Dipesh Budhathoki

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Professional Focus

Bridging mechanical systems, automation, and machine learning to deliver robust, validated solutions in manufacturing, mobility, and applied robotics.

Education

University of Cincinnati Cincinnati, OH
M.S. Mechanical Engineering (Robotics & AI Focus) *Aug 2023 – May 2026 (Expected)*

- GPA: 3.95 / 4.00
- Coursework: Robotics Dynamics & Control, Introduction to Robotics, AI & Machine Learning, Statistical Quality Control, Decision Engineering.

Institute of Engineering, Tribhuvan University Nepal
B.E. Mechanical Engineering *Nov 2013 – Dec 2017*

- Merit-based national admission (Ranked **56 / 15,000+** candidates)
- Senior Thesis: Design, Fabrication, and Testing of a Three-Wheeled Hybrid Electric Vehicle
- Awarded **Best Final-Year Project**

Publications

Budhathoki, D., et al. *Modeling and Performance Analysis of a Three-Wheeled Hybrid Electric Vehicle.* International Research Journal of Engineering and Technology (IRJET), Vol. 9, Issue 12, 2022.

Research Experience

BEARCATs Lab, University of Cincinnati Cincinnati, OH
Graduate Research Assistant *Jan 2024 – Present*

- Developing Gaussian Process Regression (GPR) models to predict knee joint torque from multi-joint gait kinematics.
- Achieved ∼**95% predictive accuracy** on stance-phase torque estimation using limited subject-specific data.
- Systematically evaluated influence of kernel choice and prior information on model stability and generalization.
- Investigating hybrid model-based + data-driven control strategies for wearable rehabilitation robotics.
- Targeting reduced calibration strides and real-time inference feasibility for embedded controllers.

Industry & Professional Experience

P&G Digital Accelerator @ the University of Cincinnati Cincinnati, OH
Graduate Research Assistant — Data Engineering & Analytics *May 2024 – May 2025*

- Worked under industry mentorship focusing on manufacturing data engineering and analytics.
- Converted complex KNIME workflows into optimized SQL and PySpark pipelines in Azure Databricks.
- Built end-to-end ETL pipelines integrating **Production, Quality Variance, Downtime, and Packaging** datasets.
- Performed exploratory data analysis and feature engineering on large-scale transactional data.
- Identified high-downtime process orders, contributing to a documented ∼**20% improvement in plant efficiency**.
- Developed automated workflows and Power BI dashboards to support operations and R&D decision-making.

Graduate Research Assistant — Deep Learning & Physics-Informed Neural Networks *May 2025 – Present*

- Developing hybrid deep learning frameworks integrating past experimental data with governing PDEs (rheological properties of material) using PyTorch.
- Implementing Physics-Informed Neural Networks (PINNs) with NVIDIA PhysicsNeMo to model physical processes.
- Designed custom loss functions combining data-driven and physics-based constraints, reducing required training data by ∼**50%**.
- Evaluating model generalization, stability, and deployment feasibility for experimental process optimization.

National Innovation Center (NIC) Kathmandu, Nepal
Research Engineer — Electric Vehicle Systems *May 2019 – Nov 2020*

- Developed mathematical and Simulink-based models of EV powertrains for performance and energy analysis.
- Designed battery enclosures, motor mounts, and drivetrain layouts using SolidWorks.
- Built and operated test benches for torque, voltage, thermal, and regenerative braking characterization.
- Supported feasibility analysis for diesel-to-electric vehicle conversion projects in mountainous terrain.

Aqysta Nepal Pvt. Ltd. Lalitpur, Nepal
Research & Experimentation Engineer *Jan 2018 – Apr 2019*

- Converted traditional water-wheel hydro-pumps into solar-powered pumping systems within **6 months**.
- Supervised installation of Barsha pumps across **20+ river sites** in Nepal.
- Led field testing and performance evaluation across varying flow and terrain conditions.

Entrepreneurship & Leadership

Auzaar Innovation Pvt. Ltd. Kathmandu, Nepal
Co-Founder & CEO *Dec 2020 – Aug 2023*

- Led a multidisciplinary team of **5 engineers** developing EV conversion systems and agri-mechanical equipment.
- Secured **$40,000+** in funding from government and non-profit research institutions.
- Designed and installed electric wool-ball dryers and food dehydrators across multiple deployment sites.

Ministry of Social Development, Bagmati Province Nepal
Principal Investigator & Mechanical Engineer *Nov 2020 – Sept 2022*

- Converted diesel safari vehicles to electric inside Chitwan National Park.
- Secured **$20,000** through the Youth Scientist Encouragement Fund.
- Delivered **2 fully operational EV prototypes** currently in service.

Selected Projects

- **Autonomous Mobile Trash Collection & Disposal Robot (ROS/Gazebo)** — Designed and simulated an autonomous service robot capable of navigating a household-like environment, collecting trash, depositing it into a designated dumpster, and returning to its starting location. Implemented hybrid control using laser, IMU, and odometry sensors with reactive obstacle avoidance and path-planning comparison (with and without planning). Github
- **Optimized Path Planning for Mobile Robots using Metaheuristic Algorithms** — Developed a modified A*-inspired path-planning framework optimized using PSO, TLBO, Firefly Algorithm, and Biogeography-Based Optimization. Evaluated performance based on minimum distance and minimum turns in grid-based environments through extensive MATLAB simulations; demonstrated superior convergence and optimality using TLBO. Github
- **Physics-Informed Deep Learning for Industrial R&D (P&G)** — Developed hybrid PINN frameworks combining sparse sensor data with governing PDEs to model physical processes; reduced experimental data requirements by $\sim$**50%** while maintaining model fidelity.

Technical Skills

Programming & Data: Python, SQL, PySpark, MATLAB, C++, Pandas, NumPy, Scikit-learn
Machine Learning: GPR, XGBoost, SHAP, PINNs, PyTorch, TensorFlow
Robotics & Control: Kinematics, Dynamics, Kalman Filters, ROS, Gazebo
Engineering Tools: SolidWorks, ANSYS, Simulink, Azure Databricks, KNIME, Power BI, Git

Extracurricular Activities

- Treasurer, Graduate Student Association — Mechanical & Materials Engineering, University of Cincinnati
- Active Member, International Partners & Leaders (IPALs), University of Cincinnati
- Volunteer mentor for international student orientation and peer support programs

Certifications

Data Scientist Nanodegree — Udacity