Shubh Jain

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Education

Carnegie Mellon University — Pittsburgh, PA
Masters in Robotic Systems Development — Aug. 2025 – May 2027
Indian Institute of Technology Kanpur — Kanpur, India
Bachelor's of Technology in Aerospace Engineering — Dec. 2021 - May. 2025
Cumulative Performance Index (CPI): **8.1/10**

Honors and Awards

International:
2024 Awarded, **Student grant scholarship** by **IEEE** for outstanding research to attend AUV Symposium — Massachusetts
2024 Qualifier, Singapore Autonomous Underwater Vehicle Challenge 2024 — Singapore
National:
2023 Gold Medal, National-level Robofest by GUJCOST for designing an underwater vehicle — Gujarat, India
2022 Fellowship, C3i Hub Undergraduate Research Scholarship in Cybersecurity — Kanpur, India
2021 AIR 2726, Joint Entrance Examination Advanced 2021 among 0.15 million JEE Mains qualified candidates — India
2021 AIR 2313, Joint Entrance Examination Mains 2021 among 1 million candidates — India

Publications

IEEE Autonomous Underwater Vehicle (AUV) Symposium 2024 — Massachusetts, USA
Shubh Jain, & Dr. D.K.Giri. "*Adaptive Image Restoration and Object Detection and Tracking using Semantic Segmentation and Cross-Correlation based trackers for light-weight embedded devices*"

- Developed an optimized, **novel adaptive image processing algorithm** in **C++** for real-time **color restoration** of underwater images
- Developed a **lightweight detection algorithm** combining **ENet** for semantic segmentation of Regions of Interest (ROI) on CPU and **YOLOv7-tiny** for fast, accurate detection on a **Jetson nano TX2 ARM Cortex-A57 processor**
- Implemented a **Discriminative Correlation Filter with Channel and Spatial Reliability (CSR-DCF)** tracker, integrating a closed-loop control fail-safe strategy
- Achieved a **15.2%** increase in Frames Per Seconds (**FPS**), improving from **7.9 to 9.1 FPS** on Nvidia Jetson nano TX2 ARM processor

IEEE 2024 International Conference on Robotics Automation & Engineering (ICRAE) — Singapore
Shubh Jain, Varun Mahajan, & DR. D.K.Giri. "*Model-Based PID Control for Trajectory Tracking of Anahita in Real Time*"

- Designed a physics **Model-based Proportional-Integral-Derivative (PID)** control system for control and trajectory tracking of underwater vehicles in complex underwater environments
- Simulated & tested the controller in environments like **Matlab** and **Gazebo**, making ready for implementation on AUVs and ROVs
- **Outperformed** traditional **PID** and **Fuzzy logic** controllers when simulated in presence of simulated external underwater waves

Research/Work Experience

Autonomous Underwater Vehicle (AUVIITK) Team, IIT Kanpur — IIT Kanpur, India
Team Lead, Supervisor: Dr. Indranil Saha — June 2022 – April 2024

- Built a comprehensive sensor-integrated **ROS software stack** for AUVs, with a **graphical user interface (GUI)**
- Developed and Simulated **Visual** and **Sonar SLAM** for **mapping** and **localization** in underwater environments in **Gazebo**
- Developed and tested an **GPS-denied inertial navigation system** based on **Inertial Measurement Unit (IMU)**, **Doppler Velocity Log (DVL)** and **Visual odometry** on AUVs
- Implemented **Extended Kalman Filters** to denoise **IMU** and **DVL** data for pose tracking of underwater vehicles
- Designed and implemented a robust **underwater image restoration pipeline** integrated with object detection using **YOLOv8**, optimizing for real-time performance at **30+ Frames Per Second (FPS)** on **Google Coral TPU**
- Conducted **Computational Fluid Dynamics**(CFD) and **structural analysis** to ensure durability for depths of up to **100 m**
- Raised over **INR 1 million** in funding by partnering with companies, startups, and government organizations

Smarttrak AI — Remote | California, USA
Mechatronic Engineer — May 2024 – July 2024

- Designed **Computer-Aided Design (CAD)** models for **single** and **double-axis** slew-based solar trackers
- Developed a **Neural Network** framework to predict next-day energy output by analysing previous three days' data and trends using models like **Times Net**

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- Achieved a **Mean Absolute Percentage Error (MAPE)** of **14.8%** and **R2** score of **0.68** on day-ahead energy prediction over 2-month real-time data
- Optimized solar tracker designs to endure wind speeds up to **130 km/h** via iterative **Computational Fluid Dynamics (CFD)** analysis

C3i Hub IIT Kanpur, India
Undergraduate Research Fellow Oct. 2022 – Oct. 2023

- Developed a phishing email detection system using the **XGBoost** algorithm for classification, **BERT** for natural language processing, and **Neural Networks** for header analysis
- Created a **multi-threaded web crawling** tool for Open Source Intelligent information gathering and analysis
- Cleared first round of **IDEX Disc 9 Startup** challenge out of **100+** startup entries and pitched to the **Indian Air Force**

Xterra Robotics, Mobile Robotics Lab (MRL) IIT Kanpur, India
Robotics Engineer Dec. 2022 – Jan. 2023

- Designed and implemented **gaits** and **trajectories** for a **quadruped robot** in the **ROS** framework using **Bézier** curves,
- Successfully integrated **LiDAR point cloud** data and image processing techniques to predict and analyse the terrain
- Built **ROS packages** to control the quadruped bot with **Xbox** and **PS** controllers, enhancing user experience

Key Projects

An Online Approach to Solve the Dynamic Vehicle Routing Problem (DVRP) IIT Kanpur, India
Course Project, Cyber-Physical Systems: Prof. Indranil Saha Aug. 2023-Dec. 2023

- Implemented **Reinforcement Learning** for real-time **para-transit routing** prediction, achieving **100%** fulfillment with **5 vehicles**
- Benchmarked the **Markov Chain Vehicle Routing Problem (MCVRP)** against the **Dynamic Randomized Least-Squares Algorithm (DRLSA)**, demonstrating superior performance in efficiency and accuracy
- Optimized system parameters, including a **30-second runtime cutoff** and **a Monte Carlo Tree Search** depth of **20**, to enhance model execution and decision-making speed

Skills

Robotics	ROS, Gazebo, RViZ, QGroundControl, ArduPilot, ArduSub PX4, Arduino, Mission Planner, Raspberry Pi
Programming	Python, C, C++, Matlab, HTML, CSS, Java, JavaScript, R, SQL, Git, bash, Latex
Softwares	Solidworks, Fusion 360, LabView, Ansys
Libraries	OpenCV, Scikit-Learn, OpenAI-Gym PyTorch, Keras, TensorFlow, NumPy, Pandas, Matplotlib, Seaborn

Relevant Courses

Computer Science	Image Processing, Intro. to Machine Learning, Fundamentals of Computing, Embedded Cyber-Physical Systems
Control Systems	Aircraft control systems, Optimal space flight control, Dynamics
Mathematics	Linear Algebra, Complex Analysis, Ordinary and Partial Differential Equations, Real Analysis, Probability, Statistics
Physics	Fluid Mechanics, Electrodynamics, Mechanics, Mechanics of Solids, Thermodynamics

Leadership & Activities

Science and Technology Council, IITK IIT Kanpur, India
Institute Secretary, Teams & Research April 2024 - Ongoing

- Managing a three tier team of **300+ students** in **20+ robotics clubs & teams**, driving technical initiatives, research and innovation
- Successfully organized a **48-hour** pan-India **Capture the Flag (CTF)** hackathon, attracting over **1000** participants nationwide
- Organized the **Open Source Opportunity Conference** in collaboration with the Open source **Linux Foundation** and **Google**

Fine Arts Club IIT Kanpur, India
Coordinator May 2023 - April 2024

- Led a team of **30+ members** to bring creative ideas to life, organize events & participate in prestigious competitions like **Inter-IIT**
- Organized **art workshops** with professional artists, engaging **50+ participants** and promoting art awareness among the students

Ultimate Frisbee Society IIT Kanpur, India
Leader and Team Captain May 2023 - April 2023

- Organized **workshops**, & **training sessions** to introduce Ultimate Frisbee to the campus community, increasing engagement
- Represented IIT Kanpur in **inter-college** Ultimate Frisbee tournaments while **mentoring 50+ players**

LinkedIn : https://www.linkedin.com/in/shubh-jain007/
GitHub : https://github.com/ShubhJain007

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