

Rafael Delwart

Robotics Engineer

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Major Projects

Wet-Dry Cycler for RNA Production

Recruited and led a team to design and build an automated system to simulate early Earth conditions for non-enzymatic RNA synthesis, supporting origins-of-life research in collaboration with Dr. David Deamer. This project included:

- **Embedded control:** C/C++ on ESP32-S3 (ESP-IDF) with a finite-state machine, timers/ISRs, watchdog, safe-state recovery, and JSON telemetry/logging.
- **PCB & electronics:** Custom PCB integrating DRV8825 stepper drivers, DC mixing motor control, heater switching, NTC thermistor sensing, limit switches, and a 12V/5V power tree with fusing and grounding; benchtop validation with DMM/scope.
- **Web server & UI:** Node/Express service with a React dashboard using WebSockets for live status/commands, interlocks, scheduling, and log export.
- **Submodules:** Thermal plate; syringe-pump rehydration/manifold; vial motion stage; mixing motors; CO₂ purge/flow; extraction/refill; limit switches & sensors; power distribution.
- **Delivery & support:** Delivered to an Eden Rock lab; trained users and documented procedures; continuing maintenance and regular communication with the PhD researchers operating the system.

3D Tracking Using an IMU for Rock Climbing

Designed a 9-DOF BNO055-based motion tracker with a minimal MCU state machine for on-wall movement analysis.

- **Embedded:** Calibration→Recording→Waiting state-machine control; BNO055 orientation/linear-accel with timestamped accel/gyro/mag data is sent over serial.
- **Data/analysis:** PC logging (CoolTerm) and MATLAB filtering/visualization; validated with gym wall trials.

Mechatronics Competition (2nd Place)

Led development of an autonomous robot for timed ball collection/deposit with robust real-time control under randomized field constraints.

- **Embedded/RT control:** C on PIC32 with interrupt-driven state machine, watchdogs, and debounced sensors.
- **Sensors/electronics:** 6 bumpers, 5 IR tape sensors; H-bridge motor control; regulated 5V (servo) and 3.3V (sensors/encoders); reverse-polarity protection with power LEDs, heatsinked 3.3V regulator; noise-reduced sensor wiring.

Detailed descriptions, documentation, and additional projects available at: ramfi-d.github.io/Engineering-Portfolio/

Work Experience

UpRna, Santa Cruz, CA

Research Scientist (Device Support)

Mar 2026–Present

Supervisor: David Deamer (Inventor of Nanopore Sequencing)

Assisted with sample preparation and analysis using Wet-dry Cycling, TLC, Nanodrop, HPLC, and mass spec. Prototyped the wet-dry automation platform for nucleotide polymerization research and supported laboratory use by training lab users, writing SOPs, performing maintenance and iterative hardware/firmware upgrades.

UCSC, Santa Cruz, CA

Undergraduate Tutor — ECE167: Sensors and Sensing

Academic Year 2024–2025

Supervisor: Professor Collen Josephson (cjosephson@ucsc.edu)

Led tri-weekly lab sessions for 100 plus students on sensor technologies and data processing. Covered sensing principles, calibration, signal filtering, ADC, and data acquisition. Guided students in practical lab applications using C programming and lab equipment.

Skills

Programming: C, C++, Python, Verilog, MATLAB, Assembly, HTML, CSS, Git.

Math & Physics: Signals & systems, control, probability, linear algebra; numerical modeling and error analysis.

Systems Modeling: Kinematics/dynamics; CAD (SolidWorks, Onshape); system architecture; feedback and controls; timing/throughput/latency tradeoffs and test planning.

Electronics: Circuit design/analysis (analog & digital); PCB fundamentals (schematic capture, layout review); power integrity/decoupling; DMM/oscilloscope/logic analyzer.

Fabrication: CNC machining; laser cutting; 3D printing; PCB milling; soldering and microsoldering;

Projects: Firmware & hardware bring-up; bench validation and log-based debugging; technical documentation.

Languages: French and English.

Education

University of California, Santa Cruz (UCSC)

Robotics Engineering, Minor in Electrical Engineering

Sept 2020 - June 2025

Dean's Honor List (4 times)

Major GPA: 3.74

Honors Graduate in both fields

References

Prof. David Deamer (deamer@soe.ucsc.edu) • Prof. Collen Josephson (cjosephson@ucsc.edu) • Vikas Peddu (Vikas.Peddu@uprna.com)