

Manav Sengupta

Embedded Systems Engineer — Firmware Engineer — Hardware Validation Engineer

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Professional Summary

Embedded systems and firmware engineer with experience in production IoT devices, hardware validation, and low-level embedded design. Skilled in ESP32 firmware, analog and digital hardware systems, error-corrected communication, and safety-critical products. Experienced in hardware-only logic systems and autonomous embedded platforms.

Education

National Institute of Technology, Agartala

2023 – 2027

B.Tech in Electronics and Instrumentation Engineering

CGPA: 8.42 — 4th Semester SGPA: 9.43 (Branch Topper)

Technical Skills

Programming: C, C++, Python, Embedded C

Firmware and OS: ESP-IDF (v4.3–v5.5), FreeRTOS, bare-metal systems, interrupt-driven firmware

Embedded Hardware: ESP32, IMU, NOR Flash, GPS/GNSS, LTE, I2C, SPI, UART, GPIO

Digital and Analog Design: Verilog (RTL), combinational logic, sequential logic, latches, op-amps, comparators, timers

RF and Validation: Antenna testing, RSSI measurement, TTFF benchmarking, signal integrity

Control Systems: PID control, LQR, sensor fusion, finite state machines

Tools: Git, logic analyzer, oscilloscope, CMake, Linux, Android debugging

Work Experience

Embedded Engineer Intern — Proxy

Jan 2026

- Built firmware for 3 commercial IoT products: Smart Helmet, AirShifter, and Solar Mesh.
- Migrated firmware from ESP-IDF v4.3 to v5.5, resolving API changes and FreeRTOS compatibility issues.
- Architected an interrupt-driven IMU driver supporting 4 event classes: tap, free fall, man down, and orientation.
- Integrated external NOR Flash over SPI with FATFS and wear leveling, enabling logging of 1,000+ data points offline.
- Improved GPS time to first fix from 15+ minutes to under 60 seconds using warm-start persistence.
- Executed RF validation for LTE, GPS, and Wi-Fi subsystems using RSSI, SNR, and mobility testing.

Technical Co-Lead (Embedded) and Embedded Robotics Lead — ANARC Robotics Club

2024 – Present

- Led embedded systems design for 30+ members across firmware and hardware teams.
- Created low-cost robotic platforms deployed in 2 national-level competitions.
- Formalized an R&D workflow, increasing annual project output by 2x across 10+ projects.

Key Projects

Proxy Smart Helmet — Safety-Critical Embedded System (Production Device)

- Delivered production firmware for a commercial worker safety helmet.
- Integrated IMU-based fall detection, tap detection, orientation tracking, and man-down logic across 4 safety modes.
- Engineered a low-power interrupt-driven architecture operating reliably under Wi-Fi and LTE load.
- Verified GPS, LTE, and Wi-Fi performance using RSSI and TTFF field tests.

Proxy AirShifter — IoT Embedded System (R&D, Pre-Launch)

- Authored core firmware modules for a commercial IoT product nearing market release.
- Unified 5 sensors including BMP, microphone, LDR, RTC, and RF modules into a single control flow.
- Deployed external NOR Flash-based data logging for offline operation.

Overcurrent Protection Circuit — Analog Hardware

- Designed an analog overcurrent protection circuit using op-amps, comparators, and latch logic.
- Enforced hardware-level shutdown independent of firmware control.
- Analyzed op-amp behavior including slew rate, input offset voltage, and saturation limits.

Discrete Hardware Communication and Logic Systems (No Microcontroller)

- Constructed a Hamming code sender and receiver using laser transmission and LDR-based reception, applied parity generation, error detection, and single-bit correction using logic gates and multiplexers
- Assembled a digital piano using 555 timers, counters, and discrete logic for audio frequency generation.

Autonomous Aerial Vehicle — Embedded Control System (Ongoing)

- Developing a fixed-wing autonomous aircraft using IMU-based sensor fusion and closed-loop attitude control.

Achievements

- 4th Semester Branch Topper (SGPA 9.43)
- AIR 38,342 in JEE Mains (98 percentile Physics)
- Completed 15+ embedded and hardware systems; 2 under patent review

Interests

Embedded systems, hardware validation, semiconductor design, analog circuits, digital logic, robotics, spirituality.