AMITABH YADAV

Electronics & Computer Engineer

Nationality: Indian · D.O.B. March 27, 1995

+1 (510)-333-7803 · *amitabhydv@gmail.com*

amitabhyadav · *amitabhydv*

SUMMARY

Graduate Researcher specializing in Computer Architecture, Circuit Design & Quantum Computing - a cheerful nerd who loves Vim, Linux, Mathematics, Physics, Computer Science and Problem solving.
Experienced in writing firmware and designing highly complex systems for critical applications in Space/Defense and Experimental Physics.

RESEARCH INTERESTS

- Computer Architecture and High-Speed Digital Design,
- Hardware/Software Co-Design,
- Circuit Design LTSpice/Cadence,
- Quantum Computing for ML/Physics Applications:
  Quantum Hardware Development, & Quantum Algorithms (QAOA, QLSA, QSVM, QITE, QNN etc).

EDUCATION

Delft University of Technology, Netherlands *September 2017 - August 2019*
Master of Science (M.Sc.) in Computer Engineering/EEMCS Overall GPA: 8.2/10.0

- Master Thesis: 'Micro-architecture Design for control of Spin Qubit Quantum Processor'.
  Thesis Grade: 9/10 (Duration: 1 year)
- Research Assistant: Quantum & Computer Engineering Lab, QuTech/TU Delft (8 months)
- Teaching Assistant:
  (i) 'The Building Blocks of a Quantum Computer: Part 1 & 2' MOOC on edx.org (12+ weeks).
  (ii) 'EE1D11 Digital Systems A: Programming in C' Spring 2019 Undergraduate Course (8 weeks).

University of Petroleum and Energy Studies, India *August 2013 - June 2017*
Bachelor of Technology (B.Tech.) in Electronics Engineering/EE Dept. Overall GPA: 3.1/4.0

- Final Year Project: 'Design & Simulation of 16-bit Microcontroller in VHDL/Xilinx ISE'.
  Project Grade: 4.0/4.0
- Pre-final Year Project: 'Embedded Hardware development for Audio Morse Code Encoder/Decoder'
  Project Grade: 4.0/4.0

St. Fidelis College, Lucknow *2012*
Senior Secondary School Overall Grade: 85.5%

St. Aloysius College, Pilibhit *2010*
High School Overall GPA: 9.4/10.0

RESEARCH EXPERIENCE

LBNL (Lawrence Berkeley National Laboratory) November 2019 - present
Research Associate - HEP.QPR (under H. Gray (PI), W. Lavrijsen, P. Calafiura) Berkeley, California

- Quantum Pattern Recognition Algorithms using Quantum Phase Estimation application for HEP Charged-Particle Track Reconstruction.
- Exploring feasibility on (a subset of) TrackML dataset.

QuTech/Intel Quantum Computing Lab September 2018 - August 2019
Master Thesis Research (under N. Khammassi (Intel, Oregon), K. Bertels (QuTech)) Delft, Netherlands

- Complete **CC-Spin Micro-architecture** development in Verilog, C and Tcl programming
- Central Controller (CC-Spin) hardware is connected in Star-topology with FPGA-controlled Direct Digital Synthesis (DDS) units via LVDS links for multi-channel synchronous waveform generation.
- Designed a Quantum Instruction Pipeline, Microcode Unit, 8b/10b Encoder/Decoder, SERDES, Timing Control Unit and SPI Master (DDS controller) to perform Qubit rotations with precise timing.
- Implemented the design on a Cyclone-V SoC-FPGA dedicated for translating the Instruction Set (QISA) to sequences of arbitrary I/Q and DC Pulses.
- Proposed a scalable micro-architecture of CC-Spin for NISQ-era Hybrid Quantum-Classical Algorithms.

DARE (Delft Aerospace Rocket Engineering) - Stratos-III October 2017 - July 2018
Electronics/Firmware Engineer - Core Team Member Delft, Netherlands

- Avionics Hardware development on ARM Cortex-M3/LPC1768 MCU and PCB Design of using Altium Designer 18 for Stratos-III Sounding Rocket.
- Writing firmware for ADC/DAQ in Assembly and C.
- Assisted Propulsion Team for manufacturing Sorbital, Paraffin & Aluminum based Solid Rocket Fuel.

CERN (European Organization for Nuclear Research) June 2017 - August 2017
Summer Student - ATLAS Pixel Group/EP-ADE-ID (under C. Solans, A. Sharma) Geneva, Switzerland

- Development of front-end DAQ firmware for FEI-4 Silicon Pixel Chip for ATLAS ITk on Xilinx KC705.
- Integrated IPBus (UDP/IP) (front-end monitoring) with 8b/10b encoded Rx/Tx Core to communicate with back-end Gigabit TRx (GBT) protocol. Developed the data_routing entity 'E_Link Bank'.
- Track routing for several PCBs in Altium Designer.
- Others: Summer Student Lectures, CERN Webfest - Co-developed an adaptable quiz application for iOS devices, CERN OpenLab Visits - ETH Zurich, OpenSystems and Google, Zurich.

BARC (Bhabha Atomic Research Center) June 2016 - July 2016
Project Trainee - Data Acquisition & Processing Systems Group (under A. Dohare) Mumbai, India

- Developed Compression and De-Noising libraries for A, B and C Scan Ultrasonic Scan Data for application in NDT of Materials.
- Achieved loss-less compression up to 75.37% in C-Scan data using information coding algorithms.
- Analyzed compression ratio & noise in Lossy compression for DCT, DFT and Wavelet Transform.
- Case-Study and performance comparison with Lempel-Ziv Compression algorithm.

ONGC (Oil & Natural Gas Corporation) Ltd. June 2015 - July 2015
Summer Intern - Geodata Processing & Interpretation Center (GEOPIC-HQ) Dehradun, India

- Study of Computer Networks, OSI Model and RAID Data Storage & Analysis at GEOPIC-Hq.

LIST OF PUBLICATIONS

1. Amitabh Yadav, Nader Khammassi, Carmina Almudever, Koen Bertels (2020) *"A Micro-architecture design for scalable control of Spin-Qubit Quantum Processor"* , TU Delft Education Repository. (Manuscript in preparation for arXiv)
2. K. Bertels, A. Sarkar, T. Hubregtsen, M. Serrao, A.A. Mouedenne, A. Yadav, A. Krol, I. Ashraf (2019) *"Quantum Computer Architecture: Towards Full-Stack Quantum Accelerators"* , arXiv: 1903.09575 (Accepted at DATE 2020)
3. Amitabh Yadav, Carlos Solans Sanchez, Abhishek Sharma (2017) *"FE-I4 Firmware Development and Integration with FELIX for the Pixel Detector"* . CERN Document Server, Meyrin, Switzerland.
4. Amitabh Yadav, Vivek Kaundal, Abhishek Sharma, Paawan Sharma, Deepak Kumar, Pankaj Badoni (2017) *"Wireless Sensor Network Based Patient Health Monitoring and Tracking System"* In Proceeding of International Conference on Intelligent Communication, Control and Devices (pp. 903-917). Springer, Singapore.

Book: Amitabh Yadav, Aritra Sarkar *"Quantum Computing Cookbook"*.
Packt Publishing Ltd. Birmingham,United Kingdom. ISBN: 978-1-83864-753-7. (August, 2020)

PATENT

1. Amitabh Yadav, Vivek Kaundal, Abhishek Sharma, Amit Kumar Mondal, Ravi Kumar Patel, Vindhya Devalla, Jitendra Kumar Pandey (2016) *"Patient Health Monitoring and Tracking System"*.
Indian Patent, Application No. 201611039333.

PRESENTATIONS

1. *"Quantum Hough Transform for Charged Particle Track Reconstruction"*. (January 7th, 2020)
Presented at Annual ATLAS LBNL Meeting 2020, Lawrence Berkeley National Laboratory, and University of California, Berkeley.

AWARDS

- Secured National Rank #1 for UPES jointly with IIT Madras, in the Critical Design Phase (Phase-II) of C130-J Super Hercules Aircraft Roll-On/Roll-Off Design Challenge.
Secured research grant (USD 65,000) by Lockheed Martin for design prototyping in collaboration with Tata Advanced Systems (TAS) Ltd Hyderabad, Indian Air Force (IAF) and National Disaster Response Force (NDRF).
- Achieved Rank 1st for Team Astral at International CanSat Competition 2017 held in Texas, USA, while acting as Technical Advisor to an excellent 10-member team of Junior and Sophomore students.
- Achieved Rank 4th (Rank #1 in Eurasia and Asia-Pacific) for Team Astral in the capacity of Team Leader (Electronics) at International CanSat Competition 2016 held in Texas, USA.
- Competed at the world's largest student-buit rocketry competiton IREC, as Chief Electronics and Payload Engineer of 'Kalam' Sounding Rocket, developed by Team Garud, Rocketry Division of UPES. Team Garud is the only Indian team to successfully launch a sounding rocket at IREC, till date.
- Ranked #1st at University Best Research Award 2017 for developing a IoT and Wireless Sensor Network based system for Landslide Forecasting in the Himalayan Regions, funded by UPES's Research Initiative for Students of Engineering (RISE) and in conducted in collaboration with ISRO-Indian Institute of Remote Sensing (IIRS).
- Ranked #8th at University Best Research Award 2016 for developing a Wireless Sensor Network for Heath Monitoring and Indoor Location Tracking, funded by UPES's Research Initiative for Students of Engineering (RISE).

NATIONAL & INTERNATIONAL LEADERSHIP

Lockheed Martin Roll-On/Roll-Off Design Challenge August 2015 - May 2017
Chief Electronics Engineer (Phase II/Critical Design Phase) *New Delhi & Washington D.C.*

- Developed the detailed technical design of Aerial Surveillance System, Payload Control and Communication System. Presented to CEO, Lockheed Martin and US Air Force at FICCI, New Delhi.
- Excelled with National Rank 1 in the Critical Design Phase (Phase-II) and secured a research grant by the Aerospace and Defense giant, Lockheed Martin (USD 25,000 + USD 40,000) to manufacture the prototype payload structure for C-130J Super Hercules Military Aircraft.
- The payload design is intended for disaster relief operations by accelerating the response time in the **'Golden Hour'** by the Indian Air Force (IAF) and National Disaster Response Force (NDRF).
- Made headlines through The Pioneer, The Hindu, Indian Defense Review, Tribune etc. **"The UPES team, Tesseract, beat IIT Delhi, DTU and BITS, Pilani, to emerge as the national winner of the Lockheed Martin aerospace design challenge.** (Tribune March 22, 2016)

Intercollegiate Rocket Engineering Competition (IREC) 2017 August 2016 - May 2017
Chief Electronics and Payload System Engineer *Spaceport America, New Mexico, USA*

- Developed the avionics and telemetry systems in the Sounding Rocket 'Kalam' (dedicated to the 11th President of India, Dr. APJ Abdul Kalam) for Team Garud (Rocketry Division of UPES).
- Development of electronics for payload - a custom built conceptual combination of Hexapod and Hexacopter, demonstrating 'Multi-Terrain Vehicle for Planetary Research'
- All payload electronics systems are implemented using triple-modular redundancy concept.
- 'Kalam' is a 2.8 meters tall, carbon fibre built (with Titanium Nose-cose tip), COTS Solid-propellant based sounding rocket, designed for altitude range of 10km AGL and speed upto 1 Mach, capable of carrying scientific payloads weighing up to 4 kg (8.8 pounds).
- Presented the design to Former Director General of the Defence Research and Development Organisation (DRDO), Dr. V. K. Saraswat.
- IREC, conducted by ESRA, SpaceX, Northrop Grumman & Spaceport America, hosts global participation from 100+ universities.

Cansat Competition (U.S. Naval Research Lab, NASA, JPL) August 2014 - June 2017
Technical Advisor 2017, Team Leader (Electronics) 2016, Team Member 2015 *Texas, USA*

CANSAT 2017 (Advisor)	Achieved International Rank#1 (96.32%) out of 96 teams. Developed *'Venus Glider'*, a helical gliding payload weighing under 500g with real-time video feed at ground. **"Indian students grab first position in global aerospace competition in Texas."** (India Today)
CANSAT 2016 (Leader)	Lead the development & integration of Sensor Subsystem, Telemetry System and real-time decent monitoring system by Ground Station for the mission payload, *'Mars Glider'* (500g). International Rank of 4th out of 72 teams. (**Report**) **"Indian Students present epic CanSat System at Global Aerospace Competition in Texas, and it left NASA absolutely stunned."** (Business Insider)
CANSAT 2015 (Member)	Developed the Sensor Subsystem (Arduino MCU) and Ground Control Station (MATLAB based GUI) for the Mission Payload, *Auto-Gyro Recovery Imager* (weighing under 500g). International Rank#13 out of 43 teams. (**Video**)

ACADEMIC PROJECTS

- Running Shor's Algorithm on IBM Quantum Experience using IBM-Q QISKit. (GitHub)
- BICMOS5 Fabrication & Measurement of IC parameters in EKL Cleanroom, TU Delft. (16 hours)
- OpenCL implementation of Smith-Waterman Algorithm for Protein/DNA Sequencing.
- Performance improvement of Plasma processor core (opencores.org) in VHDL.
  (Processor Design Project)
- Parallel Poisson Solver on Distributed Memory HPC cluster using MPI.
  (High Performance Computing)
- Design and Jitter Analysis of Quadrature Phase By-6 frequency divider in Cadence Spectre.
  (Digital IC Design)
- Development of Classic Snake Game using Software Design Patterns in Java.
  (ATHENS Programme 2017)
- University-Funded research projects (INR 45,000) on Wireless Sensor Network system
  (i) Landslide Forecasting for Himalayan Range [UPES Research Award 2017: Rank #1st]
  (in collaboration with Indian Institute of Remote Sensing)
  (ii)Patient Monitoring and Tracking System. [UPES Research Award 2016: Rank #8th]
- Project Geo-Rover: Digital mapping of a geographical area using Land robots and UAVs. The prototype was put on Exhibition in the International SPE (Society of Petroleum Engineers) Fest at UPES in 2015 for college students and international participants.

POSITION OF RESPONSIBILITY

Directorate of Student Affairs (DSA) August 2016 - March 2017
Head, UPES Discipline Committee (DC) *University of Petroleum and Energy Studies*

- Handled all student grievances and supervised safety regulations during Cultural & Technical fests.
- Spearheaded a team of 100+ active DC members across College of Engineering Studies, UPES to successfully ensure Anti-Ragging, Gender Sensitization, Anti Substance Abuse, and Road Traffic Safety.
- Served as a DC Member for the duration March 2014 - August 2016

Department of Electronics Engineering August 2013 - June 2017
Class Representative (CR) *University of Petroleum and Energy Studies*

- CR is an annually elected position for 4 students based on majority voting in class.
- Served as CR of Electronics Engineering (class of 2017) for all 4 years of undergraduate studies.
- Responsibilities include (but not limited to), handling academic/administrative inquiries, information dissemination and job-placement; representing the class at university/departmental meetings etc.

UPES-IEEE Student Chapter August 2016 - Nov 2017
IT & Design Head *University of Petroleum and Energy Studies*

- Served as committee member of university's IEEE Student Chapter headed by President, Tanmay Jain.
- Planned and Maintained UPES-IEEE website, organized online activities and managed the forum.
- Designed Posters for various events and talks organized by the IEEE Chapter.

Ignite 2015 - Annual Techno, Legal & Management Fest Nov 2014 - Feb 2015
IT & Design Manager *University of Petroleum and Energy Studies*

- Managed website, online registrations and posters designs for various events and talks during the fest.

CERTIFICATIONS

Summer Schools/Workshops

- 'The Quantum Wave in Computing', held Jan 14 - May 15, 2020 at Simons Institute for the Theory of Computing, University of California, Berkeley.
- 'Integrating ARQC Research to Deliver Scientific Discovery Quantum Computing Workshop: FAR-QC Track', held at Lawrence Berkeley National Laboratory, December 3-5, 2019.
- 'Quantum Information for Developers 2018' Summer School at Institute for Theoretical Physics, D-PHYS, ETH Zurich.
- 'Quantum Computing for High Energy Physics' Workshop (November 2018) at CERN, Geneva.
- 'Quantum Computing Meetup' (April 2019), at IBM Watson IoT Tower, Munich.
- 'TUD15 Software Design Patterns' 2018 at ATHENS Programme
- Embedded Design Workshop 2016 by Prof. D.V. Gadre. (Texas Instruments Lab, NSIT Delhi)
- Network Security and Ethical Hacking Workshop 2015 (Nettech Pvt. Ltd.)

MOOCs

- Particle Physics: An Introduction (University of Geneva, Coursera) - 2017
- Quantum Cryptography (TU Delft & Caltech, EDX) - 2018
- Quantum Machine Learning (University of Toronto, EDX) - 2019
- Advanced Algorithmics and Graph Theory with Python (Institut Mines-Tlcom, EDX) - 2019

TECHNICAL STRENGTHS

Programming Languages	C/C++, Java, Python (SciPy, NumPy, MatPlotLib), CUDA, OpenCL, MPI, MATLAB, Verilog, VHDL and HTML/CSS/Javascript
Software & Tools	Quartus Prime, Vivado/ISE, SolidWorks, LTSPICE, Altium Designer, LaTeX, Cadence Spectre, QISKit, rigetti Forest
OS	Windows, OSX, Linux(Ubuntu, Scientific Linux, BusyBox & Raspbian)
Laboratory	EKL (Class-10 IC Cleanroom), Embedded Hardware and Robotics Lab
Rapid Prototyping	Lathe, Welding (Gas and Arc), 3D printing, Fibre Glass moulding,

EXTRA-CIRRUCULAR

- Student Member - IEEE, IEEE Computer Society
- EEMCS, TU Delft Blogger 2017-18. (amitabh.weblog.tudelft.nl)
- Cross Country Cycling - Around Lac Leman (185km), Vlaadingen to Delft (115 km) etc.
- Volunteering: 10th Uttarakhand State Science and Technology Congress 2015-16.
  1st International Conference on Intelligent Communication, Control and Devices 2016.

PERSONAL DETAILS

- **Current Address:** 2020 Kittredge St. Apt. 304, Berkeley, CA 94704.
- **Hometown:** Varanasi, Uttar Pradesh, INDIA.
- **Languages:** Hindi and English.

Note: denotes a clickable hyperlink (in PDF).