Rishabh Ravi

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borlaugg
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Education

2020 – **Indian Institute of Technology Bombay, India** 9.04/10 GPA
Bachelors and Masters of Technology in Electrical Engineering

2018 – 20 **PSBB Learning Leadership Academy** 94.8%
Higher Secondary

Professional Internships

2023 **Modem Firmware Engineer** *Qualcomm*

- Revived a GPRS-specific modem firmware and virtual platform for real-world applications and created test case scenarios, emulating L1 commands, to assess and validate functionality
- Transitioned the firmware operations from 24 to 32 bits, reducing data conversion time to enhance operation speeds by roughly **2%**
- Validated the implementation by maintaining signal-to-noise ratio within defined 21 dB thresholds, affirming the accuracy of decoded data

2022 **Parallel Computing & Profiling** *Nvidia*

- Worked in a team of 5+ to parallelize ANUGA, an open-source hydrodynamic modeling software by profiling and running time analysis of the program on Nvidia Nsight Systems
- Identified hot spots of the program that required parallelization to increase performance
- Mentored a batch of 20+ students for two online certification courses on CUDA C & Python

Research Experience

2023 **A Comprehensive Study on Cache Partitioning** *Guide: Prof. Virendra Singh | IITB*

- Reproduced the work on Utility-Based Cache Partitioning (UCP) for shared LLCs in multi-core systems and analyzed the results using the SNIPER simulator
- Performed a comparative study against static partitioning on the impact on Misses Per Kilo Instructions (MPKI), miss rates, partitioning pattern, and performance
- Identified a **30%** performance gain for UCP compared to static partitioning, with increased gains accounting for improved replacement policies, such as SRRIP, implemented in the LLC

2022 **Cache Security from Side Channel Attacks** *Guide: Prof. Virendra Singh | IITB*
The hyperlink to the presentation corresponding to the following can be accessed here

- Studied the vulnerabilities of shared cache and attacks like Flush+Reload, and Prime+Probe
- Reproduced the work of PASS-P, an adaptation that mitigates such side channel attacks
- Modified PASS-P by introducing DAAIP as the replacement policy and observed a drop in performance, which could be due to PASS-P selectively reallocating clean lines

2022 **Improving Bilateral Filter** *Guide: Prof. Satish Mulleti | IITB*
The hyperlink to the work report and code corresponding to the following can be accessed here

- Explored the work of Bilateral filters for image denoising and replicated the same on Python
- Designed an alternate penalty function that took pixels nearby into consideration
- Lowered the MSE by **41.9%** as compared to Bilateral Filters, obtaining better picture quality

Research Experience (continued)

2022 **Exploring Replacement Policies** *Guide: Prof. Virendra Singh | IITB*

- Studied cache hierarchy, access patterns, and eviction policies of caches in computers
- Learned about the various cache optimizations to decrease miss rates, penalties, and hit times
- Explored multiple cache replacement policies that included LRU and MRU policies to more complex policies such as Re-Reference Interval Prediction (RRIP), Hawkeye, and Mockingjay

Technical Projects

2022-23 **Processor Design** *Guide: Prof. Virendra Singh | Course Project | IITB*

The hyperlink to the code corresponding to the following can be accessed here

- Developed a 16-bit RISC multi-staged processor that handled 17 instructions in VHDL
- Devised a 16-bit pipelined processor, pipelined into six different stages to get a performance close to 1.94 cycle/instruction
- Designed a hazard unit, branch predictor, and forwarding unit to tackle pipelining hazards
- Deployed a 16-bit RISC 2-way fetch superscalar processor handling out-of-order execution
- Implemented an ROB and a PRF to handle hazards of instruction-level parallelism

2023 **2D Mapping System** *Guide: Prof. Siddharth Tallur | Course Project | IITB*

Received recognition for **outstanding performance and achieving top rankings** *in a competitive field of projects. This project was ranked among the* **top 3** *projects out of 60+ projects. The hyperlink to the report corresponding to the following can be accessed here.*

- Designed a four-wheeled robot capable of wirelessly mapping the trajectory traced
- Utilized an IMU and a Rotary Encoder to track the robot's orientation and speed
- Transmitted the data wirelessly using a Bluetooth module mounted on a custom PCB
- Plotted a 3D map of the variation of luminous intensity along the traced trajectory

2020-22 **Matsya, Autonomous Underwater Vehicle (AUV)** *Guide: Prof. Leena Vachhani | IITB*

AUV-IITB is a team of 40+ students working on the design and development of an AUV

- Deployed a fully autonomous underwater submarine Matsya, capable of self-navigation and performing multiple tasks as described by the International RoboSub competition
- Migrated the logic of the electrical stack to work on STM32G4 from the ATmega328P, enabling higher operation speeds provided by the increased number of I/O ports
- Implemented 2-D SLAM (Simultaneous Localization and Mapping) in Python and predicted positions using the Extended Kalman filter algorithm given sensor data.

Academic Achievements

2021 – Ranked in the **top 3** out of 85 students in the Electrical Engineering (Dual Degree) Department

2023 Ranked among the top 3 projects in the Electrical Design Lab out of 70+ projects.

2021 Among the top 30 students to be awarded Change of Branch to Electrical Engineering on excellent academic performance

2020 Engaged in the winning team, achieving IEEE-Ocean Engineering Society's Young Researcher's Prize at the Underwater Technology Competition against 18+ countries

2020 Achieved All India Rank **878** in **JEE Advanced 2020** out of 150,000 candidates.

2020 Secured **99.82 percentile** in **JEE Mains 2020** out of 1,100,000 candidates.

Courses Taken

Digital Systems	Algorithmic Design of Digital Systems*, VLSI Design, Embedded Systems, Digital Systems, Digital Systems Lab
Computer Architecture	Advanced Topics in Computer Architecture*, Advanced Computer Architecture, Microprocessors, Microprocessors Lab

**to be completed by Nov 2023*

Mentorship

2023 – Appointed as a mentor from a pool of 80+ applicants based on ethics, interviews, and extensive peer reviews. Guiding and mentoring six sophomores on a one-to-one basis in their academic and co-curricular pursuits. Working with a team of 35 toward building an effective support system for students in the department

2022 Mentored a batch of recruits to AUV-IITB as the RnD head and helped train them. It involved providing resources, solving doubts, and demonstrating the functionality of the AUV.

Teaching

2021-2023 Teaching assistant at IIT Bombay for the following courses.

Year	Course
2023	MA 106, Linear Algebra
2023	MA 111, Integral Calculus
2022	MA 205, Complex Analysis
2022	MA 207, Partial Differential Equations

Technical Skills

Languages C/C++, Python, VHDL, Assembly, CUDA, FORTRAN, Bash, Perl, MATLAB, GNU Octave, Heptagon, LaTeX

Software Quartus, Nvidia Nsights, GEM5, SNIPER simulator, Arduino, Keil, CubeMX, EAGLE PCB Design, NGSPICE, GNU Radio, Fusion 360

Extracurricular

Football

- Participated in and won numerous football tournaments at both school and college levels.
- Represented the college football team at a third-division football league.

National Service Scheme

- Engaged in public speaking and outreach activities focusing on environmental education
- Empowered attendees with the significance of individual actions in preserving resources