Shikhar Tuli

PhD Candidate
Electrical Engineering
Princeton University

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Google Scholar, Research Gate, LinkedIn

Academic Details

Year	Degree	Institute	CGPA/Percentage
2016-2020	B.Tech in Electrical Engineering	Indian Institute of Technology Delhi	9.486
2016	Class XII, CBSE	Amity International School	96.6%
2014	Class X, CBSE	Amity International School	10.00

† *According to Provisional Degree Certificate (official transcript may not be available)*

Courses

- **Electrical Engineering:**
  Computer Architecture, Digital Electronics, Machine Learning and Intelligence, Analog Electronics, Physical Electronics, Power Electronics, Communication Engineering, Control Engineering, Engineering Electromagnetics, Signals and Systems, Electromechanics, Circuit Theory, IC Technology*, MOS VLSI Design*, Neuromorphic Engineering*, Mixed-Signal Circuit Design*, Compact modeling of Semiconductor Devices*, CMOS RF IC Design*
- **Computer Science, Mathematics and Physics:** Data Structures and Algorithms, Probability and Stochastic Processes, Calculus, Linear Algebra, Principles of Semiconductors

* Graduate level courses, under Department Specialization in 'VLSI & Embedded Systems'

Key Projects

Architectures of Emerging Non-Voltatile Memories — Embedded Systems Lab, EPFL
Summer Research Project — May - Nov 2019

Developing novel architectures for Emerging Non-Volatile Memories (NVMs) like RRAMs, STT-MRAMs, SOT-MRAMs, PC-RAMs, etc. For this, a Variability-Aware Controller (VAC) was proposed to asynchronously write to the NVM. This resulted in performance and energy improvements in low-power Edge applications. Computing overheads and implementing an adaptive and dynamic version of the VAC for further optimizing design-space parameters.

Modeling of HCI Degradation in GAA NWFETs — Prof. Abhisek Dixit, DWLCL, IIT Delhi
Summer Research Project (SURA) — May 2018 - Nov 2019

Investigating and modeling of Hot-Carrier Injection based Degradation Effects in Gate-All-Around NanoWire FETs. Various model dependencies of device reliability have been proposed for HCD in NWFETs. These models are being backed by experimental study (using SMUs and WGFMUs) and physical justification. The project is under the Design and Wafer-Level Charectarization Lab (DWLCL), IIT Delhi and in collaboration with IMEC Leuven, Belgium (link).

FogBus — CLOUDS Lab, University of Melbourne
Remote Summer Research Project — May - July 2018

Developed a blockchain-based lightweight framework, named FogBus for Edge and Fog Computing, for end-to-end integration of IoT-Edge-Cloud. FogBus offers a platform independent interface to IoT applications and computing instances for execution and interaction. A Sleep Apnea analysis application also has been deployed using this framework for real time notification and diagnosis by analyzing pulse oximeter data. Github Repository link.

Low Cost Air Purifier with ENMS — Prof. Sujeet K. Sinha and NanoClean India Pvt. Ltd.
Industrial Project — May 2017 - July 2018

Design and development of a commercial Air Purifier which uses Air Mask/Respirator for filtration with other primary and secondary air filters. A new innovative design has been used with FPGA based ENMS (Enhanced Network Management System) control for real time feedback, online maintenance and integration of large number of them in geographically spread locations. It is affordable and user friendly. Patent filed.

Self Learning File System to Optimize Data Recovery, Security and Integrity — Prof. S. R. Sarangi
Research Project — July 2018 - Nov 2019

Developing a Reinforcement-Learning based adaptive File Allocation System to optimize data recovery for mission critical applications without compromising I/O performance. Developed a prototype file system - "APEX" for edge computing frameworks to show the efficacy of the proposed file allocation mechanism.

Coral IP-phone — Coral Telecom Pvt. Ltd.
Industrial Project — Aug 2019 - Present

Design and development of a a VoIP phone with the use of System on Module (SOM). Integrating RGB TTL LCD with Capacitive Touch Panel (CTP), MIPI-CSI camera, PoE functionality, L2 switch, keyboard, speaker and mic onto the SOM. The phone supports all video calling features.

Coral Cloud — Coral Telecom Pvt. Ltd. and ST Microelectronics
Industrial Project — Jan - Mar 2018

Design and development of a High Availability (HA) and Load Balanced, Electronic Private Automatic Branch Exchange (EPABX) for SIP communication using Free-Switch open source software. The system has No Single Point of Failure (NSPOF) feature with Hot-Swappable power supply (SMPS).

Other Projects

Supervised and Unsupervised Spiking Neural Networks — Prof. Debanjan Bhowmik
Course Project — Aug - Nov 2019

Simulated Supervised and Unsupervised Spiking Neural Networks employing STDP Learning rule (report link) and LIF/HH neuron models, in Python. Simulated circuit implementations (Axon-Hillock and HH) and applied phenomenological models for energy and performance estimations (link).

Diode Level-1, Resistor and BSIM-6 Compact Models — Prof. Abhisek Dixit
Course Project — Aug - Nov 2019

Implemented Compact models for Diode Level-1 (report link), sub-circuit based Resistor (link) and DC BSIM-6 MOSFET (link) in IC-CAP using Verilog-A. Performed simultaneous multi-curve fitting to extract optimized model parameters.

Wallace Tree Multiplier with unbalanced pipelining — Prof. Basabi Bhowmik
Course Project — Aug - Nov 2019

Designing a 8-bit multiplier with Cascaded Carry Save Adder, employing unbalanced pipelining to improve performance. Layout implemented on 65nm TSMC technology. Report link.

DCO for NavIC Satellite Navigation System Receiver — Prof. Shouri Chatterjee
Course Project — Jan - Apr 2019

Designed and simulated cross-coupled differential Digitally Controlled Oscillator (DCO) as per IRNSS standards. Tunable frequency output (1.176, 1.585, 2.492 GHz), -80dBc phase-noise at 100 Khz offset. Layout in 180nm technology.

Real-time object detection with Intel Neural Compute Stick and Raspberry Pi — Prof. Jayadeva
Course Project — Jan - Apr 2019

Implemented and compared various object detection models (YOLO and MobileNet SSD) in Intel Neural Compute Stick with Raspberry Pi 3-B and optimized them for more efficient Edge node operation.

Simulation of FMCW Radar — Prof. Saif Mohammed
Course Project — Sep - Oct 2018

Implementation of Triangular FM Modulated Contuous Wave (FMCW) Radar on MATLAB. Effects of fading, multiple received signals and AWGN noise were observed through simulation. A simulation interface was developed. Report link.

Bomb disposal robot for competition at IIT Kharagpur — Robotics Club - IIT Delhi
National Robotics Competition — Dec 2016 - May 2017

Designing a manually controlled robot for competition at IIT Kharagpur, that collects small prototype bombs in an arena, cuts required wires in 2 minutes and deposits in clean zone. Using Arduino platform controlled from android smart phones.

Publications

- Charu Gupta, Anshul Gupta, **Shikhar Tuli**, Erik Bury*, Bertrand Parvais*, Abhisek Dixit. *Investigation and Modeling of Hot Carrier Degradation Effects in N-channel Gate-All-Around Nanowire FETs*, IEEE Transactions on Electron Devices, vol. 67, no. 1, pp. 4-10, Jan. 2020. link *from IMEC, Belgium
- Shreshth Tuli, **Shikhar Tuli**, Gurleen Wander, Praneet Wander, Sukhpal Singh Gill, Schahram Dustdar, Rizos Sakellariou, Omer Rana, *Next Generation Technologies for Smart Healthcare: Challenges, Vision, Model, Trends and Future Directions*, Internet Technology Letters. link
- **Shikhar Tuli**, Marco Rios, Alexandre Levisse, David Atienza. *RRAM-VAC: A Variability-Aware Controller for RRAM-based Memory Architectures*. 25th IEEE/ACM Asia and South Pacific Design Automation Conference (ASP-DAC '20). link
- Shreshth Tuli, **Shikhar Tuli**, Udit Jain and Rajkumar Buyya, *APEX: Adaptive Ext4 File System for Enhanced Data Recoverability in Edge Devices*, Proceedings of the 11th IEEE International Conference on Cloud Computing, Sydney, Australia, December 11-13, 2019. link
- Sukhpal Singh Gill, Shreshth Tuli, Minxian Xu, Inderpreet Singh, Karan Vijay Singh, Dominic Lindsay, **Shikhar Tuli**, Daria Smirnova, Manmeet Singh, Udit Jain, Haris Pervaiz, Bhanu Sehgal, Sukhwinder Singh Kaila, Sanjay Mishra, Mohammad Sadegh Aslanpour, Harshit Mehta, Vlado Stankovski, Peter Garraghan. *Transformative Effects of IoT, Blockchain and Artificial Intelligence on Cloud Computing: Evolution, Vision, Trends and Open Challenges*, Internet of Things, Volume 8. link
- Shreshth Tuli, Redowan Mahmud, **Shikhar Tuli**, Rajkumar Buyya. *FogBus: A Blockchain-based Lightweight Framework for Edge and Fog Computing*. Journal of Systems and Software, Volume 154, 2019, Pages 22-36. link.
  Top ten downloaded article of 2019 award link
- Neetu Jindal, Sandeep Chandran, Preeti Ranjan Panda, Sanjiva Prasad, Abhay Mitra, Kunal Singhal, Shubham Gupta, **Shikhar Tuli**. *DHOOM: Reusing Design-for-Debug Hardware for Online Monitoring*, In Proceedings of the 56th Annual Design Automation Conference 2019 (DAC '19). ACM, New York, NY, USA, Article 99, Pages 6. link

Patents

- *Low Cost Air Purification System*, **Shikhar Tuli**, Shreshth Tuli, Sujeet K. Sinha, IIT Delhi. Filed at the Indian Patent Office. Date: 2^{nd} August 2017, App. No.: 201711027523
- *Combination Lock with limited trial and resetting mechanism*, **Shikhar Tuli**, Shreshth Tuli, Harshit Abrol, Shivang Dwivedi, Saujanya Chaudhary, Kargil Singh, Sivanandam Aravindan IIT Delhi. Filed at the Indian Patent Office. Date: 10^{th} August 2017, App. no.: 201711028520

Awards and Achievements

- **Department Rank 4** in a batch of around 82 students, with CGPA of 9.433.
- Awarded **ThinkSwiss Research Scholarship** worth CHF4800 for a summer internship at Embedded Systems Laboratory (ESL), EPFL under the E3 program.
- Received **Summer Undergraduate Research Award** for outstanding research at undergraduate level.
- Received **Design Innovation Summer Award** (DISA - 2017) and **DIT Seed Grant** for Air-Purifier project.
- Placed among the **Top 7%** of IIT Delhi in the first, second, fifth and seventh semesters based on academic performance.
- Won **2nd Runners Up**, **Best Mechanical Design Award** and **Best Technical Report** Cash Prize for Bomb Disposal Robotics National Competition at IIT Kharagpur - December 2016
- Secured **All India Rank 1624** in Joint Entrance Exam Advanced - 2016 among 150,000 candidates.
- Awarded **Chairperson's Trophy** for being the **School Topper** with 96.60% in CBSE AISSCE XII standard.
- Awarded **All Rounder** for VIII and IX standard.
- Received **Best Alliance award** and **Rockwell Collin's Innovation award** for National Robotics Competition - First Tech Challenge in X standard. Competition link.

- Awarded **Second Runners Up** position and **Award for Best Marketing** in F1 in schools national competition in which students design, manufacture and race with miniature Formula 1 cars. Team Facebook page. Competition link.

Technical Skills

- **Programming Languages:** MATLAB, Verilog-A, PEL, Python, Java, C++, Verilog, x86 and ARM assembly, HTML.
- **Frameworks:** Arduino, PADS - PCB, Altium Designer, Eagle, PSIM, AnSYS HFSS, Keysight EasyEXPERT, Keysight IC-CAP, Origin Pro, Adobe Photoshop, Adobe Illustrator, Solidworks, Cinema 4D.

Teaching Experience

- **Teaching Assistant** - "Introduction to Electrical Engineering" undergraduate course at IIT Delhi. *Aug - Nov 2019*

Positions of Responsibility

- **Technical Executive** - Makerspace (Design and Innovation Centre at IIT Delhi). *Aug 2018 - Present*
- **Coordinator** - Sportech '17 (Sports fest at IIT Delhi)

Associated Research Groups

- Natural and Artificial Intelligence through Transistors and Spintronics (NAITS) Group. link
- Design and Wafer Level Characterization Laboratory (DWLCL), IIT Delhi. link
- Embedded Systems Laboratory (ESL), EPFL. link

Other Interests

Lawn Tennis, Football, Jazz Dance, Graphics Designing, Poster Making, Video Editing, Poem writing