Divas Subedi

Curriculum Vitae

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Education

B.S. in Engineering and Physics

Jan 2019 - May 2022

Trinity College — *Hartford, CT, USA*

- Cumulative GPA: 4.1
- **Physics Senior Project: Analysis of BB84 Quantum Key Distribution Algorithm**
- Engineering Senior Project: Biometric Signature Authentication
- **Relevant Training: Undergraduate School on Experimental Quantum Information Processing (USEQIP) at UWaterloo IQC**

Relevant Courseworks

- **Algorithms and Introduction to Quantum Computing**
- Quantum Mechanics
- Abstract Algebra
- Applied Linear Algebra
- Probability
- Electrodynamics
- Digital Signal Processing
- Relativity and Fundamental Particles

Research Experience

Summer Internship in Science & Technology (SIST)

Fermi National Accelerator Laboratory, Particle Physics Division — *Batavia, IL, USA*

Quantum Sensor for detection of Dark Matter [T2][P5] *May 2022 - Aug 2022*

- Utilized Geant4 (G4CMP) to simulate the generation and transport of phonons resulting from the Beyond Standard Model interaction of light Dark Matter with Silicon.
- Identified and documented bugs in the G4CMP library, enhancing the accuracy and completeness of the phonon simulation by rectifying the code and integrating additional physics principles.
- Analysed hit profile of phonon to create visualisations of phonon transport in crystals using Python.

Ground Impedance Monitor for DUNE [T1][P2] *May 2021 - Aug 2021*

- Designed and coded firmware for ground impedance monitor (GIZMo) for isolation of ground for Deep Underground Neutrino Experiment (DUNE) far side detector.
- Implemented signal processing models in FPGA for real-time impedance monitoring.
- Created and maintained a codebase using LTSPICE and Python that implements the L-BFGS algorithm to optimize circuit element parameters, enabling precise calibration of the impedance monitor by identifying optimal inductor ranges for the parasitic capacitor of the far-side detector.

Undergraduate Researcher

Trinity College, Department of Engineering — *Hartford, CT, USA*

Biometric Signature Authentication [C5,C7][P4,P6] *Sep 2021 - Feb 2023*

- Conceptualized and developed an accelerometer-integrated stylus that authenticates users by analyzing the inertial data captured during the signature execution process.
- Developed a high-speed data collection for embedded sensors using C, enabling real-time communication with the Raspberry Pi.
- Crafted a set of manual features from time-series signal data for classification using MATLAB.
- Implemented neural network, using manually crafted features, capable of authenticating users with 94% accuracy.

Vibration-based Contact Sensing [C3,C4][P3] *May 2020 - Sep 2021*

- Conceptualized and designed a novel low-cost vibration-based contact sensor utilizing an off-the-shelf accelerometer, with focus on cost-effectiveness and miniaturization.
- Developed a mathematical model for the rod's motion within the research apparatus, playing a crucial role in determining the system identification (SID) and crafting manual features for classification.
- Implemented a convolutional neural network (CNN) using MATLAB and Python to classify contact location with accuracy of 95%.

Haptic Interface for Robot Locomotion [J1] *Sep 2020 - Dec 2020*

- Developed a haptic telelocomotion interface for controlling a hexapedal robot using Python and Chai3D, enabling users to experience realistic force feedback during locomotion.
- Implemented gait trajectories based on haptic device configurations, generating appropriate force feedback to enhance user control and immersion.
- Designed an experimental procedure for users to operate the hexapedal robot and devised a scoring method to evaluate the performance of haptic feedback controller against keyboard and joystick.

Vision-based force-feedback in RMIS [C2] *Jan 2020 - Mar 2020*

- Examined the performance of haptic feedback in Robot-Assisted Minimally Invasive Surgery using simulated tissue.
- Developed mathematical models for node-to-node interaction within mesh used for modeling tissue surfaces.
- Implemented statistical models to analyze user study data using R.

Semiconductor Device Modeling [C1][P1] *May 2019 - Aug 2019*

- Led a comprehensive study utilizing COMSOL Multiphysics to evaluate the effects of constant-field scaling on FIBMOS compared to conventional MOSFETs in nanometer regime.
- Designed simulation to reproduce and expand on work by Shen et al. (1998) on 122.5-nm to 350-nm channel-length devices.
- Analyzed results showcasing FIBMOS's superiority in threshold voltage stability, enhanced output resistance, resistance to punch-through effects, and mitigating hot electron degradation compared to traditional MOSFETs.

Publications

Journal Publication

[J1] K. Huang, **D. Subedi**, R. Mitra, I. Yung, K. Boyd, E. Aldrich, and D. Chitrakar, "Telelocomotion—Remotely Operated Legged Robots", *Applied Sciences 2021*, vol. 11, no. 1:194.

Conference Publications

[C7] **D. Subedi**, D. Chitrakar, I. Yung, Y. Zhu, Y. Su, K. Huang, "Biometric Signature Authentication with Low Cost Embedded Stylus", *2023 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM)*, Seattle, WA, USA, 2023.

[C6] **D. Subedi**, W. Jiang, R. Rahman, H. Zhang, K. Huang, Y. Su, "Smoothness Constrained Curiosity Driven Multicamera Trajectory Optimization for Robot-Assisted Minimally Invasive Surgery", *2023 International Symposium on Medical Robotics (ISMR)*, Atlanta, GA, USA, 2023.

[C5] **D. Subedi**, I. Yung, D. Chitrakar, K. Huang, "Inertial-Measurement-Based Biometric Authentication of Handwritten Signature", *2022 44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, Glasgow, Scotland, United Kingdom, 2022.

[C4] **D. Subedi**, E. Schoemer, D. Chitrakar, Y. Su and K. Huang, "Contact Location via Active Oscillatory Actuation", *2022 IEEE/SICE International Symposium on System Integration (SII)*, Narvik, Norway, 2022.

[C3] R. Mitra, K. Boyd, **D. Subedi**, D. Chitrakar, E. Aldrich, A. Swamy, and K. Huang, "Contact Sensing via Active Oscillatory Actuation", *2020 3rd International Conference on Mechatronics, Robotics and Automation (ICMRA)*, Shanghai, China, 2020.

[C2] K. Huang, D. Chitrakar, R.Mitra, **D.Subedi**, and Y. Su, "Characterizing Limits of Vision-Based Force Feedback in Simulated Surgical Tool-Tissue Interaction", *2020 42nd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, Montreal, QC, Canada, 2020.

[C1] **D. Subedi** and D. A. Fixel, "MOSFET Channel Engineering and Scaling Study using COMSOL® Multiphysics Simulation Software", *2019 COMSOL Conference*, Boston, MA, USA, 2019.

Technical Reports

[T2] **D. Subedi**, K. Stifter, "Quantum Sensor for detection of Dark Matter", *Fermilab Summer Internships in Science & Technology (SIST)*, Batavia, IL, 2022.

[T1] **D. Subedi**, M.J. Utes, P.M. Rubinov, "GIZMo for DUNE at LBNF", *Fermilab Summer Internships in Science & Technology (SIST)*, Batavia, IL, 2021.

Presentations

[P6] "Biometric Signature Authentication with Low Cost Embedded Stylus", *2023 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM)*, Seattle, WA, USA, June 29, 2023.

[P5] "Quantum Sensor for detection of Dark Matter", *Fermilab Summer Internships in Science & Technology (SIST)*, Batavia, IL, August 12, 2022.

[P4] "Inertial-Measurement-Based Biometric Authentication of Handwritten Signature", *2022 44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, Glasgow, Scotland, United Kingdom, July 14, 2022.

[P3] "Contact Location via Active Oscillatory Actuation", *2022 IEEE/SICE International Symposium on System Integration (SII)*, Narvik, Norway, January 9, 2022.

[P2] "GIZMo for DUNE at LBNF", *Fermilab Summer Internships in Science & Technology (SIST)*, Batavia, IL, August 9, 2021.

[P1] "MOSFET Channel Engineering and Scaling Study using COMSOL Multiphysics Simulation Software", *2019 COMSOL Conference*, Boston, MA, USA, October 2, 2019.

Teaching Experience

Teaching Assistant

Jan 2020 - May 2022

Trinity College — *Hartford, CT, USA*

- Lead lab and recitation sections for 15-20 students in varying levels of physics, engineering and computer science classes, fostering an interactive and engaging learning environment.
- Provided personalized one-on-one mentorship to students, focusing on helping student find their learning style.
- Developed fair rubrics and accurate solutions in order to grade students' assignments.

Leadership & Community Involvement

President: IEEE Student Chapter

Jan 2020 - May 2021

Trinity College — *Hartford, CT, USA*

- Revived a dormant IEEE chapter, increasing membership and activity; secured regular funding for the chapter.
- Acted as the principal liaison, facilitating effective communication between the Connecticut section of IEEE and the Trinity chapter.
- Organized a TechSavvy LEGO robot programming workshop for about 50 students, inspiring middle school girls in STEM.
- Coordinated TryEngineering program, connecting college students with underprivileged kids through STEM pen-pal projects.

Treasurer: Society of Physics Students

Sep 2019 - May 2022

Trinity College — *Hartford, CT, USA*

- Conceived and led "Physics in Films" evenings, attracting over 10 participants per session to critically assess and discuss the portrayal of physics in cinema.
- Supported the organization of various events by managing finances, contributing to successful student-run events such as weekly Physics Coffee, major information sessions, and alumni panels.

Member: SPECTRUM *Sep 2022 - Present*

Fermi National Accelerator Laboratory *Batavia, IL, USA*

- Organized lab activities such as intern luncheons, fostering a welcoming and inclusive environment for LGBTQIA+ communities.
- Assisted in organization of the 2023 Pride Parade, contributing to the visible presence of Spectrum and promoting LGBTQIA+ awareness within and beyond the Fermilab community.
- Attended and contributed to discussions on policy-making related to diversity and inclusion, advocating for equitable and respectful practices within Fermilab.

Skills

Programming Python (Qiskit, SciPy, TensorFlow, Pandas), MATLAB, C, C++, R, Mathematica, C#, Java
Softwares Geant4, COMSOL,SPICE, Github, Linux, Jupyter, ROS, LaTeX, Unity3D
Hardwares FPGA, Raspberry Pi, Arduino, Data Acquisition and Timing systems

Honors & Awards

The Physics Senior Prize, Excellence in physics at advanced undergraduate level *Trinity College* *May 2022*
The Travelers Companies Foundation Senior Research Prize, Best engineering senior project *Trinity College* *May 2022*
President's Fellow for Physics, Nominated senior for outstanding achievement within the major *Trinity College* *Nov 2021*
Thomas Holland Scholarship, For high academic rank in class *Trinity College* *Aug 2021*
The Albert J. Howard, Jr. Prize, Excellence in physics among the junior class *Trinity College* *May 2021*
The Theodore R. Blakeslee II Award, Excellence as TA in engineering *Trinity College* *May 2021*
The Junior Engineering Book Prize, Excellence in engineering among the junior class *Trinity College* *Nov 2021*
The Phi Gamma Delta Prize in Mathematics, Outstanding achievement in second year Mathematics *Trinity College* *May 2021*

Other Work Experience

Software Developer *Sep 2022 - Present*

Fermi National Accelerator Laboratory *Batavia, IL, USA*

- Developed and maintained a complex Denodo data virtualization codebase with over 10,000 lines of code, implementing new features for real-time data integration and performance optimization.
- Collaborated closely with software operations teams, swiftly diagnosing and resolving production bugs that impacted critical data pipelines.