Mert Sefa AKGUN

Lead Software Engineer — Real-Time AI and Systems
Real-time AI agents | Backend & platform | Systems networking | Embedded/RTOS | Infrastructure
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REAL-TIME AI / SYSTEMS / CRAFT

Engineering Highlights

Real-Time AI / Voice Agents	LiveKit, WebRTC, Pipecat; streaming STT → LLM/tools → TTS; Python/asyncio.
Backend / Agent Platforms	Async runtimes, tool orchestration, PostgreSQL, RAG, long-lived memory and idempotent persistence.
Systems / Linux Networking	Rust, Linux, eBPF/XDP, time-sensitive networking (TSN/PTP), Yocto and Buildroot.
Embedded / RTOS / Edge	C/C++, bare-metal firmware, Zephyr, NuttX, FreeRTOS, UWB/BLE and device protocols.
Platform / Infrastructure	Linux, Docker, networking, reverse proxies, TLS/WAF, virtualization, observability and recovery.

Profile

Lead Software Engineer at VYVO, responsible for architecture and production hardening of a **real-time multimodal AI agent platform**. Professional software roles since 2022 span **embedded/RTOS firmware, eBPF/XDP networking, and real-time AI systems**, alongside independent infrastructure work since 2017. Personal projects extend this range into operating systems, language design, graphics, mobile, and web development.

Professional Experience

VYVO — **Oct 2024 – Present**
Lead Software Engineer — *Dec 2025 – Present | U.S. (Remote)*
Software Engineer — *Oct 2024 – Nov 2025*

- Own architecture and production hardening for a **real-time multimodal agent platform** spanning voice, text, tools, state, memory, retrieval, persistence, and operational surfaces.
- Build **streaming STT → LLM/tools → TTS pipelines** with hot-swappable providers and Python asyncio, addressing tail latency, cancellation, interruption handling, and backpressure.
- Implement **multimodal RAG and long-lived memory** using PostgreSQL plus Qdrant, SurrealDB, ChromaDB, and LanceDB, with embeddings, keyword retrieval, ranking, caching, and storage lifecycle concerns.
- Design **idempotent transcript and event flushing** to handle retries, partial failures, races, reconnects, and shutdown paths while avoiding duplicate writes and inconsistent state.
- Deliver WebRTC communication behind reverse proxies and harden long-running sessions against jitter, disconnects, provider stalls, partial failures, lifecycle leaks, and degraded dependencies.
- Add structured logs, **OpenTelemetry tracing**, task supervision, and review standards around async lifecycles, state machines, tool-call flows, persistence correctness, and production observability.
- Lead refactors and code reviews focused on runtime safety, testability, maintainability, and preserving product-facing behavior.

Tech: Python, asyncio, PyTorch, NumPy, LiveKit, Pipecat, WebRTC, PostgreSQL, Qdrant, SurrealDB, ChromaDB, LanceDB, OpenTelemetry, Docker, Linux

Professional Experience, Continued

Baykar **Mar 2024 – Jun 2024**
Systems Software Developer *Istanbul, Turkiye (On-site)*

- Developed a custom real-time Layer 2 networking stack for aerial vehicles using **IEEE 802.1 TSN** concepts.
- Implemented IEEE 802.1CB Frame Replication and Elimination for Reliability with **eBPF/XDP** to minimize fast-path overhead.
- Worked with IEEE 802.1AS (PTP), 802.1Qbv (Time-Aware Shaping), and 802.1Qbu (Frame Preemption) for time-sensitive networking.
- Developed Rust components for eBPF/XDP networking using Aya and libbpf-rs tooling, and produced custom Linux kernels with Yocto and Buildroot.

Tech: Rust, eBPF, XDP, Aya, libbpf-rs, Linux, Yocto, Buildroot, IEEE 802.1AS/Qbv/Qbu/CB

Fora (Mavisoft) **Mar 2022 – Mar 2024**
Embedded Systems Software Developer *Istanbul, Turkiye (Hybrid)*

- Developed bare-metal and RTOS firmware for access-control and security products across multiple device lines.
- Built a C/C++ implementation of **SIA OSDP (Open Supervised Device Protocol)** for secure supervised access-control communication.
- Implemented symmetric encryption and authentication in C for **constrained, non-TLS-capable devices**; the implementation underwent an external security audit.
- Built a real-time indoor localization system with **UWB TDoA/TWR and BLE**, including EKF filtering, calibration/debugging tooling, and a Tauri visualization/configuration application.
- Debugged production firmware across card readers, relays, sensors, field integrations, undefined behavior, constrained resources, and latency-sensitive failures.
- Worked across UART/I2C/SPI, Modbus, RS232/RS485, TCP/IP, peripheral control, field setup, protocol integrations, and constrained-resource targets.

Tech: C/C++, Zephyr, NuttX, FreeRTOS, UWB, BLE, UART/I2C/SPI, Modbus, RS232/RS485, TCP/IP, Tauri, TypeScript

Independent Infrastructure & Systems Work **Jan 2017 – Present**
System Administrator / Infrastructure Operator *Remote*

- Operate production systems on dedicated servers and AWS, GCP, Azure, and Hetzner.
- Build secure access and recovery patterns with VPNs, tunnels, SSH jump hosts, reverse proxies, hardened deployments, monitoring, and disciplined backups.
- Manage virtualization, storage, and firewalling with Proxmox, QEMU/KVM tuning, RAID10, Ceph, OPNsense, WireGuard, and OpenVPN.
- Maintain reproducible deployments with an operator mindset: observability, backup discipline, segmented access, incident debugging, recovery paths, and follow-up hardening.
- Built and operate a **reverse proxy and WAF platform** (ProxyPanther) managing public-facing routing, TLS termination, and security filtering for multiple domains.

Tech: Linux, Docker, NGINX, Proxmox, Ceph, OPNsense, WireGuard, OpenVPN-DCO, PostgreSQL, MySQL, MongoDB

THROUGH-LINE Independent infrastructure since 2017; professional software roles since 2022, progressing from embedded firmware through networking to real-time AI systems.

Selected Projects & Range

Personal projects and exploratory work, separate from the professional roles above:

- **Operating system:** bare-metal aarch64 OS in Rust — boot, memory management, scheduling, syscall interface.
- **Programming language:** custom language built from scratch in Rust — lexer, parser, type system, codegen.
- **Game engine & graphics:** WASM/WebGPU roguelike, Rust raytracers, Mandelbrot/Voronoi renderers, GPU/FFI generative art.
- **Mobile & client tools:** Flutter/Dart mobile applications; Svelte-based UAV ground control software with telemetry visualization.
- **Frontend & web:** `msakg.com` (SvelteKit), Vue/TypeScript dashboards, ambient-sound and breathing-exercise web apps.
- **Crypto & security:** JWT auth servers (Rust/Axum), OSDP protocol libraries (ANSI C), reverse-proxy/WAF with security filtering.

Technical Skills

Tools used across professional roles and personal projects; depth and production scope vary by area.

Languages	C/C++, Rust, Python, JavaScript/TypeScript; additional project experience: Dart, Java, C#, Lua, Elixir.
AI & Backend	Streaming STT/LLM/TTS, LiveKit, Pipecat, asyncio, tool orchestration, state machines, RAG/multimodal RAG, provider abstraction, evaluation harnesses.
Data & Retrieval	PostgreSQL, SQL, schema design, performance tuning, Qdrant, VectorChord, SurrealDB, ChromaDB, LanceDB, MongoDB, embeddings, vector and BM25-style keyword retrieval.
Systems/Networking	Linux, TCP/IP, WebRTC, eBPF/XDP, TSN, IEEE 802.1CB/AS/Qbv/Qbu, reverse proxies, profiling, concurrency, scheduling, backpressure.
Embedded	Bare-metal, FreeRTOS, Zephyr, NuttX, UART/I2C/SPI, Modbus, RS232/RS485, UWB, BLE, peripherals, constrained crypto/authentication.
Mobile & Frontend	Flutter/Dart, Svelte/SvelteKit, Vue, TypeScript, WASM/WebGPU, Tauri, HTML/CSS, responsive design.
Infra/Security	NGINX, Proxmox, Ceph, OPNsense, WireGuard/OpenVPN, Docker, Yocto, Buildroot, Aya, libbpf-rs, OpenTelemetry, CI/CD, JWT auth, WAF, OSDP, symmetric crypto, backups.
Graphics & Maker	Raytracers, Mandelbrot, Voronoi, WASM/WebGPU roguelike, GPU/FFI, hardware/software prototyping, electronics, 3D modeling, audio production, sound design.

Engineering Practice & Research

- **Implementation and operation:** build, benchmark, debug, and operate systems with attention to network, hardware, dependency, and field constraints.
- **Systems from scratch:** explore operating systems, language implementation, raytracers, and protocol libraries through personal projects.
- **Search and optimization:** study evolutionary algorithms and genetic programming, with interest in AI-agent autonomy and optimization-driven approaches to system design.
- **Taste under constraint:** music production, embedded systems, networking, and outdoor practice all reinforce sensitivity to timing, feedback, resilience, iteration, and physical-world failure modes.

Leadership & Operating Style

- Own technical direction from design through implementation, rollout, maintenance, incident debugging, and follow-up hardening.
- Use focused refactors, code reviews, pair-debugging, explicit integration contracts, and practical runbooks to support runtime safety and maintainability.
- Connect product, infrastructure, AI, and systems concerns in professional work; extend that perspective through personal mobile and frontend projects.
- Consider trade-offs across runtime, networking, firmware, and client interfaces, drawing on both professional work and personal systems projects.
- Set engineering standards around async/task lifecycles, state-machine boundaries, persistence correctness, testability, review quality, and production readiness.

Creative Practice & Personal Signal

- **Taste as engineering judgment:** cares about invisible details that shape user trust: timing, cancellation, feedback, defaults, debugging affordances, and operational clarity.
- **Maker-led engineering:** end-to-end prototyping across software, hardware, electronics, 3D modeling, firmware, visualization tools, client tooling, and deployment.
- **Audio and interaction taste:** audiophile listening, EDM sound design, and music production—including rumble kicks, trance synths, dynamics, and texture—sharpen sensitivity to latency, timing, feedback, and user-perceived quality.
- **Systems practice:** enjoys building, benchmarking, debugging, and operating software in real environments.
- **Outdoor resilience:** cycling, hiking/camping, climbing, and snowboarding reinforce exploration, risk reading, adaptation, iteration, and calm under difficult conditions.

Education & Community

Cumhuriyet University — Bachelor's Degree **2020 – 2024**
Selected coursework: Operating Systems, Computer Networks, Embedded Systems, Data Structures & Algorithms.

Google Summer of Code 2020 — Python Fury.

Teknofest: 2021 Unmanned Underwater Vehicle finalist (7th); 2021 International Unmanned Air Vehicle finalist; 2022–2023 International Fighter Unmanned Air Vehicle participant.