Soumyodipta Nath

M.Tech, Robotics and Autonomous Systems

Indian Institute of Science (IISc), Bangalore

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soumyodipta-nath 𝐢𝐧

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
Advisor: Prof. Pushpak Jagtap, Robert Bosch Center for Cyber-Physical Systems

IISc Bangalore
Aug 2025 – Ongoing
F1TenthGym 🔗

- 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
Advisor: Prof. Ravi Prakash, Robert Bosch Center for Cyber-Physical Systems

IISc Bangalore
Feb 2025 – Sept 2025
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 **ICRA 2026** and **CoRL (SRRL) 2025**.

SwarmPass: Safe Swarm Traversal via C3BF & HOCBF
Advisor: Prof Jishnu Keshavan | Dept. of Mechanical Engineering

IISc Bangalore
Aug 2025 – Ongoing
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
Advisor: Prof. Shishir N Y,   Robert Bosch Center for Cyber-Physical Systems

IISc, Bangalore,
Aug 2024 – Dec 2024
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
Industrialization Team

Bangalore, India
May 2025 – Aug 2025
[Portfolio ↗](#)

- 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
Advisor: Prof. Pavakumar Tallapragada, Dept. of Electrical Engineering

IISc Bangalore
May 2023 – Aug 2023
Acknowledged at:
[IEEE ↗](#)

- 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 | ***ICRA '26 & CoRL (SRRL Workshop) '25***

May 2025
[OpenReview ↗](#)

Building Multihop LoRa Network for Enhanced Quality Transmission of Healthcare Data, S. Paria, *Soumyodipta Nath*, C. Mallick, D. Das | ***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: F1Tenth Car, CrazyFlie, Franka Emika, UR10, TurtleBot 4, Pololu Bots, 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