Soumyodipta Nath

M.Tech, Robotics and Autonomous Systems

Indian Institute of Science (IISc), Bangalore

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Education

M.Tech **Indian Institute of Science (IISc), Bangalore** — 2024 – Ongoing
Robotics and Autonomous Systems | CGPA: $9.40/10$

B.E. **Jadavpur University, Kolkata** — 2020 – 2024
Electronics and Telecommunication Engineering | CGPA: $9.38/10$

Research & Projects

Optimal Trajectory Synthesis via Multi-Expert Switching | M.Tech Thesis — IISc Bangalore, Aug 2025 – Ongoing
Advisor: Prof. Pushpak Jagtap, Robert Bosch Center for Cyber-Physical Systems

- Formulated a **hierarchical control framework** using **Gaussian Mixture Models (GMM)** to discretize track topology into adaptive "Smart Bins," effectively isolating high-variance cornering regimes.
- Developed a **Dynamic Programming (DP)** solver to optimize switching sequences between experts, ensuring kinematic feasibility and minimizing jerk transitions on the **F1Tenth** platform.
- Participated in **Roboracer 2025** at TechFest IIT Bombay.

SafeDMP: Formal Safety with Dynamic Movement Primitives — IISc Bangalore, Feb 2025 – Sept 2025
Advisor: Prof. Ravi Prakash, Robert Bosch Center for Cyber-Physical Systems
SafeDMP

- Synthesized a modular framework combining **DMPs** with **Spatio-Temporal Tubes (STTs)** to provide formal safety guarantees for **Franka Emika** robots in adaptive HRI tasks.
- Derived **closed-form feedback laws** that outperformed optimization-based CBFs with **99.97% faster execution** and **48% lower memory footprint**.
- Validated on physical hardware and **NVIDIA Isaac Sim**, demonstrating robust recovery under human intervention; work *accepted* at **CoRL (SRRL) 2025** and *under review* for **ICRA 2026**.

SwarmPass: Safe Swarm Traversal via C3BF & HOCBF — IISc Bangalore, Aug 2025 – Ongoing
Advisor: Prof Jishnu Keshavan | Dept. of Mechanical Engineering
SwarmPass

- Developed a hierarchical framework for quadrotor swarms to safely traverse spatial bottlenecks using **Collision-Cone (C3BF)** and **High-Order (HOCBF)** Control Barrier Functions.
- Implemented safety filters as real-time **Quadratic Programs (QP)** and validated the full control stack via **PyBullet** and simulation trials on the **Crazyflie 2.1** platform.

RobotConga: Leader-Follower Sequential Path Following — IISc, Bangalore, Aug 2024 – Dec 2024
Advisor: Prof. Shishir N Y, Robert Bosch Center for Cyber-Physical Systems
RobotConga

- Developed **Robot Conga**, a leader-follower control strategy using **spatial displacement** for precise inter-agent spacing while allowing real-time, user-defined **path updates**.
- Validated the algorithm on **TurtleBot3** and **Laikago quadruped** platforms, using **ROS2, Gazebo, and PyBullet** to simulate multi-agent coordination and evaluate stability in centralized control environments.

Experience

Robotics Software Intern | Airbus — Bangalore, India
Industrialization Team — May 2025 – Aug 2025

- Optimized **Coverage Path Planning (CPP)** for non-planar surfaces using Gaussian surface parameterization in cylidircal coordinate system with automated cavity detection and avoidance.
- Fine-tuned a **Reinforcement Learning** agent in **Isaac Lab** for UR10 goal-reaching, significantly reducing joint jerk in the proxiity of the goal through reward function shaping followed by hardware deployment.
- Developed a **Nearest Neighbors-based** pipeline to automate **STL-to-URDF** generation by autonomously identifying joint axes and positions.

Summer Research Intern | IISc — IISc Bangalore
Advisor: Prof. Pavakumar Tallapragada, Dept. of Electrical Engineering — May 2023 – Aug 2023

- Deployed an **RL-based crossing order prediction** framework on a fleet of **Pololu robots**, optimizing multi-agent intersection clearance latency.
- Engineered high-speed communication links to **ensure policy robustness** against hardware noise, achieving near-simulated efficiency in physical experiments.

Publications

SafeDMPs: Integrating Formal Safety with DMPs for Adaptive HRI, *Soumyodipta Nath*, P. Tiwari, R. Prakash | *Accepted: CoRL (SRRL Workshop) '25* | *Under Review: ICRA '26* — May 2025 — OpenReview

Building Multihop LoRa Network for Enhanced Quality Transmission of Healthcare Data, S. Paria, *Soumyodipta Nath*, C. Mallick, D. Das | *Accepted: IEEE CODEC '23* — Dec 2023 — IEEE

Technical Skills

Robotics & Control: ROS2, NVIDIA Isaac Lab/Sim, Gazebo, PyBullet, Motion Planning, MPC, LQR, SMC

AI & Software: Python, C, MATLAB, TensorFlow, PyTorch, Linux (Ubuntu), Git

Hardware: Franka Emika, UR10, TurtleBot 4, Pololu Bots, Jetson Nano, LoRa Modules

Leadership & Service

Graduate Teaching Assistant — IISc Bangalore
Aug 2024 – Dec 2025

- **Applied Linear & Non-Linear Control**: Conducted tutorial sessions on Lyapunov Stability & Controller Design (*LQR, CLF, Backstepping, SMC, MRAC*); evaluated and provided detailed feedback on assignments & examinations.

Student Organizer, *Open Day (RBCCPS)* — IISc Bangalore
Mar 2025

- Designed and deployed interactive robotics exhibits for 5,000+ visitors to demonstrate the fundamentals of *Cyber-Physical Systems*.

Scholastic Achievements

GATE EC Rank: 142 (Top 0.15% among 100K candidates) — 2024

WBJEE Rank: 135 (Top 0.13% among 100K candidates) — 2020

JEE Advanced Rank: 5702 (among 150K candidates) — 2020