Aayush Dulal

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Research Interests

- Linear and Non-Linear Control, Fuzzy Logic
- Machine Learning and Artificial Intelligence
- Dynamic Systems and Optimization
- Robotics and Autonomous systems
- Swarm Robotics and Computer Vision

Education

- **Tribhuvan University, Institute of Engineering, Thapathali Campus** Thapathali, Kathmandu
  Bachelors in Mechanical Engineering; Agg Percentage: 75.47 *2017 - 2022*
  - **Coursework**: Control systems, Electric Machines, Manufacturing Technology, Theory of Machine and Mechanisms, Finite Element Analysis, Mechanical Design and Simulation, Operational Research and Management, Basic Electronics Engineering, Basic Electrical Engineering, Engineering Mathematics.
  - **Project Title**: Comparative analysis of fuzzy logic controller and PID controller for trajectory control.
    - **Research**: Studying the effects of including joint acceleration as an input variable in fuzzy logic controller deployed for trajectory control of robot manipulator in the presence of disturbances and noise. Benchmarking the performance with a PID controller.

Research Experience

- **Research Assistant**
  Supervisor - Dr Khem Gyanwali *Aug 2022 - Feb 2023*
  - **Optimal EV Charging Stations For Public Vehicles**: Working on performing linear programming in python to solve for optimal locations for charging stations while minimizing the cost in the presence of constraints in battery size, number of buses. Data analysis and solution of the optimization problem also done in python.
  - **Results**: Optimized locations for placement of EV charging stations for electric buses operating in Kathmandu.
- **Team Lead**
  Supervisor - Mr Subodh Kumar Ghimire *2021 - 2022*
  - **Comparative Analysis of Fuzzy Logic Controller and PID Controller For Trajectory Control.**: Worked on designing fuzzy logic controller, PID controller and simulation in MATLAB environment. Studied inclusion of acceleration as an input variable in fuzzy logic controller. Solid model was also simulated in ROS .
  - **Results**:
    - : FLC with acceleration outperforms FLC without acceleration.
    - : The improvement from acceleration addition is more noticeable when simulated with disturbances.
- **Team lead**
  Shireto- Autonomous Division *2021 - 2022*
  - **Autonomous Systems For Ground Vehicles**: Led a team of fellow undergraduates in research and development of autonomous systems for electric vehicle. Team studied applications of AI and computer vision in development of autonomous ground vehicles. Participated in several competitions organised by Shell.

Publications

- **Conference Proceedings**
  VETOMAC 2022 *15th Dec, 2022*
  - **Title**: *Comparison of new fuzzy logic controller algorithm and classical proportional-integral-derivative controller (PID) controller for trajectory tracking*
- **Unpublished Manuscripts**
  In Preparation
  - **Title**: *Locating the Optimal EV Charging Stations For Public Vehicles*

Professional Experience

- **Teaching Assistant / Part-time Faculty**
  Thapathali Campus *Nov 2022 - Current*
  - **Instrumentation and Measurement Laboratory**: Conducted the lab for undergraduate students.
  - **Mechanical Drawing and AutoCAD**: Conducted classes for undergraduate students.
- **Mechanical Engineer**
  Robotics Association Nepal *Feb 2023 - Current*
  - **Early Warning Detection System for Flood**: Involved in hardware design and fabrication. In the Development of the machine learning model.
  - **Drone Seed Bombing**: Involved in hardware design and fabrication. Focused on mechanical parts.
- **Junior Design Engineer**
  Darshan Consulting Services *Oct 2019 - Jun 2020*
  - **CHEPE 'A' Hydropower**: Solid modeling and drafting of hydropower system components.
- **Engineering Intern**
  Darshan Consulting Services *Jul 2019 - Sep 2019*
  - **Mechanical Design**: Assisted senior design engineers in drafting and drawing of plumbing and venting systems.
- **Engineering Intern**
  Nepal Government, Road and Transportation Division *Sep 2021 - Oct 2021*
  - **Achievements**: Completely reinstalled cat D11 engine.

Skills Summary

- **Languages**: C++, Python, C, MATLAB
- **Softwares**: Ansys, Solidworks, ROS, MS-office, AutoCad, Fusion 360
- **Tools**: Docker, GIT, Tensorflow, Keras,LaTeX

Academic Projects

- **Boogie Rocker**: Designed and fabricated a mobile robot specializing in mobility on difficult terrain. This project won second place in the annual robotics competition organized by Robotics and Automation Centre, Thapathali Campus.
- **Lathe Machine Power Transmission Design**: Designed and drafted a power transmission mechanism for the Lathe machine.
- **Binary Gender Classifier**: Developed a binary gender classifier based on deep learning using Python and TensorFlow. This software localizes the faces in a frame and successfully classifies the binary gender of the individual.
- **Ancient Painting Generation Using GAN**: Built a Generative Adversarial Network deep learning model to generate paintings of ancient themes
- **Early Warning System**: Early warning system which warns a village in Far Western Nepal about a possible flood. The prediction is done with a machine learning model.
- **Trajectory Control of a mobile robot**: Autonomous division of team 'Shireto' participated in a competition organized by Shell. The competition was on writing the best code for path optimization of a virtual robot.
- **PID and Fuzzy Logic Controller Design**: For a three DOF robot manipulator, A PID controller and a Fuzzy Logic controller were designed. These two controllers were simulated for studying the trajectory control of the manipulator. The simulation was performed on SIMULINK and MATLAB
- **Drone Seed Bombing**: System for seed bombing deforested parts of hilly Nepal using a Drone; supported by UNDP

Certifications and Training

- Registered Mechanical Engineer in Nepal
- Deep Learning Specialization
- Boiler Training on Industrial Maintenance
- Convolutional Neural Networks Using Tensorflow
- Natural language Processing Using Tensorflow
- Ansys Training
- MATLAB Simscape Training

Honors and Awards

- Finalist in HULT PRIZE 2022 ON campus event
- College Representative for Thapathali Campus in HULT PRIZE 2022
- Second Place in annual robotics competition at Thapathali Campus
- First Place in Sanitary Hackathon organized by Asian Development Bank (Received funding for the idea)