable Energy / Controls

In progress

- Sensor-fusion solar tracker with predictive astronomical modelling to optimise panel orientation and reduce mechanical wear.

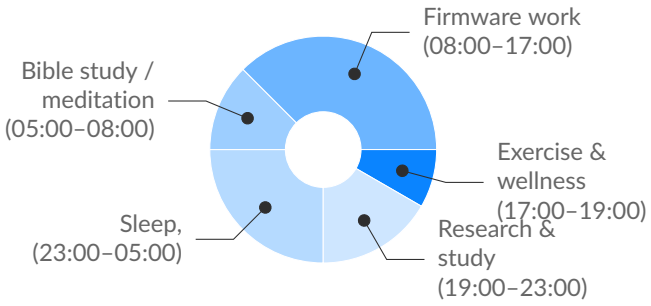
Algorithmic Trading System

Machine Learning / Finance

In progress

- Prototype transformer-based trading model (LLaMA base fine-tuned) consuming market data and news summaries for automated execution; focus on latency and robustness.

A DAY OF MY LIFE



PUBLICATIONS

- Heterogeneous computing for low-cost robotic platforms, MATEC Web of Conferences (2023).