Anish **Saxena**

Senior Undergraduate

Indian Institute of Technology Kanpur

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Education

Indian Institute of Technology Kanpur — *Kanpur, India*

Bachelor of Technology, Mechanical Engineering/ **CPI: 9.1/10.0** — *2017 - 2021 (exp.)*

- Minor in Computer Systems

St. Kabir School — *Ahmedabad, India*

Central Board of Secondary Education Class XII/ **94.4%** | **School Topper** — *2017*

Central Board of Secondary Education Class X/ **CGPA: 10.0/10.0** — *2015*

Honors & Awards

2019 **Semiconductor Research Corporation (SRC) Member**, Indian Research Program — *India*

2017 **Aditya Birla Group Scholarship**, Awarded to 15 students selected from IITs and BITS — *Mumbai*

2017 **All India Rank 1828**, Joint Entrance Examination Advanced, 175,000 students — *India*

2017 **KVPY Fellowship**, Awarded by IISc Bangalore and Government of India — *Bangalore*

Work Experience

Intel Labs, India — *Mr. Anant Nori*

Research Intern, Processor Architecture Research Lab — *May 2020 - Sep. 2020*

- Improved the performance of non-inclusive cache hierarchy by implementing and extending research ideas.
- Extended a state-of-the-art research simulator, collected memory traces, and performed cache simulations.
- **Reduced simulation time by 10×** while maintaining greater than 99% correlation to a full-scale simulation.
- Devised Bloom Filter-based implementation to track parameters like reuse distance efficiently in hardware.
- Developed custom cache policies and examined performance against oracular policies like Belady.

CAR3S Group, IIT Kanpur — *Prof. Biswabandan Panda*

Group Member — *Apr. 2019 - Jun. 2020*

- Improved accuracy of attacks that exploit instruction execution latency variation caused by processor caches.
- Identified that Dynamic Voltage and Frequency Scaling (DVFS) and OS scheduling affect execution latency.
- Introduced noise-aware calibration, periodic feedback, and victim profiling to optimize baseline attacks.
- Devised **DABANGG, a novel set of refinements that enable precise, accurate, and noise-resilient attacks**.
- Conducted experiments, mounted attacks on AES and RSA cryptosystems in OpenSSL and GnuPG libraries.
- **First author of the paper under submission** to the IEEE Symposium on Security and Privacy, 2021.
- Funded by NXP Semiconductors through SRC; work is accessible at car3s.github.io/dabangg/.

New York Office, IIT Kanpur — *Prof. Manindra Agrawal*

Computer Systems Intern — *May 2018 - Jul. 2018*

- Led a team of 4 to develop the infrastructure stack of a scalable microservice-based web portal.
- Integrated Spinnaker to enable continuous and immutable delivery of Docker images on Kubernetes cluster.
- Configured pipelines, auto-triggered by Concourse Continuous Integration (CI) workflow, for Spinnaker.
- Integrated Clair static vulnerability analysis tool to flag buggy Docker images and fail the build in CI stage.
- Added Canary analysis stage to the pipeline and integrated Locust load testing framework in this stage.
- Implemented client-side auth-enabled snapshot facility in UPMC Enterprises' Elasticsearch-operator.

Relevant Coursework

- Advanced Computer Architecture[A]
- Programming for Performance[A]
- High Performance Computing & ML[i]
- Data Structures & Algorithms
- Applied Numerical Methods[A]
- Computer Architecture[A*]
- Operating Systems[A]
- Modern Cryptology[i]
- Introduction to Programming[A]
- Linear Algebra
- Topics in Operating Systems
- Computer Organization[A]
- Non Classical Logic
- Complex Analysis
- Multivariable Calculus

A: grade for exceptional performance* *A: grade* *i: in progress*

Projects

Efficient and synergic heterogeneous systems
Prof. Biswabandan Panda

CAR3S Group, IIT Kanpur — *Jul. 2020 - present*

- Funded by Qualcomm Research to improve the front-end and memory subsystem of Systems-on-Chip.
- Developed a framework to collect Memory & Data Traces (MDT) through emulation or natively for Android.
- Modified QEMU, the emulator used by Android Studio, to collect MDT from Android 9.0 API with x86_64 ABI.
- **Extended Valgrind, a memory profiling framework, collected MDT natively** from ARMv8-based devices.
- Extended ChampSim, a trace-driven simulator, utilized MDT and analyzed patterns to improve value prediction, branch prediction, instruction prefetching, and cache compression at LLC.

SMA Actuator-based Space Antenna
Prof. Sahil Kalra

Space Technology Cell, IIT Kanpur — *Jan. 2019 - Feb. 2019*

- Developed mechanism for ISRO to enable motion with 3 degrees of freedom in antenna deployed in satellites.
- Utilized a novel State Memory Alloy (SMA) actuator to allow the third axis of rotation through motors.
- **Designed protocols for ISRO's NavIC chip** for transmission and reception of signals to control the system.

Campus Sustainability Challenge
Team Leader

7TH Inter-IIT Tech Meet, IIT Bombay — *Oct. 2018 - Dec. 2018*

- Led a team of 6 to propose and implement solutions for waste generated on the institute campus.
- Mounted sensors in composting bins, captured Biogas, reduced PNG consumption in hostel messes by 14%.
- Configured E-Waste Management Software, modelled E-waste generation, analyzed disposal frequency, environmental and economic factors, and identified optimal combination of recycling techniques.

E-Waste Management Software
Prof. Indranil Saha

Course Project — *Aug. 2017 - Nov. 2017*

- Given E-waste disposal behavior and constraints on economic and environmental resources, identified the optimal path to safely and efficiently treat the E-waste.
- **Modelled the path-finding algorithm from scratch** to perform linear optimization of 8 parameters, like amortized cost, subject to 20 constraints, like efficiency, per process.

Talks

2020 **DABANGG Attack**, via CAOS reading group to graduate students and faculty — *IIT Kanpur*

2020 **Microarchitectural Security**, talk and demo as part of SRC Annual Design Review — *Bangalore*

2019 **Flush-based Attacks**, guest lecture as part of course on Secure Memory Systems — *IIT Kanpur*

2019 **ZombieLoad and CLK$_{screw}$ Attacks**, via CAOS reading group — *IIT Kanpur*

Skills

Programming C++, C, Python, Golang, Java, Bash, Verilog

Frameworks Pthreads, OpenMP, CUDA, Intel TBB, ANTLR, Valgrind

Utilities Git, Vim, LaTeX, GDB, PIN, QEMU, ChampSim, Xilinx ISE, Docker, Kubernetes

Extracurricular Activities

2020 **Systems Reading Group**, Leader — *IIT Kanpur*

Conducted series of talks to discuss basic and advanced topics in systems research.

2019 **Programming Club**, Coordinator — *IIT Kanpur*

Guided a team of 24, conducted workshops, organized hackathons, and delivered lectures.

2019 **HDL & Digital Design**, Programming Club Project — *IIT Kanpur*

Mentored 5 students to develop a 16-bit pipelined processor and synthesized it on FPGA.

2018 **Clean Coder**, Association for Computing Activities Project — *IIT Kanpur*

Developed a filesystem using Go-FUSE to sandbox a guest user on a host filesystem.

Miscellaneous

- Senior Mentor to 15 undergraduate freshers, helped them navigate life and career choices in college. *2020*
- Represented CAR3S group in departmental seminars and maintained the group website. *2019, 2020*