

ANAM FARRUKH

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[LINKEDIN](#)

Embedded Software Engineer | Vehicle Management Systems | Virtualization | RTOS/Linux Kernels

PROFESSIONAL SUMMARY

Embedded Stack Development: Led the end-to-end design of the Vehicle Management System (firmware, hypervisor, multicore OSES, mixed-criticality application integration and scheduling) for central compute platforms in software-defined vehicle architectures.

System Verification and Validation: Constructed new models for mapping ECU automotive functions to the integrated VMS and conducted SIL & HIL simulations using empirical CAN data to improve performance against ECU implementations.

Team Enablement: Mentored PhD, MS, and BS students as a team lead for VMS development with tangible deliverables.

KEY SKILLS

Technologies	• OSES (Quest RTOS, Yocto Linux, NuttX RTOS) • Hypervisors (Quest-V, Xen) • Build Systems (GNU Make, Bitbake) • Debugging (STLink, JTAG, Serial, GDB) • Frameworks (MATLAB/Simulink, LTSpice-IV, OpenCV, Electric VLSI SoC, Cadence Gate-level Design) • Firmware (Cleanflight, Ardupilot, PX4, Betaflight, CARLA) • Microcontrollers (Teensy, Arduino, PIC, STM32)
Programming Languages	• C/C++, Java, Python, C#, Scripting (Bash, Perl) • Assembly (x86, ARM, MIPS, RISC-V) • HDL (Verilog, VHDL) • Web (HTML5, Javascript, CCS)

WORK EXPERIENCE

AI Trainer & Fellow (Remote Contract), Handshake AI, MOVE Fellowship. (2025-Present)

Research & Development Assistant + Consultant (Part-time CPT Contract), Drako Motors Inc. & Real-Time Systems Ph.D Lab, BU. (2020-2025)

Graduate Teaching Fellow, Boston University Course Assistant: OS, Advanced Software Systems, Computer Systems. (2017-2021) (complete list @ <https://cs-people.bu.edu/afarrukh/>)

Software Engineer, Techlogix Inc: Front-end Web Portal Development for Enterprise Mobility Platforms. (2015-2016)

Cloud Support Engineer, Pivot Technology (RentVM): Technical Support and Mangement of Apache CloudStack. (2014-2015)

EDUCATION

PhD Computer Science, Boston University (BU), Boston, USA (Defence Date: Aug'25, GPA: 3.8)

Thesis: "Critical Function Consolidation for Centralized Software-defined Vehicle Management Systems"

Adviser: Prof. Richard West (<https://www.cs.bu.edu/fac/richwest/index2.html>)

M.S Electrical Engineering, Lahore University of Management Sciences (LUMS), Lahore, Pakistan (2014, GPA: 3.8)

Area of concentration: Electronics and Embedded Systems

PROFESSIONAL SERVICES

Research & Development (Curriculum Practical Training, Independent Contractor) at Drako Motors Inc. (2021-2025)

Supervisor: Richard West (Chief Software Architect, Drako Motors) & Shiv Sikand (Executive VP, Drako Motors)

- Designed and developed the **centralized Software-Defined Vehicle (SDV) architecture** for Drako Motors' DriveOS Vehicle Management System (VMS).
 - Enabled **SMP support** for guest virtual machines (VMs) (Yocto Linux, Quest RTOS) within the **partitioning hypervisor**, Quest-V, for the **virtualized VMS**.

- Laid the foundation for **safety-critical** function **integration & modeling** system infrastructure that enables offline analyzability for guaranteed end-to-end **control stability**, functional **correctness** and hard real-time **execution integrity** for the graph-based network comprising consolidated vehicle functions.
- Customized **Yocto Linux Bitbake layers** for x86 platforms to add features such as kernel modules for virtualization support, DMA patches for memory partitioning, serial terminal support for debugging, application package repository support and compiler toolchains for on-target code development.
- Implemented a **centralized I/O gateway service** within the RTOS domain managing multiple I/O protocols, **CAN, PWM, GPIO, I2C, SPI**, etc., with bounded latencies in hard real-time on behalf of all the guest VMs and interfaced the service with a USB-3.x communication backbone communicating data packets to/from distributed I/O controllers in the production vehicle.
- Developed time-critical system-wide **power management** subsystem for the virtualized VMS to enable **ACPI suspend/resume** from RAM of the hypervisor + guest domains while maintaining state and temporal integrity of real-time safety-critical task executions across power transitions.
- **Verified** functional correctness and improved end-to-end reaction times and throughput efficiency of task pipelines representing sensing, processing and actuation modules of interconnected vehicle functions.
- Performed system-level **debugging** using HIL/SIL test rigs comprising lab car setups and CARLA simulations to identify and resolve real-time scheduling and timing anomalies.
- Collaborated with automotive startup engineering teams @ Drako Motors to deploy the VMS in production and provided continuous feedback and technical support + documentation for effective **testing, verification & validation**.

Research Mentor and Student Adviser/Mentor

- Advised a team of MS & PhD students in the development of a 1/8th-scale (3-motor) **vehicle testbed** for testing and verification of DriveOS torque vectoring control as part of a directed study program during Spring and Summer 2025 semesters. (2025)
- Mentored undergraduate students on extending **CARLA simulation** platform for multiple camera support and integration of parallel sensor streams with **OpenPilot's driver assistance for digital-twin simulation** of the physical vehicle testbed. (2022)

Primary (Program Committee Member) and Secondary Research Paper Reviewer

- IEEE Real-Time Systems Symposium (RTSS): 2018, 2019, 2020, 2022, 2024.
- IEEE Real-Time and Embedded Technology and Application Symposium (RTAS): 2019, 2025.
- ACM SIGBED International Conference on Embedded Software (EMSOFT): 2021.
- Others: Computer Journal'25, RTJ (2022, 2023), JSA (2021, 2022), OSPERT'22, JRWRTC (2021, 2022), JSys'21, TCAD'21, RTCSA'18.

ACADEMIC PUBLICATIONS

- **Anam Farrukh** and Richard West, "[JuMP2start: Time-Aware Stop-Start Technology for a Software-Defined Vehicle System](#)", ECRTS 2024, Volume 298. (2024)
- **Anam Farrukh** and Richard West, "[FlyOS: Rethinking Integrated Modular Avionics for Autonomous Multicopters](#)", RTSJ. (2023)
- Soham Sinha, **Anam Farrukh** and Richard West, "[ModelMap: A Model-based Multi-domain Application Framework for Centralized Automotive Systems](#)", ICCAD. (2022)
- **Anam Farrukh** and Richard West, "[FlyOS: Integrated Modular Avionics for Autonomous Multicopters](#)", RTAS. (2022)
 - **SIGBED Blog:** (2022) <https://sigbed.org/2022/07/25/rtas-22-best-student-paper-flyos-integrated-modular-avionics-for-autonomous-multicopters/>
- **Anam Farrukh** and Richard West, "[smARTflight: An Environmentally-Aware Adaptive Real-Time Flight Management System](#)", ECRTS. (2020)
- Michel Kinsy, Shreeya Khadka, Mihailo Isakov and **Anam Farrukh**, "[Hermes: Secure Heterogeneous Multicore Architecture Design](#)", HOST. (2017)

ACADEMIC AWARDS

Selected as a Young Researcher for the Heidelberg Laureate Forum 2023 (top 200 worldwide in math and computer science).

Outstanding Paper Award and Best Student Paper Award: Publication in RTAS'22 for work titled "*FlyOS: Integrated Modular Avionics for Autonomous Multicopters*". (2022)

Outstanding Paper Award and Best Paper Award: Publication in ECRTS'20 for work titled "*smARTflight: An Environmentally-Aware Adaptive Real-Time Flight Management System*". (2020)

ACADEMIC PROJECTS

Research: (2017-2025)

- **DriveOS: Critical Function Consolidation for Centralized Software Defined Automotive Management Systems**
 - Laid the foundation for the VMS: a software-defined virtualized architecture leveraging a partitioning hypervisor, Quest-V, that supported concurrent guest OS sandboxes: Yocto Linux and Quest RTOS, in a separation-kernel configuration upon subsets of partitioned hardware resources (CPU, memory, I/O) with low-latency, high bandwidth shared memory communication channels between guests.
 - Enabled SMP support for the guest VMs.
 - Introduced time-aware system-wide ACPI power management for suspend/resume from RAM to reduce VMS boot delays for automotive grade PC-class platforms.
 - Ensured state consistency and hard real-time scheduling integrity for task pipelines contained within each guest domain as well as those spanning multiple guest domains.
 - Developed the function integration and modeling framework for safety-critical task pipelines enabling *safe* consolidation by-design of drive-by-wire and motor torque control loops within the DriveOS VMS.
 - Implemented and empirically evaluated end-to-end functionality and performance for the vehicle control unit integrated with a centralized CAN I/O gateway service, in the presence of other less and non-critical services such as HVAC, Instrument Cluster (IC) and In-Vehicle Infotainment (IVI).
- **JuMP2start: Time-Aware Stop-Start Technology for a Software-Defined Vehicle System**
 - Introduced a restartable/continuable task model within DriveOS and showcased its efficacy in maintaining state and temporal integrity of safety-critical task pipelines across system-wide power state changes.
- **ModelMap: A Model-based Multi-Domain Application Framework for Centralized Automotive Systems**
 - Developed the code generation and mapping process as well as the modeling tool abstractions for automated function pipeline generation and deployment within the multi-OS domain DriveOS system.
 - Validated against a case study of the HVAC vehicle function, specified as a task graph in the MATLAB/Simulink design environment augmented with real-time task parameters and execution constraints.
 - Showcased the end-to-end mechanism with MIL and HIL simulations of the HVAC function.
- **FlyOS: Integrated Modular Avionics for Autonomous Multicopters**
 - Designed a centralized flight management system called FlyOS with low-level PID flight control loops retrofitted for real-time execution on the Quest RTOS and integrated with autonomous mission navigation applications in Yocto Linux guest hosted by Quest-V partitioning hypervisor upon a centralized x86 avionics platform.
 - Conducted and presented an in-depth study of the Madgwick and Mahony's complementary filter algorithm for IMU sensor fusion utilizing Hamiltonian Quaternions to overcome gimbal lock.
 - Developed hypervisor based fault detection and hot fail-over recovery mechanism for the critical flight control loop to maintain the drone's attitude during midflight faults.
 - Validated and verified the autonomous flight performance of the VMS on a 500mm quadcopter drone, built in-lab and fixed in a birdcage contraption for repeated and replicable attitude control experiments.
 - Compared and contrasted the space-time isolation characteristics and benefits of the design against ARINC-653 partitioning standard and objectives.
 - Proposed a unique VMS design enabling runtime adaptation of flight control characteristics based on external environmental factors via dynamic switch-over across flight control algorithms hosted within distinct RTOS guests.
- **smARTflight: An Environmentally-Aware Adaptive Real-Time Flight Management System**
 - Developed a real-time mixed-criticality scheduling framework for autopilot firmware + executive hosted upon an ARM Cortex-M based STM32 microcontroller.
 - Showcased improvement in response time performance and accuracy of attitude control for a quadcopter drone, when impacted by environmental disturbances on a real-world HIL setup.
 - Extended the Cleanflight autopilot firmware with hard real-time execution semantics and adaptive task frequencies - maintaining schedulability under mixed-criticality constraints and efficient management of processor resources.

Other projects:

- **RISC-V Quad-core processor and OS Kernel Development for x86 processors (2016 - 2017)**
 - Implemented in Verilog a multi-core RISC-V processor with private I-Cache and a shared, banked D-Cache upon a Xilinx FPGA. Verified with a multi-threaded sorting micro benchmark developed in C.
 - Implemented a bare-metal OS for x86 processor including a GRUB legacy bootloader, e820 BIOS memory prober, keyboard driver, real-time FIFO and RR schedulers, simple file system and kernel threading/tasking environment.
- **A Configurable, Multi-Cycle Integer and Floating Point MIPS Pipeline Simulation Tool (2014)**
 - *MS Project & Thesis*, Advisor: Prof. Jahangir Ikram
 - Extended "Visual MIPS" simulation tool with integer and floating point execution units. Enabled configurability of micro architectural plug-n-play modules.

- **5-stage Micro-Architectural Pipeline for MIPS 32-bit processor (2012)**
 - *Undergraduate Senior Year Project, Advisor: Prof. Shahid Masud (LUMS), Prof. Adeel Pasha (LUMS) and Prof. Omar Khan (UCONN).*
 - Prototyped MIPS processor in VHDL on a Xilinx FPGA and verified functionality against assembly programs.
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