S. Ranjan Mishra

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SUMMARY

Mechanical engineer with 5+ years of hands-on experience across design, prototyping, and manufacturing in regulated medical and industrial environments. Specialized in finite element modeling, product optimization, and V&V testing. Proven ability to lead multidisciplinary teams, integrate simulation with prototyping, and deliver validated hardware. Open to full-time roles and relocation; publications and references available upon request.

SKILLS

Product Development:	Conceptual Design, Design for Manufacturability, DFMEA, 3D Prototyping, Design Optimization.
Simulation & Testing:	MATLAB, COMSOL, SolidWorks, MATLAB, FEA, Excel, Python, Bench Testing, V&V.
Project Execution:	Agile Development, BOM Planning, Test Protocols, CAD Documentation, SOPs.
Prototyping:	FDM, SLA, Laser Cutting, CNC, Milling, Casting, Molding, Powder Coating.

WORK EXPERIENCE

Hospital for Sick Children | Research Assistant (Contract)   **Toronto, ON. | 05/2023 – 04/2025**

- Designed an **AI based non-invasive ventilator prototype** for pediatric use; aligned with ISO 13485 and IEC 60601-1 standards.
- Built a cardiopulmonary simulation model; improved parameter tuning for **patient-specific ventilator support**.
- Developed a real-time ML algorithm; achieved >**92%** accuracy in respiratory demand prediction.
- **Led benchtop V&V tests**; validated pressure and flow profiles for clinical readiness.
- Created Power BI dashboards to visualize airflow, compliance, and pressure trends for clinicians.
- Contributed to **2 peer-reviewed publications** supporting device safety and performance claims.

University of Toronto | Research Assistant (PhD)   **Toronto, ON. | 05/2021 – 04/2025**

- Prototyped a PVDF-based sensor with ±0.35 V accuracy; **cut simulation time by 60%** using surrogate models.
- Reduced design cycle time by **40%** through three rounds of rapid prototyping and bench testing.
- Achieved **95%** match between COMSOL simulations and physical test data across **30+ design iterations**.
- Integrated FEA outputs, benchtop data, and design history files into a unified dataset to enable longitudinal performance tracking.
- Invented the **Design Readiness Level (DRL)** model to quantify multi-domain readiness, improving granularity by **5x** over traditional models.
- Published **4+ peer-reviewed articles**, supervised **8 multidisciplinary student teams**, and managed lab operations and infrastructure for iterative testing.

University of Toronto | Research Assistant (MASc.)   **Toronto, ON. | 08/2019 – 04/2021**

- Evaluated **20+ ventilator prototypes** for usability and compliance during COVID-19 emergency response.
- Built a scoring tool mapping features to FDA EUA, ISO 80601, and Health Canada product emergency use compliance.
- Cut review time by **40%** using modular checklists for rapid risk and compliance assessment.
- Developed **Excel + Python** dashboards to support triage and procurement decisions.
- **Invited by *HardwareX* to publish findings**; results informed public procurement and emergency ventilation strategies.

EDUCATION

University of Toronto   **Toronto, ON. | 05/2021 – 04/2025**
PhD Mechanical and Industrial Engineering | GPA: 3.5+

CERTIFICATIONS AND TRAINING

Foundations: Data, Data Everywhere - Google Data Analytics	**Data Science & Business Analytics** – University of Toronto
Ask Questions to Make Data-Driven Decisions - Google Data Analytics	**Business Process Management & Lean Six Sigma** – BKO Accreditation
Preparing Data for Analysis with Excel - Microsoft	**Power BI for Business Intelligence (Foundational)** – Microsoft

RELEVANT PROJECTS

AI Controlled Non-Invasive External Ventilator (NIEV) for Fontan Patients *(Patent Pending)*
Tools: COMSOL, SolidWorks, Python (Surrogate Models), Power BI, Excel

- Designed and prototyped a **biphasic negative-pressure ventilator** for Fontan patients; built using **lightweight materials (<2.5 kg).**
- Integrated **smart/manual control logic** using Arduino; achieved **<50 ms system response time** under dynamic load.
- Developed a **0D Fontan physiology model** to simulate patient-specific circulation and guide controller tuning.
- Conducted structural and functional V&V through **bench and simulation testing**, supporting early regulatory evaluation.

Energy Harvesters for Biomedical Applications
Tools: COMSOL, MATLAB, SolidWorks, Python

- Led design of **thin-film piezoelectric energy harvesters** for wearable biosensors; secured **$5000 CGCA grant**.
- Simulated multiphysics interactions to optimize **film layout and mechanical-electrical coupling**.
- **Published results in Actuators (MDPI);** contributed to lab-wide strategies for embedded energy systems.

Reverse Engineering of Open-Source FDM 3D Printer
Tools: SolidWorks, AutoCAD, FDM Prototyping

- Reverse-engineered key modules of a low-cost FDM printer to improve **print precision and part stability**.
- Redesigned extrusion, heated bed, and motion system for **better manufacturability** and reduced mechanical drift.
- Lowered **bill of materials cost by 15%**, enabling **cost-effective in-house fabrication** for academic use.

TECHNICAL LEADERSHIP & KNOWLEDGE TRANSFER

University of Toronto | Teaching Assistant   Toronto, ON. | 05/2021 – 04/2025

- Mentored **20+ capstone teams** in systems design, guiding iterative development using lean startup and agile principles.
- Facilitated innovation labs for **100+ students**, resulting in **12 validated product concepts** selected for prototyping.
- Provided structured feedback on user research, risk analysis, and design feasibility in team-based product development.

Research Laboratory (ARL-MLS) | Lab Manager   Toronto, ON. | 05/2021 – 05/2023

- Decommissioned **50+ obsolete instruments**, reclaiming **200+ sq. ft.** and cutting lab utility costs by **8%**.
- Reduced onboarding time by **3 days** by introducing lab manuals, SOPs, and safety protocols for new researchers.
- Managed daily operations, equipment usage, and hazard compliance to meet institutional safety standards.
- Led web content strategy for lab communications, improving internal visibility and increasing site traffic from collaborators.

INTERNSHIPS

Infuse 3D | Business Development Partner   Hyderabad, IN. | 05/2019 – 08/2019

- Delivered **40% revenue growth** by aligning custom 3D printing with client product needs.
- Supervised **CNC, milling, welding, and coating operations** to ensure build quality and on-time delivery.
- Executed **full-cycle fabrication** of a **custom Royal Enfield bobber**; met all design and tolerance specs.

Maker Global 3D | Rapid Prototyping Engineer   Hyderabad, IN. | 12/2018 –05/2019

- **Led reverse engineering** efforts to improve product models for cost efficiency and manufacturability.
- Reduced **material waste by 15%** and accelerated **development time by 20%** using improved FDM parameterization.
- Redesigned a UVGI sterilizer to enhance scalability and **cut unit production cost by 42%.**

Central Institute for Tool Design | Mechanical Engineer in Training   Hyderabad, IN. | 05/2017 –07/2017

- Contributed to high-precision tooling projects, gaining exposure to design validation, safety protocols, and QA checks.
- Developed SOPs and technical documentation to support standardized machining and inspection workflows.

ACHIEVEMENTS

Winner, Connaught Global Challenge Award
Led a 3-member team in designing energy harvesters for wearable biosensors (2021)

Award Mentor, John Senders Capstone Award
Supervised winning design teams across 3 consecutive years (2022–25)