DAX RAJANI

Embedded Firmware Engineer | MEng Electrical and Computer Engineering, Concordia University 2026
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WORK EXPERIENCE

Glide Technology Pvt. Ltd. | Ahmedabad, India Jul 2023 – Aug 2024
Associate Engineer, Embedded Firmware

- Implemented embedded C firmware for a BLE 5.0 and NFC wearable access control device on Dialog DA14xxx (ARM Cortex-M0+), including a 4-state flash-persisted FSM, 256-bit ECC (ECDSA P-256) mutual authentication, NFC tag password protection, and dual A/B OTA over BLE with automatic bootloader rollback on failed images.
- Developed multi-variant BLE and NFC reader firmware across 4 hardware SKUs on Dialog DA1469x (ARM Cortex-M33) under FreeRTOS, integrating an FFT-based wireless ranging pipeline for centimetre-precision distance measurement, dual NFC subsystems over I2C and SPI, NFC card authentication support, and a custom binary datagram protocol abstracted across USB CDC and UART.
- Designed a multi-target OTA firmware update system that updated 3 co-processors simultaneously including the main MCU, Sub-GHz radio module, and fuel gauge IC, using CRC32-validated 64-byte chunk transfers, non-volatile storage state persistence through mid-update reboots, and a BLE fallback delivery path for devices unable to reach the primary wireless hub.
- Architected Sub-GHz wireless sensor network firmware on Microchip SAMR30 (ARM Cortex-M0+) supporting 13 simultaneous connections using a proprietary Star topology protocol, with RSSI-based network selection, a dual-stage bootloader with automatic external flash fallback on repeated failed boots, and a reliable datagram protocol with C11 type-safe serialisation and ACK-based retransmission.
- Diagnosed and resolved a production-critical BLE firmware memory leak under a two-week manufacturing deadline by instrumenting heap usage, triggering the defect reproducibly with controlled BLE advertising traffic, and tracing every dynamic allocation and deallocation in the scan validation path to deliver a stable golden firmware image before the full production run of **450 sensors**. Also identified and fixed a rare RTOS task scheduling race condition in a concurrent ranging system and implemented a remote crash diagnostic pipeline enabling wireless coredump retrieval and cloud upload without physical hardware access.

Glide Technology Pvt. Ltd. | Ahmedabad, India Dec 2022 – Jun 2023
Software Engineering Intern, Embedded Systems

- Identified and fixed a critical BLE firmware memory exhaustion defect within **2 weeks** by systematically tracing heap allocations and deallocations in the BLE scan processing path across **20 to 25 initial validation units** that were resetting continuously due to an unfreed allocation on the scan discard path.
- Prototyped a real-time BLE indoor positioning system on a Dialog DA1469x microcontroller using embedded C, implementing BLE advertising, RSSI-based distance calculation, and data-frame validation logic that discarded non-compliant packets before processing, providing the technical foundation for the production ranging system built in the associate role.

PERSONAL PROJECTS

Secure A/B OTA Bootloader — nRF52840 | C, Zephyr NCS v3.2.4, MCUboot, ECDSA P-256, BLE SMP, GitHub Actions CI 2026

- Implemented a production-quality secure OTA firmware update system on the nRF52840 using MCUboot swap-scratch A/B partition slots, ECDSA P-256 image signing to reject unsigned images at boot, and BLE SMP wireless delivery via MCUmgr compatible with the nRF Connect mobile app, with automatic rollback to the previous image if the new firmware fails to confirm within 2 seconds.
- Configured a GitHub Actions CI pipeline that installs the Zephyr SDK, runs west init and west update, generates an ephemeral ECDSA P-256 signing key, builds the full sysbuild combining MCUboot and the application, and verifies every signed binary with imgtool verify on each push to main.

ACADEMIC PROJECTS

Health Symptom Analyzer — 7-Model Ensemble ML Pipeline | Python, PyTorch, scikit-learn, XGBoost, Streamlit Fall 2025

- Designed and trained a 7-model Soft Voting Ensemble combining Random Forest, SVM, Naive Bayes, KNN, Decision Tree, Logistic Regression, and XGBoost to classify 41 disease classes from patient symptoms, achieving sub-**50ms** real-time inference and deployed the pipeline as a Streamlit web application with confidence scoring and per-class confusion matrices.

3D MRI Denoising — Blockwise NLM Algorithm | MATLAB, Signal Processing, Algorithm Optimisation Fall 2025

- Optimised a Non-Local Means denoising algorithm for 3D MRI volumes in MATLAB using a Blockwise approach, reducing runtime by **8x** from 58.64 minutes to 7.31 minutes with only 0.19 dB quality loss, and improved peak signal quality from 25.91 dB to **28.32 dB PSNR** by adding physics-based Rician bias correction and auto-tuning.

fMRI Neural Signal Analysis — Biological Signal Processing | MATLAB, SPM12, GLM, Statistical Neuroimaging Winter 2025

- Executed a complete fMRI preprocessing and GLM statistical analysis pipeline in MATLAB using SPM12 across a **16-subject** dataset, covering slice timing correction, motion correction, coregistration, MNI normalisation, and Gaussian smoothing, with FWE-corrected group-level analysis at $p < 0.05$ identifying face-selective activations in the fusiform gyrus and occipital face area.

Wireless Network Protocol Simulation | QualNet, IEEE 802.11, CSMA, TCP/UDP, Rayleigh Fading Winter 2025

- Analysed IEEE 802.11 and CSMA MAC protocol performance across throughput, packet delay, queue length, packet loss, and collision rate metrics using QualNet simulation, including a 4-subnetwork multi-hop TCP and UDP topology under Rayleigh fading conditions to evaluate physical layer impact on end-to-end performance.

E-Commerce Analytics Pipeline — Distributed Systems | Apache Spark, GCP Dataproc, Python, PySpark Winter 2026

- Deployed a distributed e-commerce analytics pipeline on GCP Dataproc using Apache Spark, processing **42M rows** with sessionisation, funnel analysis, last-touch attribution with 24-hour lookback windows, and anomaly detection using 7-day rolling z-score baselines, validated across a 3x3 cluster and data size scaling study.

EDUCATION

Concordia University | Montreal, QC 2024 – 2026 (Expected)

Master of Engineering, Electrical and Computer Engineering

Relevant Coursework: Telecommunication Networks (IEEE 802.11, CSMA, QualNet), Biological Signal Processing (SPM12, fMRI, MATLAB), Medical Image Processing (NLM, MATLAB), Digital Signal Processing, Applied Machine Learning, Computer Neural Networks, Distributed Systems, Embedded Systems

Ganpat University | Gujarat, India 2019 – 2023

Bachelor of Technology, Computer Engineering | Grade: 8.54 / 10

ACHIEVEMENTS

- Awarded **Emerging Star of the Year 2023–24** at Glide Technology for technical contributions across multiple embedded production deployments.
- Earned 3 provincial and district gold medals in Powerlifting, demonstrating sustained high-performance discipline and competitive resilience.

KEY SKILLS

Embedded Firmware: C, Embedded C, C++, Python, Bare-Metal, FreeRTOS, Zephyr RTOS, State Machine Design, Memory Management, Interrupt Handling, Multithreading

Microcontrollers and SoCs: ARM Cortex-M0+ / M33 (Dialog DA14xxx, Dialog DA1469x, Microchip SAMR30, Nordic nRF52840), JTAG/SWD, GDB, SEGGER RTT, Logic Analyzer, Oscilloscope

Wireless and Protocols: BLE 5.0/5.1 (GATT, SMP, BLE OTA), NFC (multi-card-type support), Sub-GHz RF Star Topology, UART, I2C, SPI, USB CDC, FFT-Based Wireless Ranging

Security and OTA: ECDSA P-256, MCUboot A/B Bootloader, Multi-Target OTA, CRC32 Validation, Auto-Rollback, Cloud Crash Diagnostics

OS, Build and Cloud: Yocto Linux, Zephyr NCS, West, GCC ARM, CMake, GitHub Actions CI, GCP Dataproc, Apache Spark, Git

Signal Processing and ML: MATLAB, SPM12, DSP, fMRI Analysis, 3D Image Denoising, PyTorch, scikit-learn, XGBoost, NumPy, Ensemble Methods