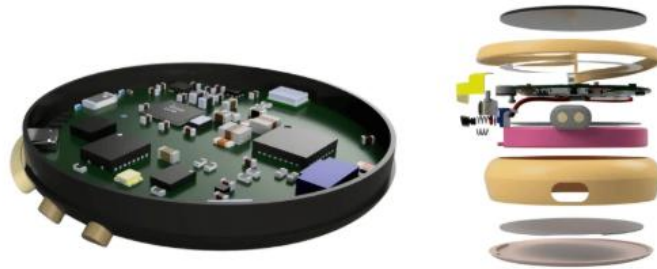


Wearable AI Necklace

A wearable AI necklace developed for the consumer wellness market. The project involved complete electronics development, including hardware architecture, component selection, PCB design, firmware development, power management, wireless connectivity, and mechanical integration within a compact $\text{Ø}30 \text{ mm} \times 6 \text{ mm}$ metal enclosure.



Key Features:

- Ultra-compact embedded system within a compact wearable enclosure
- Dual-microphone architecture for voice capture and noise reduction
- Automatic BLE-to-SD card audio fallback for uninterrupted operation
- LRA haptic feedback for real-time user interaction



Hardware Development:

- Designed a 6-layer HDI PCB with blind, buried, and microvias
- Developed a complete hardware, covering power, connectivity, sensing, and storage
- Optimized enclosure architecture to balance RF performance
- Designed RF layout, antenna, and charging interface within the pendant geometry

Firmware Development:

- Developed dual-core firmware architecture for BLE communication
- Managed audio switching between BLE streaming and onboard storage
- Configured low-power IMU sensing for breathing rate monitoring
- Implemented Device Firmware Update (DFU) over BLE

Applications:

- Consumer wellness and mindfulness wearables
- Ambient voice AI devices
- Ultra-compact connected electronics

Technologies Used:

- **MCU/SoC:** Nordic nRF5340 (Dual-Core Arm Cortex-M33, Bluetooth 5.1)
- **Microphones:** 2× T5838 PDM Digital Microphones
- **IMU:** 6-Axis Motion Sensor
- **Storage:** microSDHC, 32GB
- **Haptic Feedback:** Linear Resonant Actuator (LRA)
- **Power Management:** Nordic nPM1300 PMIC
- **Battery:** 185mAh Rechargeable Li-Ion

