Ayoosh Bansal

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Passionate about crafting innovative and efficient systems to overcome complex challenges, I strive to unravel intricacies and find elegantly simple solutions. My problem-solving methodology revolves around harnessing expertise across diverse layers within a system, fostering collaboration among components, and prioritizing simplicity in design. This approach has empowered me to architect frameworks for safe autonomous driving, enable comprehensive security auditing for real-time systems, and mitigate execution variability stemming from cache coherence mechanisms. I am excited to continue tackling new challenges and create innovative solutions that drive progress.

Education

University of Illinois Urbana-Champaign

PhD in Computer Science, Advised by Prof. Lui Sha — Aug 2017 - Present

Research Topics: Cyber-Physical Systems, Real-Time Systems, Functional Safety, Temporal Safety, System Security, Architecture

University of Wisconsin-Madison

Master of Science in Electrical Engineering, GPA 4/4 — Sep 2013 - May 2015

Birla Institute of Technology and Science Pilani, India

Bachelor of Engineering Electrical and Electronics, CGPA 8.6/10 — Aug 2006 - Jul 2010

Experience

Cyber Physical Systems Integration Lab, UIUC — Urbana

Graduate Research Assistant — Aug 2017 – Present

- Conducted diverse research within the realms of cyber-physical and real-time systems, enhancing functional safety, bolstering system security, and refining temporal predictability. A presentation summarizing the research works and publications is available here.
- Ongoing work on *Synergistic Simplex* system architecture that harnesses cooperation among safety- and mission-critical elements, as well as between perception and control modules, to enhance the safety and performance of autonomous ground and aerial vehicles.
- Devised *Perception Simplex*, a system architecture for autonomous vehicles that decouples mission and safety responsibilities, providing verifiable obstacle detection and deterministic collision avoidance within the operational design domain.
- Recognizing the lack of context-aware metrics for object detection in autonomous driving, created *Risk Ranked Recall*.
- Optimized security auditing for real-time applications, creating *Ellipsis*. Harnessing the inherent predictability of behaviors in real-time applications, *Ellipsis* all but eliminates the possibility of audit event loss during typical operation and significantly curtails auditing data volume (> 90%) while preserving security-relevant information.
- Introduced a new memory type, *Inner Non-Cacheable, Outer Cacheable*, empowering real-time applications to bypass cache coherence mechanisms and mitigate memory access latency variability selectively for shared data, with no impact on private data. Prototype implementation on Linux Kernel and Gem5 simulator, yielded 52% less worst-case latency and negligible impact on performance.
- Helped design security-aware task scheduling for real-time applications and input prioritization schemes for object detection DNN.

NVIDIA — Santa Clara

Automotive System Software Intern — May 2020 – Aug 2020

- Engineered a hypervisor-level latency analysis system aimed at optimizing applications with stringent latency requirements.

Automotive System Software Intern — Jun 2018 – Aug 2018

- Analysed latency variability stemming from processor architecture and helped verify proposed solutions.

System Software Engineer — Jul 2015 – Jul 2017

- Developed device drivers to manage memory bandwidth allocations and participated in kernel bring-up on Tegra Parker.
- Developed the infrastructure to deploy Linux Kernel on the full-chip simulation platform for Tegra Xavier.
- Successfully led a cross-organizational effort to integrate the new full-chip simulation platform with a new regression testing infrastructure.
- Mentored an internship project which overhauled the simulator software startup process to create a seamless silicon-like flow.

NetApp — Bangalore

Member of Technical Staff — Jul 2010 – Jul 2013

- Progressed through roles in CIFS server quality assurance, NFS server maintenance, and finally NFS server development.
- Resolved diverse customer issues and escalations, mitigating active disruptions. Conducted SSH CVE applicability analysis.
- Conceptualized an invention optimizing stale mount points handling within NFS server implementations, resulting in a monetary award.

Skills

C, Python, C++, Assembly, Linux Kernel Development, Git, Gem5, Perl, Verilog, Cyber-RT, ROS, Gem5-Aladdin, LLVM, Xilinx Vivado.