

ARUN KUMAR

Software Engineer | AI Agent Engineering & Systems Programming (C++/Python)

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PROFESSIONAL SUMMARY

Software engineer with 4.5+ years of experience in AI model evaluation, LLM-assisted development, and AI agent orchestration, backed by deep systems-level engineering in C++, Python, and Linux. Reviews, debugs, and benchmarks AI-generated code across multiple model-training platforms, and designed and built Cerberus, an open-source AI agent orchestration runtime built from scratch in C, C++, and Python with custom memory management and sub-millisecond context pruning. Works daily with modern AI-assisted development toolchains, including Claude Code, Cursor, GitHub Copilot, and Gemini CLI. Also brings hardware and firmware engineering experience bare-metal ARM Cortex-M4 development, RTOS, and CAN bus - contributing full-stack engineering judgment from silicon to software.

TECHNICAL SKILLS

Programming Languages: C++ (17/20/23), C (11), Python 3, Embedded C, CUDA C++

AI / LLM & Agent Engineering: CUDA GPU Acceleration, Pybind11, SIMD Vectorization (AVX2), FastMCP Tool Orchestration, Local LLM Integration (Ollama), Claude Code, Gemini CLI, Cursor, Windsurf, GitHub Copilot

Systems & OS Engineering: Linux System Programming, OS Internals, Multithreading & Concurrency, Mutexes & Semaphores, RTOS, Memory Management (Arena Allocators), POSIX API, TCP/IP Networking, Network Protocol Stack, System Debugging, Software Testing & Validation

Cloud & Web Services: AWS (EC2, S3, Lambda, IAM, CloudWatch), Docker on AWS/ECS, REST API Design & Development, HTTP/JSON, API Gateway, Swagger/OpenAPI, Flask/FastAPI

Tools & Infrastructure: GCC Toolchain, GDB, CMake, Valgrind, AddressSanitizer (ASan), Keil MDK, STM32CubeIDE, Docker, NumPy, Pandas, Linux CLI, Git (CI/CD Pipelines)

Embedded & Hardware: ARM Cortex-M4, STM32 Peripherals, Bare-Metal Register Programming, SPI, I2C, LTDC, SDRAM, CAN Protocol, BIOS Firmware, Chip-Level Diagnostics

PROFESSIONAL EXPERIENCE

Software Engineer Role - HandShake AI

Jun 2026 - Present

Freelance | Remote

- Design complex, multi-step coding problems and edge-case scenarios in Python engineered to stress-test frontier LLMs, exposing vulnerabilities in reasoning, context management, and logic execution.
- Containerize test environments and execution runtimes with Docker to isolate, reproduce, and benchmark model-generated code against strict unit test suites.
- Evaluate, debug, and rank model-generated Python, C++, and C solutions for time/space complexity, memory leaks, and adherence to production coding standards.
- Build automated benchmarking pipelines for regression testing and hallucination detection, and audit chain-of-thought reasoning traces to catch subtle logical fallacies and edge-case failures.

SWE Consultant - Code Review, Architecture & Benchmarking

Jun 2025 - Aug 2026

Ecademic Tube - Online Technical Education Platform | Remote

- Reviewed 150+ engineering solutions in C++, Python, and Linux systems, assessing correctness, performance bottlenecks, and implementation quality against professional standards, including concurrency bugs and memory-management issues.

- Benchmarked coding-agent outputs (Claude Code, Gemini CLI, Cursor, GitHub Copilot, ChatGPT/Codex) to quantify differences in correctness, scalability, and engineering trade-offs.
- Delivered structured technical feedback on algorithm design and debugging methodology; authored documentation on Linux concurrency-debugging workflows and systems-level problem solving.

AI Training Contributor - Outlier.ai

Jan 2025 - May 2025

Freelance | Remote

- Performed code review and debugging on 120+ C++ submissions for an AI model training platform, evaluating correctness, logic, and adherence to coding standards to support model fine-tuning and evaluation datasets.
- Took on generalist evaluation tasks spanning additional domains beyond code, contributing to broader training-data quality as part of a distributed freelance contributor pool.
- Delivered structured technical assessments used to support model reasoning and response-quality improvements.

Embedded Systems Engineer - Training & Project

Jun 2024 - Dec 2024

Vector India, Chennai

- Completed an intensive 6-month professional program in Embedded Systems, Linux Programming, RTOS, C++, and TCP/IP networking, including socket programming and transport-layer fundamentals.
- Designed a distributed real-time embedded control system (Body Control Module) with multi-node CAN bus communication, addressing bus arbitration, message scheduling, and fault handling under concurrent load.
- Developed state-machine-based control logic in Embedded C/C++ for automotive subsystems, coordinating distributed node behavior under RTOS scheduling constraints.

Hardware & Firmware Specialist

May 2022 - May 2024

Self-Employed | Remote / On-site

- Performed chip-level diagnostics and component-level failure analysis on laptop/desktop hardware, tracing faults through power delivery, memory, and peripheral interfaces using multimeters and oscilloscopes.
- Executed BIOS firmware programming, editing, and optimization, resolving boot-sequence failures caused by corrupted or misconfigured firmware.
- Built practical expertise in hardware-software interfaces and signal-level debugging that directly underpins bare-metal embedded systems work.

TECHNICAL PROJECTS

Cerberus - Bare-Metal AI Agent Orchestrator (Open Source)(Ongoing)

Jul 2026

- Built a cross-language AI agent runtime - a Python API bridged via Pybind11 to a custom C/C++ execution core - implementing a Think -> Plan -> Act orchestration loop.
- Designed a custom AVX2-aligned memory arena allocator (~2ns per allocation) and an O(1) context-sliding-window that prunes context in under 0.5ms, removing garbage-collection pauses from long-running agent sessions.
- Benchmarked orchestration throughput against LangChain (208MB vs. 424MB cold-start RAM) and implemented native FastMCP tool routing with local LLM (Ollama) integration for sandboxed, privacy-first agent execution.

Tools: Python, C++, C11, CMake, Pybind11, pthreads, AVX2, FastMCP, Ollama

Bare-Metal Battleship Game Engine - STM32F429I-DISC1

Jun 2025

- Architected a bare-metal FSM-based game engine managing menus, grid rendering, turn logic, and win/loss evaluation with no RTOS, middleware, or HAL.

- Engineered a predictive "Hunt and Target" AI opponent interfacing directly with the hardware RNG peripheral; built low-level SPI/I2C drivers from scratch for the ILI9341 LCD and STMPE811 touchscreen controller.
- Diagnosed and resolved SDRAM initialization issues causing blank-display failures, and calibrated touch-input coordinate mapping.

Tools: Embedded C, ARM Cortex-M4, SPI, I2C, LTDC, SDRAM, Hardware RNG, Keil MDK / STM32CubeIDE

Low-Level Clock & Peripherals - STM32F429I-DISC1

May 2024

- Configured ARM Cortex-M4 core clock architecture (RCC/PLL) from scratch to drive the processor at its maximum operating frequency, with zero HAL or middleware.
- Developed bare-metal peripheral drivers via direct register manipulation and high-precision SysTick timing routines; validated register-state and signal timing using the ST-Link debugger and logic analyzer.

Tools: Embedded C, ARM Cortex-M4, SysTick, RCC, PLL, GPIO, ST-Link Debugger

Body Control Module - CAN Bus Distributed System

Vector India, 2024

- Designed a distributed real-time control architecture with multi-node CAN bus communication, addressing bus arbitration, message scheduling, and fault handling under concurrent load.
- Developed state-machine-based control logic in Embedded C/C++ for automotive subsystems (lighting, wiper, power window, door lock), validated through systematic debugging across multiple scenarios.

Tools: Embedded C, C++, CAN Protocol, RTOS, GCC Toolchain, GDB

IoT-Based Two-Way Communicable Doorbell System

Dec 2021 - Mar 2022

Built a smart doorbell on Raspberry Pi with a real-time deep-learning object-detection pipeline in Python and automated IFTTT push notifications, designed for deaf users who rely on visual alerts over audio cues. **Tools:** Raspberry Pi, Python, NumPy, Pandas, Deep Learning, IFTTT Webhooks.

EDUCATION

B.E., Electronics and Communication Engineering - CGPA: 8.26

Jul 2018 - Mar 2022

Kings College of Engineering (Affiliated to Anna University), Chennai

CERTIFICATIONS

Embedded & Linux Development with C++

May 2024 - Dec 2024

Vector India, Chennai | 6-Month Training

LANGUAGES

English (Upper Intermediate) | Tamil (Native)