Biraj Kharel

Mechanical Engineer

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PROFESSIONAL INTEREST

Dynamic Modeling and Control of Energy Systems
CFD for aerodynamic optimization and thermal management.
Predictive Energy Management Systems for Electric and Hybrid Vehicles
Vehicle Control Systems and Real-World Testing/Validation
System Identification and Data-Driven analysis in Energy Systems

EDUCATION

Bachelor's in Mechanical Engineering, *Kathmandu University, Dhulikhel,2023* GPA: 3.47/4

MAJOR COURSES

Calculus and Linear Algebra, Advanced Calculus, Differential Equations & Complex Variables, Statistics and Probability, Structured Programming, Object-Oriented Programming, Numerical Methods, Entrepreneurship Development

WORK EXPERIENCE

Research Assistant, *Energy Systems and Technology Research Laboratory (ESTRL), Aug 2023 - Present*
- Conducted system-level research and modeling for EVs and PHEVs, integrating energy optimization, performance analysis, and sustainable transportation strategies.
- Designed and fabricated a modular vehicle (camper, truck, SUV) to meet diverse transportation needs in rural areas, applying fabrication techniques and ideas for interchangeable parts to allow for easy customization.
- Led simulation and fabrication efforts on a project to convert an ICE bus to a fully electric bus, achieving significant emissions reductions and energy savings.
- Collaborated with SAJHA YATAYAT in Nepal to implement a parallel-hybrid conversion, enhancing fuel efficiency and local economic opportunities.

Internship at Heavy Equipment Divison, *Department of Roads, Government of Nepal, Jan 2023 - Mar 2023*
- Learned to perform routine maintenance on heavy and light vehicles (trucks, bulldozers, excavators), ensuring operational safety and efficiency by diagnosing and repairing mechanical issues such as engines, transmissions, and brakes.
- Gained experience in diagnosing mechanical faults and assisting senior engineers with complex repair jobs, enhancing problem-solving and technical skills while maintaining detailed maintenance records.
- Acquired hands-on skills in lathe operations, arc welding, and forklift operation, applying these techniques as needed for vehicle repairs and maintenance tasks.

Research Intern, *Energy System and Technology Research Laboratory (ESTRL), Jan 2022 - Dec 2022*
- Gained hands-on experience with MATLAB, Scilab, Ansys, Fusion 360, and SolidWorks while learning mathematical modeling, simulations, structural analysis, and 3D design techniques.
- Applied these skills to analyze and optimize electric vehicle components through thermal, structural, and performance simulations, enhancing design accuracy and efficiency.
- Developed project management and communication skills by organizing seminars, conferences, and training, facilitating collaboration and knowledge exchange within the lab.

Vehicle Optimization and Design Team, Shell Eco Marathon, Indonesia, *Team Junkiri*
- Participated in the Shell Eco-Marathon Asia 2022, a global energy efficiency competition held in Lombok, Indonesia.
- Designed a lightweight, aerodynamic three-wheeler vehicle using SolidWorks.
- Led the technical team in vehicle fabrication, engine installation, and EFI tuning.
- Conducted structural and aerodynamic analyses using Ansys Workbench to ensure efficiency and reliability.
- Ensured the vehicle passed rigorous technical inspections and successfully competed in the event.

Teaching Instructor, *Prerana English Boarding High School, 2017-2018*
- Mathematics, Science, Opt. Mathematics

PATENT AND PUBLICATIONS

Patent under review in Department of Industries, *Ministry of Industries, Commerce and Supplies, Government of Nepal*
"Retrofitting Process of Internal Combustion Engine Vehicle to Electric Vehicle."

Published in IOP Conference Series, *Earth and Environmental Science (EES).*
- Sustainable Manufacturing Practices in the Hydropower Industry: A review
- Integrated analysis of on-road energy consumption and range optimization in the conversion of an IC engine vehicle to a battery-electric vehicle: a comprehensive research study

PROJECTS

Research and Analysis on the Factors Affecting On-Road Energy Consumption and Range of Electric Vehicles
- Conducted a comprehensive study on factors influencing energy consumption and range of electric vehicles (EVs) during real-world driving conditions.
- Analyzed data on driving behaviour, road conditions, and vehicle parameters.
- Used MATLAB and Python for data analysis and developed models to predict energy consumption.

Conversion of an IC engine vehicle to battery electric vehicle
- Converted a 28-year-old Maruti 800 into a fully electric vehicle.
- Designed and installed the electric drivetrain, including motor, battery pack, and controls.
- Conducted testing and optimization, proving the feasibility of retrofitting vehicles to reduce emissions.

Building Energy Consumption Prediction for Nepal Using Machine Learning
- Developed a machine learning model to predict energy consumption in buildings across Nepal.
- Collected data on factors like weather, building materials, occupancy patterns, and energy use.
- Applied data pre-processing and used regression algorithms for prediction.

Simulating the Impact of Thermal Management on Battery Degradation in Electric Vehicles
- Developed a CFD model in ANSYS Fluent to simulate thermal dynamics in lithium-ion battery cells, validating the model against experimental temperature measurements.
- Explored various cooling strategies to assess their effectiveness in enhancing battery life and maintaining temperature uniformity during charge and discharge cycles.
- Provided design recommendations for optimized cooling channel configurations to improve thermal performance and reliability of battery packs.

Formula SAE Composite Monocoque Chassis Analysis on Ansys
- Performed a structural analysis of a composite monocoque chassis for a Formula SAE race car using ANSYS software.
- Evaluated the chassis design for strength, stiffness, and safety under various loading conditions.
- Conducted simulations of impact, torsion, and bending scenarios.

Mathematical modelling for sizing motor and battery of electric vehicle using Scilab Xcos.
- Simulation and sizing of motor and battery for off-road vehicle using Scilab Xcos.
- Calculated and simulated driving cycle and vehicle requirements through block diagrams.
- Theoretical validation of the design and comparison with established experimental data.

PROFESSIONAL DEVELOPMENT TRAINING

- Capacity Development Program on Electric Vehicle Technology and Its Importance in Nepal
- Capacity Development Training on Transient System Simulation Program
  - Application of Crystal Ball Software for Production, Manufacturing, and Project Planning
  - Supervised Machine Learning: Regression and Classification by DeepLearning.AI in collaboration with Stanford University
  - Introduction to Modeling and Design for Manufacturing, Autodesk
  - Data Analytics using Excel, Great learning Academy

EXPERIENCES AND ACTIVITIES

- Volunteer for AIU NORTH ZONE VICE CHANCELLORS' MEET 2024 organizee by Association of Indian University (AIU) and Hosted by Kathmandu University : Dhulikhel, Nepal.
- Participated in a virtual training session provided by Shell Eco on autonomous programming, energy consumption reduction, and improved performance through optimized aerodynamics.
  - Worked as an Organizing Member for AMES Bulletin board : Kathmandu University, Dhulikhel
  - Participated in a 24-hour hardware hackathon "Mechathon:Innovation for Impact" Organised by AMES, Kathmandu University
  - Participated in 17th International Computer Olympiad "COFAS-2014" held by City Montessori School : Lucknow, India.October,2014.

CERTIFICATIONS

Solidworks Certificates : — Associate-Mechanical Design | Professional-Advanced Drawing tools | Professional-Advanced Surfacing | Certified SOLIDWORKS Associate (CSWA)

SKILLS

Programming and Analytics Tools:
*MATLAB, C++,*Excel (Advanced), *Excel VBA,* R,Python (Numpy, Pandas, Matplotlib, Scikitlearn) Oracle: Crystal Ball

Soft Skills
Critical thinking, teamwork, communication, adaptability

Proficiency in CAD software:
Fusion 360,SolidWorks,Blender,AutoCAD, ANSYS

Project Management:
Leadership in cross-functional teams, Agile methodologies, resource allocation