



Prajnaana Technologies

... embedded system solutions

End-to-End Embedded Product Engineering
Automotive • Industrial • Medical • Connected Devices
Bengaluru, INDIA

Why Prajnaana ?

- 
- **Prajnaana partners** with OEMs, semiconductor companies and product organizations to design, develop and sustain **complex embedded products** - helping customers accelerate product development, reduce engineering risk and successfully deliver production-ready embedded products across Automotive, Industrial, Medical and Connected Device and Semiconductor markets.
 - **End-to-End Ownership:** Take complete ownership of the embedded software lifecycle—from architecture through production and long-term sustenance.
 - **Hardware/Software Co-Engineering:** Collaborate with hardware teams from the earliest design stages to reduce integration risks, accelerate product bring-up and optimize overall system performance.
 - **Senior Engineering Team:** Experienced core engineers supported by domain specialists, ensuring scalable and predictable project execution.
 - **Architecture-Driven Development:** Design scalable and maintainable software architectures that support future product evolution.
 - **Production and sustenance:** Support products beyond development through manufacturing, validation and long-term sustenance.

Core Engineering Capabilities



System Architecture

Product Architecture, Software Architecture, HW/SW Partitioning, Technology Evaluation, System Design

Platform Engineering

BSP, Bootloaders, Device Drivers, RTOS, Embedded Linux, Android Platform

Middleware & Connectivity

Middleware, Protocol Stacks, USB, Bluetooth, Wi-Fi, CAN, Ethernet, Peripheral Interfaces

Algorithms & AI Engineering Tools

GNSS Algorithms, Medical Signal Processing, AI-Driven Engineering Tools, Real-time Optimization

Product Software

Embedded Applications, Device Management, Diagnostics, Android Applications

System Integration

Third-Party IP Integration, Validation, Performance Optimization, Compliance

Product Lifecycle Engineering

Manufacturing Support, Sustenance, Maintenance & Feature Evolution, Technology Migration

Automotive Product Engineering

Platform software, virtualization and connectivity solutions for next-generation Software Defined Vehicles (SDVs)



Connected Cockpit

- Android Automotive OS
- Linux IVI
- Digital Instrument Cluster
- Audio Framework
- BT Connectivity Management

Vehicle Networking (QNX)

- **AUTOSAR Adaptive-aligned**
- Vehicle Signal Management
 - CAN Signal Gateway & Publisher, DBC Parser
 - Security Policy Management

Virtualization & OS Platform

- QNX Hypervisor
- QNX Host-OS
- Android Guest-OS

Peripheral Virtualization

- USB OTGHUB including BC1.1
- Device Virtualizer – Zonal Architecture
- **Patent-proposed virtualization protocol**

Platform Enablement

- Qualcomm Snapdragon Automotive SoCs
- BSP Bring-up
- Linux
- Nucleus RTOS

Engineering Delivery

- System Architecture
- Subsystem Development
- System Integration

Platforms & Technologies: Qualcomm SA6155 • SA8155 • Telechips SoC • Android Automotive OS
• QNX Hypervisor • QNX SDP • Embedded Linux • USB • CAN • Bluetooth • Wi-Fi • Ethernet

Medical Devices

Medical algorithms, physiological signal processing and AI-assisted engineering tools for connected healthcare products.



Hemodynamic Signal Processing

- For a bedside Patient Monitoring System for measuring
 - Invasive Blood Pressure (**IBP**)
 - Pulse Pressure (**PP**)
 - Stroke Volume (**SV**)
 - Pulse Pressure Variation (**PPV**)
 - Stroke Volume Variation (**SVV**)
- Algorithm Development and Verification using MIMIC-III Physiological Database
- Clinical evaluation performed on ICU patients using the client device running the developed algorithm

Physiological Signal Processing

- For a safety-related Wearable Device for measuring
 - Heart Rate (**HR**)
 - Respiratory Rate (**RR**)
 - Heart Rate Variability (**HRV**)
 - Respiratory Rate Variability (**RRV**)
- Physiological trend analysis for early event/anomaly detection

AI-Assisted Test-Automation for BT-Enabled Hearing-Aid

- AI-assisted Test Case Generation
- Firmware Change Impact Analysis
- Automated Regression Prioritization
- PyTest-based Automated Execution

Embedded Product Engineering Across Industries

Industrial Automation

- EtherNet/IP IO Gateway for Industrial PLCs
- IO-Link & Fieldbus Integration
- Industrial Protocol Implementation (CIP)
- Event-driven Data Transport Architecture

GNSS & Navigation

- GNSS Signal Processing Algorithms
- Receiver Architecture
- Timing Algorithms
- Low-Power Receiver Optimization

Consumer & Smart Devices

- FPGA-based Smart Glass Platform
- Camera Driver Development
- Firmware Architecture
- Mobile Host Interface APIs

Across these domains, Prajnaana has delivered complete product ownership—from architecture and firmware development to system integration, certification support, manufacturing enablement and long-term sustenance

IoT and Connected Products

- Critical Asset Tracking Systems
- Ambulance Tracking with Oxygen Monitoring
- Remote Device Management & OTA Updates
- Sensor Data Acquisition & Cloud Connectivity

M2M & Smart Infrastructure

- Bluetooth Gateway Products
- Vending Machine Automation
- Highway Emergency Alert Systems
- Senior Citizen Health Monitoring

USB2.0 and USB3.0 Engineering

- Development across diverse products—**Bare-Metal** (on custom silicon) and **RTOS-Based**
- **CDCACM, CDCNCM, Audio, UVC, MSC Drivers**
- Proprietary **USB-SDIO Bridge** and **Virtualization Protocol** drivers

Selected Engineering Engagements

Automotive Add-On Devices



Customer	Customer Challenge	Prajnaana Contribution	Outcome
Chinese OEM	Supporting Carplay, Carlife and Android-Auto over a HeadUnit-USB in Host-Mode	Worked on the concept, architected, designed and developed OTGHUB	Production-Ready device delivered and installed in Vehicles in China
USA Tier1	A variation of OTGHUB with custom Silicon and many added features	Worked with silicon designer, architected, designed and developed new OTGHUB	Complete product with Production-Floor testing; installed in vehicles in the USA
German Company, spun-off from Audi	Zonal Architecture to connect sensors across the vehicle along with support for Carplay & Android-Auto.	Worked on the concept along with custom silicon vendor, architected, designed and developed Device-Virtualizer along with patent-proposed Virtualization protocol.	Device Virtualization first tested in i.MX8 platform and handed over the complete technology to the client

Selected Engineering Engagements

Automotive IVI



Customer	Customer Challenge	Prajnaana Contribution	Outcome
India-based Tier1	1) New-generation IVI architecture. 2) New features for Linux IVI	Connectivity module architecture; worked with client Architecture team. Voice-based AC/temperature control; field audio issue resolution.	BT Connectivity Management architecture document. Voice-based AC controls. Tested and field deployed Audio fixes.
India-based OEM	VSP & Chime architecture	VSP & safety-chime play-out design on Qualcomm platforms	Complete design documents
2 India-based Tier1s	QNX Hypervisor + Android Guest OS; peripheral pass-through; secure Vehicle Signal	QNX/Hypervisor modifications; Android Guest-OS bring-up; peripheral pass-through; ASIL-D-ready Vehicle Signal module	Patches delivered; OEM demonstration with CarPlay & Android Auto

Selected Engineering Engagements

Consumer Electronic Devices



Customer	Customer Challenge	Prajnaana Contribution	Outcome
US Based Consumer-Electronic Start-up	Complete FW architecture and design for SmartGlass Product	Complete FW architecture, design & development along with Client's IP Module integration	Successfully tested product resulting in the acquisition of the company for USD 100M
US Based Design House	Complete Firmware development and UVC driver for Thermal Camera	Complete FW architecture, design & development along with UVC driver for Thermal Camera streaming to Host over USB2.0	Successfully test and delivered the firmware which was later productized.

Selected Engineering Engagements

Medical Device Algorithms



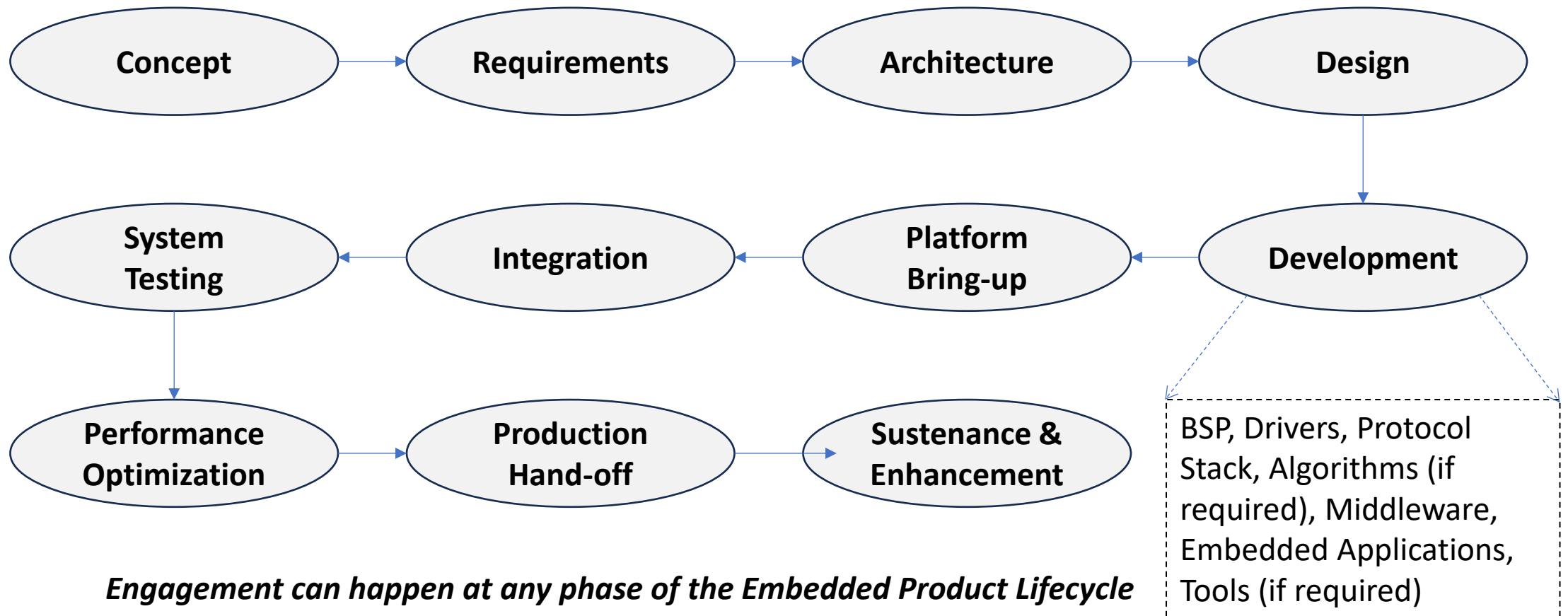
Customer	Customer Challenge	Prajnaana Contribution	Outcome
India Based Medical Device Manufacturer	Niche Algorithm for Hemodynamic Signal Processing to extract BP, PP, SV, PPV and SVV	Completely designed new Algorithm, studying various Research Papers; Tested the algorithm with many Patient Data from MIMIC-III Database	Algorithm was integrated by the Client and Clinically tested on ICU patients, with strong measurement correlation.
India Based Start-up for Wearable Devices	PPG Signal Analysis to extract physiological parameters	Completely designed new Algorithm, studying various Research Papers to extract HR, RR, HRV and RRV	Algorithm was delivered to the client, for further integration into the product
UK Based Hearing-Aid Manufacturer	Regression test-suite	Proposed, designed and developed AI-Assisted Test Automation Suite	Tested in the Lab for various regression testcases. (Subjective audio quality tests excluded)

Technology Ecosystem & Experience



Domain	Breadth of Experience
Operating Systems	FreeRTOS, Micrium-RTOS, Segger-RTOS, Proprietary Kernel, Zephyr, ThreadX, Nucleus, QNX, QNX-Hypervisor, Android Automotive, Linux
Connectivity	USB2.0, USB3.0, CAN, CAN-FD, Bluetooth, Ethernet, Wi-Fi, Peripheral Interfaces, Proprietary Radio, GNSS
Processors	NXP, RISC-V, Microchip, MIPS, Various ARM Cores, STM, Telechips, Qualcomm
Development	Yocto, Android Studio, Python, Git, GreenHills,
Languages	C, C++, Java, Python, Rust

Engagement Model



Why Customers choose Prajnaana

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- **Engineering Ownership**
 - Own complex subsystems—not just individual tasks.
 - **Senior Technical Leadership**
 - Direct involvement of experienced engineers throughout the engagement.
 - **Architecture-to-Production Capability**
 - From concept and architecture through integration, manufacturing and sustenance.
 - **Complex Problem Solving**
 - Platform, virtualization, connectivity, algorithms and system integration.
 - **Cross-Domain Experience**
 - Automotive, Medical, Industrial, IoT, GNSS and Consumer Products.
 - **Flexible Engagement**
 - Engage at any stage—from a focused engineering problem to complete product ownership.



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Appendix



Product Engineering Services

- In partnership with a **Hardware Design Partner**, **Prajnaana Technologies** provides complete product engineering services, during any phase of the product life cycle, right from conception



Engagement and Commercial Models

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- **Project Based**
 - Fixed-Cost Model
 - Defined Scope and Deliverables
 - **Co-Engineering**
 - T & M Model
 - Joint Client and & Prajnaana Teams
 - **Dedicated Engineering Team**
 - ODC – Offshore Development Center
 - Client-dedicated Engineers
 - Costing depends on the model chosen and the effort & timeline estimations required to complete the delivery. It would be worked out during engagement contract.

Dedicated Engineering Center (ODC)

- **Dedicated Team**

- Skilled embedded-systems engineers working exclusively on Client products and services

- **Prajnaana Ownership**

- Team establishment, recruitment, management, mentorship, operations and delivery

- **Flexible Transition**

- Option to transition the dedicated team into the Client organization after 2 years of operation

- **Extended Engineering Support**

- 'Board-level' hardware engineering through our hardware partner companies in Bengaluru, India and the USA





THANK YOU

