Harsh Raj

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EDUCATION

Indian Institute of Technology, Kharagpur **November 2020 – Present**
Master of Technology in Aerospace Engineering - ***CGPA: 8.45/10*** *West Bengal, India*

Bharat National Public School **May 2019**
Class XII - Central Board of Secondary Education - ***Percentage - 90%*** *Delhi, India*

RELEVANT COURSEWORK

Programming and Related: Machine Learning Foundation and Applications, Programming and Data Structures, Advanced Calculus, Linear Algebra, Numerical Solutions of ODE and PDE, Transform Calculus
Core: Advanced Gas Turbine Theory, Thermodynamics, Gas Dynamics, Flight Vehicle Controls, Mechanics Of Flight, Aerodynamics, Structural Analysis, Principles of Satellite and Inertial Navigation System, Avionics

INTERNSHIPS

Aeronautical Development Agency | Engine Starting System **May 2023 – June 2023**
Propulsion Research Intern *DRDO, Bengaluru*

- Worked on **preliminary design** and analysis of engine starting system for 5th Generation AMCA Fighter Aircraft.
- Utilized MATLAB/SIMULINK to evaluate pressure loss in **valves** and **ducts** connecting APU, ATS, and Engine.
- Proposed a **statistical approach** for health monitoring of the APU using different prognostic and diagnostics models

Aerostrovilos Pvt. Ltd | Micro Gas Turbine **June 2023 – July 2023**
Turbomachinery and Python Developer Intern *IIT Madras, Chennai*

- Developed a program for Off-design Performance Prediction of Radial Inflow Turbines using loss correlations in **python**
- Conducted research about seals used in micro gas turbines, assisted in performing **CFD** analysis of the seal in **Fluent**
- Calculated **creep life** of the radial turbine and plotted the contours in **ANSYS Mechanical** using CSV plot.

Artenal Robotics | Deep Learning **May 2022 – Aug 2022**
Computer Vision Intern *Vancouver, Canada*

- Utilized **TensorFlow** for Object Detection and Recognition and for developing orientation detection algorithms.
- Custom trained **CNN** models, specializing in **YOLO v5/v6** using advanced transfer learning techniques.
- Created an efficient **image annotation app** using Python's KTkinter library, streamlining project workflows.

PROJECTS

Variable Cycle Micro Gas Turbine Engine | *B.Tech Project* **July 2023 – Present**
Guide: Dr. C.S. Mistry, Professor, Department of Aerospace Engineering, IIT Kharagpur

- Actively spearheaded the development of a versatile Variable Cycle Micro Gas Turbine for **future** applications.
- Led the innovation of an engine design that enables effortless transitions between **turbojet** and **turboshaft** modes.
- Utilized 1-D meanline analysis and generated 3D blade shapes using **BladeGen** and **VISTA CCD**. Employed **Turbo Grid** for meshing and **CFX** for conducting CFD studies of the mixed flow compressor within **ANSYS** environment.

VTOL and Fixed Wing Hybrid Drone Design | *Flight Testing Lab* **Aug 2022 – Nov 2022**
Guide: Dr. Sandeep Saha, Professor, Department of Aerospace Engineering, IIT Kharagpur

- Designed and simulated a hybrid **VTOL** and fixed-wing drone using MATLAB/SIMULINK with **Simscape library**.
- Conducted comprehensive analysis of the drone's flight characteristics and aerodynamic performance in **OpenVSP**.
- Designed and implemented PID control systems to facilitate **transitions** between hover and horizontal flight mode.

Piezo-Electric Droplet Generator | *Innovation Lab* **Aug 2022 – Nov 2022**
Guide: Dr.Srinibas Karmakar, Professor, Department of Aerospace Engineering, IIT Kharagpur

- Designed a Piezoelectric Droplet Generator to understand how different fuels burn and behave in combustion processes.
- Utilized **3D printing** techniques to fabricate critical components from CAD models developed in SOLIDWORKS.
- Configured and integrated electrical connections using **Arduino**, for precision and control in droplet generation.

Aerial Image Segmentation with PyTorch | *Self Project* **July 2022**
[Project]

- Developed custom dataset class, applied image-mask **augmentation** using Albumentations, and harnessed a pretrained **U-Net** model from the PyTorch Segmentation Model library for the Massachusetts Roads Segmentation Dataset.

- Streamlined model training by creating efficient **training** and **evaluation** functions.

Rock Paper Scissor Game | *Self project* **May 2022 – June 2023**

[Project]

- Built a real-time 'Rock, Paper, Scissors in Browser' web app, **training** deep learning models using webcam images.
- Leveraged TensorFlow and transfer learning for user-driven model training with **real-time predictions**.
- Enabled model download for **user convenience**, extending the utility of the trained deep learning model.

COMPETITION/CONFERENCE

AIAA Jet Engine Design Competition **Dec 2022 – Apr 2023**

[Problem Statement] *Boston, USA*

- Proposed an industry-level solution for a Hybrid-Electric Propulsion System using Fuselage Boundary Layer Ingestion.
- Presented the solution to experts at AIAA AVIATION Forum and received **top 3** recognition for the technical report.
- Designed **high-efficiency compressors** and the BLI Fan using advanced **Turbo-machinery** Aerodynamics principles
- Engaged in extensive research of gas turbine systems to improve overall efficiency and cycle optimization

e-Yantra Robotics Competition **Oct 2021 – Feb 2022**

[Problem Statement] *IIT Bombay, Mumbai*

- Developed **autonomous navigation** capabilities for the robot to traverse farm rooms and galleries efficiently.
- Improved berry harvesting efficiency through the integration of **computer vision** techniques for berry identification.
- Utilized **PID** controller and **inverse kinematics** for precise navigation and arm operation in simulated environments.

ASME GtIndia Conference **June 2023 – Present**

[Research Paper] *Bengaluru, India*

- Got selected to present pioneering research on hybrid propulsion at ASME Gtindia Conference in Bengaluru, on the topic of "Strategic design approach for Future Fuselage BLI Engine Based Hybrid Propulsion System".

SKILLS

Languages and Tools: C/C++, Python, OpenCV, Matplotlib, TensorFlow, SimScape, JS, PyTorch, CFD, FEM
Softwares: MATLAB/SIMULINK, Solidworks, ANSYS, OpenFOAM, GasTurb, OpenVSP, Vrep(CoppeliaSim)

LEADERSHIP / EXTRA-CURRICULAR

- Recorded and delivered physics lectures to assist students preparing for the Physics Olympiad.
- Represented the institution as a football player in the prestigious **Inter IIT** sports competition.
- Organized and conducted training sessions for over **30+** players, enhancing their football skills.
- Participated as a member of the **National Service Scheme**, engaging in various community services.