Pranav Deshakulkarni Manjunath ⚲ College Park, MD

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Professional Summary

Self-driven Embedded Firmware Engineer with 3+ years of experience specializing in **real-time embedded software** using **C** and **Modern C++ (14/17/20)**. Leveraging a background in Mechanical Engineering to bridge the gap between complex hardware systems and robust firmware. Expertise in developing **System Drivers**, **RTOS Internals**, and **Event-Driven Architectures** on **ARM Cortex-M**. Proven track record of managing and diagnosing field issues for **5000+ deployed devices**, ensuring high reliability via **RAS** practices and **OTA updates**.

Skills

Languages & Scripting: C, C++ (14/17/20), Python, Rust, Assembly (ARM), Bash
Embedded Platforms: ARM Cortex-M, Renesas RA, nRF52, Jetson Orin Nano (Linux), Arduino
Frameworks & RTOS: Zephyr RTOS (Driver Dev), FreeRTOS, Renesas FSP, Nordic nRF SDK
Testing & Security: GTest, Unity, CMock, Secure Boot, TrustZone, CI/CD (GitHub Actions)
Protocols & Interfaces: CAN (J1939/OBD-II), UART, SPI, I2C, DMA, ADC, MQTT, TCP/IP
Key Concepts: Real-time Processing, State Machines, Low-Power Design, Motor Control (PID), RAS

Work Experience

Gradient Student Researcher — *RAAS Lab, University of Maryland, College Park*   *September 2024-Present*
- Developing a semantic mapping pipeline on **Jetson Orin Nano** platform, integrating vision-based scene understanding with robot navigation using **ROS 2** and **Python**.
- Integrating local LLMs to assist with task planning, enabling natural-language command interpretation.

Embedded Firmware Engineer — *Intellicar Telematics Private Limited, Bengaluru, India*   *November 2021-May 2024*
- Architected **firmware** for **Li-ion Battery Management Systems (BMS)**, integrating **SoC monitoring** algorithms and fail-safe **safety cutoff** logic via CAN-based control.
- Designed **real-time control loops** on Renesas RA2L1 (Cortex-M23), optimizing **ADC/DMA** usage for high-frequency sensor acquisition, achieving a **2x reduction** in interrupt latency.
- Optimized communication protocols (CAN J1939, UART, SPI), improving **reliability rate to 97%+** at maximum throughput.
- Managed and diagnosed critical field issues for a fleet of **5000+ vehicles**, performing **root-cause analysis** on logs and deploying **hotfixes** via OTA to resolve data dropouts.
- Implemented **OTA firmware update** ecosystem with **MQTT**-based configuration management, eliminating the need for manual service visits for distributed fleets.
- Developed **Unit Tests** and System-level test automation using **Unity**, **Python**, and **Bash**, ensuring regression stability across releases.

Hardware Intern — *Intellicar Telematics Private Limited, Bengaluru, India*   *August 2021-November 2021*
- Performed hardware bring-up and debugging using **Oscilloscopes**, **Picoscopes**, and **Logic Analyzers** to validate signal integrity and protocol compliance.
- Collaborated with hardware teams to root cause signal issues on custom PCBs, utilizing **multimeters** and performing **soldering** rework for prototypes.

Projects

Distributed Telemetry & Compression Pipeline: Implemented a CAN/OBD-II telemetry pipeline and a lossless edge-compression algorithm, optimizing for **limited bandwidth** and memory constraints ($2.6\times$ compression).
Tools: C (bare-metal), Renesas RA2L1 FSP

BMS Firmware Integration & OTA System: Developed firmware application for interfacing with external **Battery Management System**, implementing **SoC monitoring** and **safety cutoff** logic.
Tools: C (bare-metal), Renesas RA2L1, CAN/J1939, MQTT, Unity

Human Gait Trajectory Prediction on the Edge: Developed an embedded gait-trajectory predictor, optimizing model footprint to under **200 KB** to fit strict memory constraints on Arduino Nano 33 BLE Sense (96% Accuracy).
Tools: C++, Python, TensorFlow Lite, Arduino

SRAM Accelerator for Edge AI In-Memory Inference: Designed and verified a 5.2kb (65x10) SRAM accelerator. Validated system performance, calculating **power consumption** (1.13 nJ/inference) and speed optimization.
Tools: Cadence Virtuoso, Verilog, Python

Robust State Estimation for Noisy ArUco Tracking: Improved pose estimation from noisy ArUco marker tracking using robust Kalman filter with incremental EM-based online learning. Reduced NRMSE from **0.094 to 0.019**.

Tools: ROS2, Python, MATLAB

Education

University of Maryland, College Park — *Master of Engineering, Robotics* *August 2024-May 2026* (Expected)
Coursework: Robot Modeling, Control, Path Planning, Perception, Deep Learning, Embedded ML   Current GPA: 3.55

B.M.S. College of Engineering — *Bachelor of Engineering, Mechanical* *August 2017-May 2021*
Coursework: Mechatronics, Microprocessors, Fundamentals of Robotics, Classical Controls   Cumulative GPA: 3.56