

Aditya Nair

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EDUCATION

University of Florida

Gainesville, FL

B.S. Mechanical Engineering; Computer Engineering Dual Major (in progress) — GPA: 3.75/4.00 Expected Dec. 2028

- Relevant Coursework: Programming Fundamentals I & II, Data Structures & Algorithms, Statics, Differential Equations.
- Honors & Certifications: Dean's List; Certified SolidWorks Associate; Florida Academic Scholar.

PROJECTS

Custom Quadcopter Flight Controller | *STM32, C/C++, KiCad, DShot, Real-Time Control*

- Designed a custom STM32 flight controller on a self-made KiCad PCB for quadcopter attitude control, with 8 kHz SPI gyro acquisition feeding a 4 kHz rate-PID control loop and DShot300 ESC output.
- Implemented the control stack in bare-metal C/C++: 6-axis attitude estimation, configurable low-pass and notch gyro filtering, and fixed-rate deterministic scheduling, structured for bidirectional DShot RPM telemetry next.
- Characterized loop timing on hardware, holding control-loop jitter under 1% at 4 kHz — a deterministic real-time base for closed-loop flight and future GPS/state estimation.
- Designed and implemented a HIL testing rig ensuring controller determinism and field reliability. Implemented numerous PIL simulations

BikeLoop — Algorithmic Cycling Route Generator | *Python, FastAPI, MapLibre*

- Built a self-hosted web app that generates distance-targeted cycling *loops* over ~18.1M OpenStreetMap road segments across major cities in the US, inverting a shortest-path routing engine into a closed-loop generator via damped numerical convergence.
- Designed custom computational-geometry metrics (self-overlap, turn-roughness) and a diversity-aware multi-objective ranker; a circle-join model cut cornering roughness 0.36 → 0.17 and backtracking 22% → ~0% on a 12 km loop.
- Built a dependency-injected routing core behind a strict quality gate (mypy, ≥85% branch coverage, ~90 unit tests), deployed as a containerized 3-service stack with self-hosted CI/CD at bloop.mdracc.org.

Off-Grid LoRa Mesh Network | *ESP32-C3, LoRa, embedded C, solar/battery*

- Built a 6-node off-grid LoRa mesh on ESP32-C3 with 1–3 km node spacing along a walking trail, providing multi-hop telemetry and paging where no network infrastructure reaches.
- Engineered solar-recharged battery nodes for ~36 h of no-sun runtime on a ~3-week service interval, with LoRa as the primary long-range link.

CAD & 3D-Printed Mechanical Design | *SolidWorks, FDM*

- Design and 3D-print functional mechanical parts — enclosures, sensor and board mounts, and fixtures — modeled to spec in SolidWorks for hardware and embedded projects.
- Use SolidWorks Simulation to sanity-check stress and deflection on load-bearing parts before committing to print.

Homelab & Systems Administration | *Linux, Docker, virtualization*

- Design and operate a multi-node homelab: segmented networking, least-privilege firewalling, and redundant storage across container and VM workloads.
- Automate TLS and SSH certificate issuance through an internal certificate authority, and run recurring security audits with verified remediation.

TECHNICAL SKILLS

Languages: Python, C/C++, Bash

Embedded & Controls: STM32, ESP32 (ESP-IDF), real-time control, PID, IMU/sensor fusion, SPI/I2C, DShot, LPF/notch filtering, PCB design (KiCad), LoRa

Engineering & Simulation: SolidWorks (CAD & Simulation FEA), ANSYS, MATLAB

Software & Data: FastAPI, asyncio, NumPy, Git, CI/CD (GitHub Actions), pytest, gtest, gMock

Systems: Linux, Docker, Proxmox, KVM/LXC, ZFS, VLANs, TLS/PKI, WireGuard