Lakshmanan Rajaram

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Professional Summary

Embedded Firmware Engineer with **5 years of engineering experience** developing **C/C++ firmware for ARM Cortex-M and connected medical-device platforms**, including FDA-regulated products from prototype through production release. Hands on experience with **RTOS, BLE, GPIO, ADC/DAC, UART, SPI, I2C, DMA, interrupts, low-power firmware, hardware firmware integration, and embedded debugging** using oscilloscopes, logic analyzers, JTAG, and GDB. Experienced in **firmware verification and validation, Python test automation, IEC 62304 development, requirements traceability, and modular embedded software architecture**.

Technical Skills

Embedded Firmware: C, C++, Embedded C, Assembly, ARM Cortex-M/A, STM32, Nordic nRF52, NXP, PIC, AVR, interrupt driven and event driven firmware

RTOS / Embedded OS: Zephyr RTOS, FreeRTOS, Embedded Linux, real-time systems, low power embedded design

Hardware / Interfaces: GPIO, ADC/DAC, timers, DMA, interrupts, I2C, SPI, UART, sensors, low power modes

Wireless / Connectivity: Bluetooth Low Energy (BLE), GATT/GAP, advertising, connection parameter tuning, secure pairing/bonding, RF debugging, OpenSync, Openwrt, LTE, MQTT

Debugging / Verification: JTAG, GDB, oscilloscopes, logic analyzers, multimeters, hardware firmware integration, white box unit testing, integration testing, regression testing, stress testing, Python test automation

Medical Device Development: FDA regulated firmware, IEC 62304, requirements traceability, risk mitigation documentation, verification & validation

Tools / Workflow: Git, Python, Embedded Wizard, Qt, Agile development

Professional Experience

vTitan Corporation Pvt. Ltd. **Chennai, India**
Embedded Software Engineer *Oct 2022 – Oct 2024*

- Delivered **production C/C++ firmware for ARM Cortex-M and Nordic nRF52 platforms** used in FDA regulated wearable medical devices, owning embedded modules from development and hardware integration through verification and multiple product releases.
- Improved **device reliability and battery efficient operation** by developing and debugging firmware for **GPIO, timers, ADC, UART, interrupts, and low power modes**, using hardware datasheets and timing analysis to configure MCU peripherals.
- Delivered reliable wireless communication by developing the **Bluetooth Low Energy stack**, including **GATT/GAP profiles, advertising, connection parameter tuning, throughput optimization, secure pairing, bonding, and encrypted data transmission**.
- Resolved **BLE connectivity, interrupt, and peripheral timing defects** through packet-level and hardware debugging using **BLE sniffers, logic analyzers, JTAG/GDB, and datasheet driven root cause analysis**.
- Strengthened firmware release quality by performing **verification and validation, white box unit testing, integration testing, regression testing, and stress testing**, using **Python automation** to identify defects before production release.
- Supported production medical-device firmware compliance with **IEC 62304** through peer code reviews, requirements traceability, disciplined documentation, risk related development records, and release ready software practices.
- Improved firmware maintainability across product releases by owning **software architecture decisions** and developing modular, event driven components supporting products from prototype through market launch.
- Integrated embedded user interfaces for infusion-pump hardware using **Embedded Wizard**, connecting device configuration and real time status visualization with underlying embedded firmware.
- Supported engineering delivery and knowledge transfer by **mentoring junior engineers**, reviewing implementation approaches, and assisting with firmware debugging and project execution.

Phoenix Medical Systems (P) Ltd. **Chennai, India**
Embedded Engineer *Oct 2021 – Oct 2022*

- Delivered embedded firmware for **FDA class medical devices** using **ST/Dialog ARM Cortex-M, PIC, and AVR microcontrollers**, implementing low level control of ADCs, timers, UART, sensors, and hardware peripherals.
- Improved **hardware firmware integration** by validating peripheral configurations and troubleshooting embedded-system defects using **hardware datasheets, oscilloscopes, multimeters, and hardware-level debugging techniques**.
- Enabled connected wearable and monitoring products by integrating and validating **BLE communication modules**, performing stack level configuration and hardware/software communication testing.
- Supported successful production releases by performing **firmware verification, hardware firmware validation, defect investigation, and integration testing** across medical device hardware and embedded software.
- Supported **IEC 62304 software lifecycle compliance** by maintaining requirements traceability, risk mitigation records, verification evidence, and release documentation for regulated medical device software.

– Improved firmware maintainability by contributing to **software architecture and hardware/software interface design** for assistive and patient monitoring devices carried from development through production release.
– Delivered embedded medical device interfaces using **Qt**, integrating device configuration and real time system-status functionality with underlying embedded software.

A.I. School of India **Chennai, India**
Technical Engineer *Jan 2020 – Aug 2021*

– Developed embedded systems for **real-time computer vision and autonomous robotics** using NVIDIA Jetson Nano, Raspberry Pi, AVR, and ATmega platforms, integrating sensing, perception, and actuator-control subsystems.
– Enabled autonomous prototype operation by developing **microcontroller firmware for sensor acquisition and actuator control**, integrating embedded hardware with higher-level vision and control software.
– Familiarity with **OpenWrt-based embedded Linux platforms**, including the **build system, package management, and UCI configuration** for network-connected embedded devices.
– Familiarity with **OpenSync cloud-managed CPE architecture**, including **OpenSync Managers, OVSDB-based configuration, and MQTT telemetry** for device management and monitoring.
– Supported prototypes from initial development through **field-ready deployment** by debugging hardware/software integration issues and integrating real-time perception, motor-control, and embedded subsystems.

Education

Colorado State University **Fort Collins, CO**
Master of Engineering in Computer Engineering, GPA: 3.355 *Aug 2024 – 2026*

– Focus: **Real-Time Operating Systems, Embedded Machine Learning, Low-Power Design, and Edge Computing**.

S.A. Engineering College **Chennai, India**
Bachelor of Engineering in Electrical and Electronics Engineering *Aug 2016 – 2020*

Selected Projects

CardioClassifier – Real-Time Heart Murmur Detection STM32WB5MMGHTR, TensorFlow Lite, Embedded ML
– Developed an **on device embedded ML pipeline** by training an LSTM model for heart murmur classification, converting the model to TensorFlow Lite, and deploying it to an **STM32WB5MMGHTR microcontroller for real time inference**.

Parameterized RISC-V ALU Design Verilog, RTL Simulation
– Designed a **parameterized 32-bit ALU** supporting arithmetic, logical, and shift operations including ADD, SUB, AND, OR, XOR, and configurable shift operations.
– Implemented combinational and sequential RTL with structured clocking and reset logic, and verified functional behavior through **RTL simulation and waveform analysis**.

AXI-Lite Slave Peripheral SystemVerilog, SoC Interfaces
– Developed an **AXI-Lite slave peripheral** with memory-mapped control and status registers, demonstrating low-level hardware/software communication within an SoC architecture.
– Designed **FSM-based read and write channels** and validated AXI-Lite protocol behavior through RTL simulation, transaction analysis, and timing-aware waveform debugging.

UART Controller (TX/RX) Verilog, FSM Design
– Designed a **UART transmitter and receiver** with configurable baud-rate generation and FIFO-based buffering for reliable asynchronous serial communication.
– Implemented **FSM-based TX/RX control** and verified data transmission, reception, buffering, and interrupt-handling behavior using RTL simulation and waveform analysis.

Electric Solar Car Raspberry Pi, Python, IoT, Embedded Systems
– Built an **IoT-connected solar powered vehicle** with sensor integration, power system firmware, and a Python interface for real time monitoring of speed, battery level, and solar charging; received the **Innovation Award and Future Award** at ESVC 2019.

Smart Chef ARM Cortex-M0+, Wi-Fi, Embedded C
– Designed a **Wi-Fi-connected autonomous embedded device** on ARM Cortex-M0+, integrating sensor feedback and low power operation; selected as a **finalist in the ACCS Design Challenge 2019**.

Publication

IEEE Xplore: "Real-time detection and tracking of human based on image processing with laser pointing" – research in real-time computer vision, object tracking, and embedded systems.