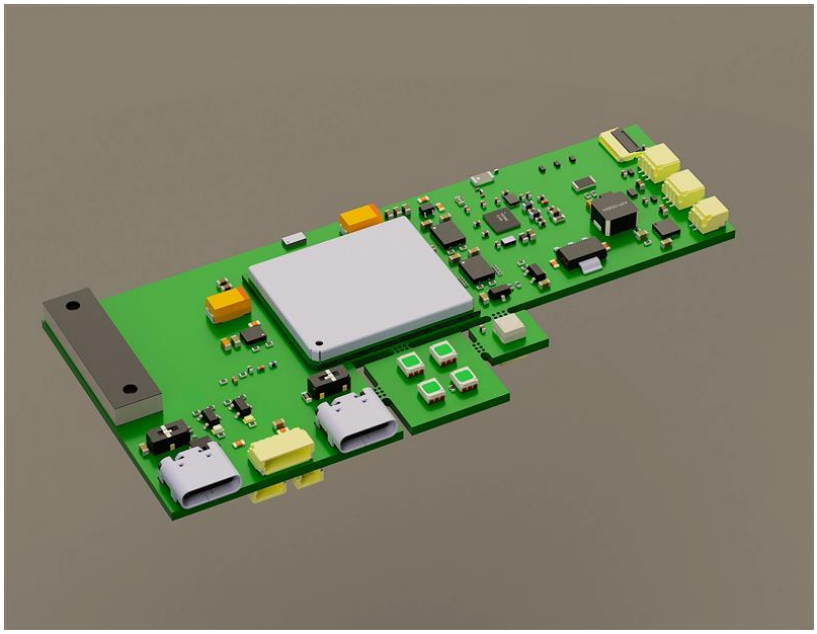
Oxeltech

Secure and Connected Smart Bag

This project involved the development of a secure smart bag equipped with biometric authentication, BLE and LTE connectivity, real-time GNSS tracking, and a controlled locking mechanism. The goal was to meet complex security and connectivity requirements while keeping the design cost-effective.

Hardware Development:

- Designed a custom PCB integrating the dual-core Nordic nRF53 MCU for BLE communication and processing.
- Integrated Quectel Cat 1 bis LTE module with GNSS and 1NCE eSIM for real-time location tracking and communication.
- Designed-in fingerprint sensor, motor-driven lock, LED indicators, and vibration motor as part of the hardware system.



Firmware Development:

- Designed Zephyr RTOS-based architecture with prioritized threads and message queues for fingerprint, BLE, LTE, and lock control.
- Developed custom UART drivers for fingerprint, GNSS and LTE.
- Added secure DFU over USB with bootloader signature verification for firmware updates.
- Added Coredump for crash diagnostics and post-mortem debugging.

Applications:

• Smart Consumer Products
• Anti-Theft Systems
• Fashion Tech & Personalization

Technologies Used:

• MCU: Nordic nRF5340 (ARM Cortex-M33 Dual-Core)
• Firmware: Zephyr RTOS, C
• Communication: BLE, LTE, GNSS
• Peripherals: Fingerprint Sensor, Motor Driver, LED Drivers, Vibrator
• Features: DFU, Coredump