

Anam Farrukh

Website: <https://cs-people.bu.edu/afarrukh/>

Email: afarrukh@bu.edu

RESEARCH INTERESTS

Autonomous Vehicle Management Systems, Real-time Embedded and Cyber-Physical Systems, Mixed Criticality System Architectures, Hardware Software Co-design

EDUCATION

PhD. in Computer Engineering (CGPA: 3.73/4.00) 2016-Present

Boston University-Computer Science Department, Boston, USA

Current research topic: DriveOS: An Integrated Vehicle Management System for Autonomous Electric Vehicles

Research Advisor: Professor Richard West

Course Work: Adv. Digital Design in Verilog, Introduction to Operating Systems, Computer Architecture, Digital VLSI Circuit Design

Masters of Science in Electrical Engineering (CGPA: 3.75/4.00) 2012-2014

Lahore University of Management Sciences (LUMS), Lahore, Pakistan

Specialization: Electronics and Embedded Systems

Thesis title: A Configurable, Multi-Cycle Integer and Floating Point MIPS Pipeline Simulation Tool (for Educational Purposes)

Thesis Advisor: Professor Jahangir Ikram

Course Work: Embedded Systems, Computer Architecture, Digital Control Systems, Digital Signal Processing

PROFESSIONAL SERVICES

Boston University (BU) 2017 - Present

- **Curriculum Practical Trainee (CPT) Internship** under the advisement of Prof. Richard West (BU) and Shiv Sikand (Drako Motors, 2021- Present)
- **PhD Student Representative** from the Computer Science Department at Boston University for the official visit of Dr. Margaret Martonosi, Assistant Director for NSF's Computer and Information Science and Engineering (CISE) division (2022)
- **Student Research Advisor** to Undergraduate Students for their senior year thesis projects (2020-2022)
- **PhD Research Fellow** in Real-Time Systems Lab @ BU (2021)
- **Graduate Teaching Fellow** for Operating Systems, Software Engineering, Introduction to Computer Science, Advanced Software Systems and Fundamentals of Computer Systems (2017-2020)
- **Primary Research Paper Reviewer (Program Committee Member): (2018-Present)**
 - IEEE Real-Time Systems Symposium - Brief Presentations (RTSS 2022)
 - Junior Researcher Workshop on Real-Time Computing (JRWRTC 2021 & 2022). Also served on the Best Paper Decision Committee (2022)
 - Journal of Real-Time Systems (JRTS 2022)
 - Journal of Systems Research (JSys 2021)
 - Transactions on Computer-Aided Design (TCAD 2021)
 - Journal of Systems Architecture (JSA 2021)
 - 24th IEEE International Conference on Embedded and Real-Time Computing Systems and Applications (RTCSA 2018)
- **Secondary Research-Paper Reviewer: (2018-Present)**
 - Operating Systems Platforms for Embedded Real-Time applications (OSPERS 2019 & 2022)
 - International Conference on Embedded Software (EMSOFT 2021)
 - Real-Time Systems Symposium (RTSS 2022, 2019, 2018)
 - Real-Time and Embedded Technology and Application Symposium (RTAS 2019)

WORKSHOPS

- Women of Color in the Academy Conference 2022
- Google's International Women's Day Summit - Women Techmakers 2017
- Facebook Women In Research Lean-In Conference 2017
- CRA-Women Grad Cohort Workshop and Grad Cohort for IDEALS (formally GC-URMD) 2018-2021

PUBLICATIONS

(Citations on Research Gate: <https://www.researchgate.net/profile/Anam-Farrukh-2/research>)

- *Soham Sinha, Anam Farrukh and Richard West, "ModelMap: A Model-based Multi-domain Application Framework for Centralized Automotive Systems", in Proceedings of the 41st IEEE/ACM International Conference on Computer-Aided Design (ICCAD), San Diego, CA, USA, Oct 30-Nov 3, 2022.* 2022
- *Anam Farrukh and Richard West, "FlyOS: Integrated Modular Avionics for Autonomous Multicopters", in Proceedings of the 28th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS), Milan, Italy, May 4-6, 2022.* 2022
(Outstanding Paper, Best Student Paper Award)
 - **SIGBED Blog** @ <https://sigbed.org/2022/07/25/rtas-22-best-student-paper-flyos-integrated-modular-avionics-for-autonomous-multicopters/>
 - Extended Version submitted for peer review in Special Issue of Real-Time Systems (RTS) Springer Journal
- *Anam Farrukh and Richard West, "smARTflight: An Environmentally-Aware Adaptive Real-Time Flight Management System", in Proceedings of the 32nd Euromicro Conference on Real-Time Systems (ECRTS), Modena, Italy, 7- 10 July, 2020.* 2020
(Outstanding Paper, Best Paper Award)
- *Michel Kinsy, Shreeya Khadka, Mihailo Isakov and Anam Farrukh, "Secure Heterogeneous Multicore Architecture Design", in IEEE International Symposium on Hardware Oriented Security and Trust (HOST), 2017* 2017

HONORS & AWARDS

- Outstanding Paper Award and Best Student Paper Award (Research Project: FlyOS) 2022
- Outstanding Paper Award and Best Paper Award (Research Project: smARTflight) 2020
- Distinguished Computer Engineering PhD Fellowship – Freshman Year 2016-2017
- Deans Honor list on Graduation, MS graduate level (LUMS) 2014
- 100% Scholarship of Merit at MS graduate level (LUMS) 2013-2014

SKILLS

- **Systems:** Experience with Linux (since 2014), Quest (since 2020), Cleanflight/Betaflight Autopilots (since 2017), MIPS and RISC-V ISA (since 2011), x86 ISA (since 2020)
- **Languages:** C/C++, Python, Java, Bash Scripting, Visual Basic 6, VHDL and Verilog hardware description languages, HTML5, CSS and Javascript
- **Other Platforms and IDEs:** Cadence for Gate-level designs, MATLAB/Simulink, LT Spice IV, QTCreator, Electric (digital VLSI SoC design), Apache Cloudstack Cloud Orchestration Platform, Citrix XenServer, Citrix Netscaler, AngularJS, Xilinx FPGAs, MINI6410, Arduino, PIC and STM32 microcontrollers

REFERENCES: Available upon request

RESEARCH & PROJECTS

- **PhD Research project:** *“DriveOS: An Integrated Vehicle Management System for Autonomous Electric Vehicles”* – Design a safe, extensible and predictable automotive system for modern vehicle management on centralized hardware platforms. We use the separation-kernel technology to co-host mixed-criticality functions across virtualized sandboxed domains. My work relates to the design of the underlying software architecture and integration of safety and timing critical vehicle functions such as the Vehicle Control Unit and Battery Management System, using performance efficient functional decomposition. I am also working on the design of a robust sandbox-level fault-tolerance subsystem that identifies faults and recovers critical functionality in real-time. The project is in collaboration with *Drako Motors Inc.* 2022-Present
- **PhD Research Project:** *“FlyOS: Integrated Modular Avionics for Autonomous Multicopters”* – Design a virtualized dual-OS topology based on the IMA (Integrated Modular Avionics) concept for next-generation avionics architectures that are safe, real-time predictable and performance efficient. A partitioning hypervisor enables a flexible and integrated design framework for multicopter flight management systems 2020-2021
- **PhD Research Project:** *“smARTflight: An Environmentally-Aware Adaptive Real-Time Flight Management System”* – A criticality aware, rate adaptive scheduler implemented for the open-source Cleanflight flight management software. smARTflight allows the autopilot to reason about the external environment and adapt rates of execution of tasks during flight. This ensures time-critical responsiveness of the drone to changing ambient conditions. The scheduler manages allocation of resources in accordance with the criticality modes of the system. 2020
- **PhD Course Project (Intro. To OS):** Kernel development for the design of a custom baremetal OS, x86 assembly programming for the bootloader, development of a UNIX based file system, FIFO/RR scheduler and a task threading library. 2017-2019
- **PhD Research Project:** *“Hermes: Secure Heterogeneous Multicore Architecture Design”* – Developed a secure multicore architecture that incorporates secure and insecure components onto the same chip. Implemented RISC-V ISA in Verilog. 2016-2017
- **PhD Course Project (Computer Architecture):** Verilog programming of a RISC-V ISA based quad-core processor with instruction and data L1 cache subsystem and custom network-on-a-chip (NOC) design. 2017
- **PhD Course Project (VLSI Digital Design):** Designed layouts and schematics of digital gates in Cadence 2016
- **PhD Course Project (Advanced Digital Design in Verilog):** Sparse matrix-vector multiplier implementation in Verilog. Reproduced results of a research paper: *“High Memory Bandwidth FPGA Accelerator for Sparse Matrix-Vector Multiplication”* by Fowers et. al. 2016

- **Master's Thesis:** *"A Configurable, Multi-Cycle Integer and Floating Point MIPS Pipeline Simulation Tool (for Educational Purposes)"* - Extension to **"Visual MIPS"** educational and simulation tool from an integer-only processor to a fully configurable Floating Point pipeline. 2013 -2014
- **Undergraduate Senior Year Thesis:** *"Design and Implementation of a 5-stage pipeline for a uncore MIPS processor on a Xilinx FPGA using VHDL hardware description language"* – This project was externally advised by Prof. Omar Khan from University of Connecticut in collaboration with Prof. Shahid Masud (LUMS) and Prof. Adeel Pasha (LUMS) 2011-2012