

Ganga Nair B

M. Tech in Robotics and Autonomous Systems,
Indian Institute of Science, Bangalore

Research Interests: Learning-based Control, Safe RL, Legged Locomotion

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EDUCATION

- **Indian Institute of Science**, Bengaluru, India

Master of Technology - Robotics and Autonomous Systems; CGPA: 8.80 (Scale 10)

July 2024 - June 2026

Relevant Courses: Non-linear Control, Reinforcement Learning, Robotic Perception, Motion Planning, Swarm Robotics, ML

- **National Institute of Technology**, Calicut, India

Bachelor of Technology - Mechanical Engineering; CGPA: 9.19 (Scale 10)

July 2018 - June 2022

Relevant Courses: Solid Mechanics, Machine Design, Manufacturing, Control Systems, Non-linear dynamics, Embedded Systems

- **Bhavans Vidya Mandir**, Eroor, India

All India Secondary School Examination (CBSE); Score: 96%

June 2017 - May 2018

RESEARCH EXPERIENCE - ROBOTICS

Real-time Gait Adaptation in Quadruped Locomotion March, 2025 - Dec, 2025

Under **Prof. Shishir N Y Kolathaya**, Indian Institute of Science

- Developed an MPC-based framework for gait selection to leverage the advantages offered by diverse gaits for different terrain and task requirements.
- Integrated a Dreamer-style world model, which learns from a gait-dependent RL framework, to provide learned dynamics and reward priors for real-time MPC.
- Implemented on **Unitree Go1** in simulation and hardware with continuous gait transitions for improved energy and velocity tracking.
- Presented as Late Breaking Result at 2025 IEEE-RAS **Humanoid Robots Conference**, Seoul. [Website]

STRIDE: Physics-Guided Generative Dynamics Modeling Aug, 2025 - March 2026

Under **Prof. Shishir N Y Kolathaya**, Indian Institute of Science

- Developing a structured dynamics model combining **Lagrangian Neural Networks (LNN)** with **Conditional Flow Matching (CFM)** to capture stochastic contact dynamics.
- Models rigid-body mechanics with physics priors while learning multi-modal residual forces from data.
- Validated on **Unitree Go1** and **Unitree G1**, improving rollout stability and contact-force prediction over deterministic and diffusion baselines.

Physics-Informed Machine Learning for Safe and Optimal Control Oct, 2025 - Feb 2026

Under **Prof. Shishir Kolathaya**, IISc in collaboration with **Prof Somil Bansal**, Stanford University

- Formulated co-optimization of safety performance as a state-constrained optimal control problem. Performance objectives are encoded via a cost function and safety requirements are imposed as state constraints.
- The resultant value function satisfies a Hamilton-Jacobi-Bellman (HJB) equation, which is approximated efficiently using a physics-informed machine learning framework
- Validated on multi-agent and disturbance-driven systems with stronger safety guarantees than CRL and CBF baselines.

Quadruped Locomotion using Central Pattern Generators Feb, 2026 - Ongoing

Under **Prof. Shishir N Y Kolathaya** in collaboration with **Prof. Jun Morimoto**, Kyoto University

- Developing a locomotion framework for optimization of **Central Pattern Generators (CPGs)** for morphology, terrain and load using **Conditional Bayesian Optimization**.
- Inspired by animal locomotion, a conditionally optimized CPG framework enables adaptable legged locomotion across varying morphologies, terrains, and load conditions.
- Ongoing implementation and evaluation in hardware focusing on energy efficiency, robustness, and smooth gait transitions at Learning Machines Group, Kyoto University.

PATENTS AND PUBLICATIONS

Publications

- Manan T., Aditya S., Ganga N. B., Pushpak J., Shishir K., Somil S., **A Robust Physics-Informed Machine Learning Framework for Safe and Optimal Control of Autonomous Systems**, *International Journal of Robotics Research (IJRR)* (Submitted)
- Prakrut K., Ganga N.B., Shishir K., **STRIDE: Structured Lagrangian and Stochastic Residual Dynamics via Flow Matching**, *2026 IEEE/RSJ International Conference on Intelligent Robots and Systems* (Submitted)

- Ganga N.B., Prakrut K., Shishir K., **Real-Time Gait Adaptation for Quadrupeds Using Model Predictive Control and Reinforcement Learning**, *The 2025 Eleventh Indian Control Conference (ICC-11)*. [Website] [Paper]
- Ganga N.B., Antony N.J., Mathew S.S., Jagadeesha T., **Modelling and Simulation of Magneto-Rheological Fluid in a Damper Using COMSOL**, *Advances in Manufacturing, Automation, Design and Energy Technologies, ICoFT 2020, Lecture Notes in Mechanical Engineering, Springer, Singapore*. [Paper]

Patents

- Jagadeesha T., Ganga N.B., et al., **Magneto-rheological Fluid-Based Dynamic Vibration Absorber**, Indian Patent Application No. 202241036483, filed Jun 24, 2022. Status: Patent pending.

PROJECTS - ROBOTICS

Online iLQR with Neural Network Dynamics Jan 2025 – Apr 2025

Under **Prof. Aditya Gopalan**, Dept. of ECE, IISc

- Integrated iLQR with an online-trained neural network to control systems with unknown nonlinear dynamics.
- Demonstrated on MountainCar and CartPole without prior dynamics training.

Safe Swarm Navigation using Control Barrier Functions Dec 2025 – Jan 2025

Under **Prof. Jishnu Keshavan**, Indian Institute of Science (IISc)

- Developing a CBF-based safety framework for multi-quadrotor swarm navigation in constrained environments.
- Implemented Collision Cone and High-Order CBFs with a real-time QP safety filter; validated in simulation and Crazyflie hardware.

Hybrid Dynamics Modeling with LNN and Conditional Flow Matching Aug 2025 – Ongoing

M.Tech Thesis, Indian Institute of Science (IISc)

- Proposed a hybrid dynamics framework combining Lagrangian Neural Networks (LNNs) for conservative dynamics with generative techniques.
- Demonstrated improved long-horizon prediction and model-based control performance on Cartpole, Unitree Go1, and Unitree G1 compared to deterministic residual baselines.

EXPERIENCE

ExxonMobil Services & Technology, Bengaluru, India

Project Engineer

July 2022 – August 2024

- **Refinery Project Management:** Led end-to-end engineering and procurement for 10 multidisciplinary refinery projects with a combined estimated cost of up to \$25M. Projects spanned piping systems, civil structures, and instrumentation, with a strong focus on engineering management.
- **Innovation and Optimization:** Recognized within the company for introducing impactful innovations that improved project cost and schedule efficiency. Key contributions include integrating a lead-neutralizing paint remover and deploying 3D scanning in hazardous underground waste pits to eliminate the need for human entry.
- **Safety Leadership:** Led the safety initiative at the Bengaluru office, promoting safer engineering practices and raising awareness of project-specific safety risks across cross-functional teams.
- **Status:** Currently on sabbatical from this role.

ExxonMobil Services & Technology, Bengaluru, India

Execution Engineer (Intern)

March 2021 - July 2021

- **Regulatory projects:** Involved in Project Plan development, updating the team weekly, and creating tools for improving coordination for a project targeted at adhering to updated government regulations.

SKILLS SUMMARY

- **Languages:** Python, C++, MATLAB
- **Libraries:** PyTorch, JAX, NumPy, OpenCV, Matplotlib
- **Robotics & Simulation:** ROS2, Gazebo, IsaacGym, PyBullet
- **Tools:** Git, Linux, Simulink, SolidWorks, Ansys

EXTRA-CURRICULAR ACTIVITIES

- **Volunteer Work:** Provided academic support as a volunteer with 'Make a Difference', Science for Rural India, and other educational NGOs.
- **Talks and Presentations:** Delivered technical and non-technical talks at various events and won prizes for public speaking and presentation skills.
- **Writing:** Content writing and blogging on diverse topics.