Himanshu Lodha

lodha.11@osu.edu

Curriculum Vitae

Education

The Ohio State University
Doctor of Philosophy in Mechanical and Aerospace Engineering — *Aug. 2025 — May 2030*

The Ohio State University
Master of Science in Electrical and Computer Engineering — *Aug. 2023 — May 2025*

Savitribai Phule Pune University (formerly, University of Pune)
Vishwakarma Institute of Information Technology (VIIT) — *Aug. 2017 — May 2021*
Bachelor of Technology in Electronics and Telecommunication

Technical Skills and Interests

Programming: Python, C/C++, Embedded C, MATLAB, Git, ROS, Linux, Verilog
Electronic Design Automation: KiCad, Eagle
Prototyping: Arduino, ESP32, RaspberryPi, TI Tiva, STM32, Proteus, PCB Designing, Manufacturing, and Debugging, IMU, ToF, Field Oriented Control, BLE, DC, Servo, BLDC, Stepper motor
Communication Protocols: Ethernet, CAN, SPI, UART
AI/ML: PyTorch, MuJoCo, Gazebo, Tensorflow, Numpy, Scipy, Pandas, Deep Learning, Reinforcement Learning, Object Detection, OpenCV
Biology: Microscope Imaging, *C. elegans*

Experience

The Ohio State University
***Graduate Research Associate**, Fang-Yen Lab* — *Jun. 2025 — May 2030*
Advisor: Dr. Christopher Fang-Yen
Developing a 6-axis desktop robotic system to automate biological experimentation of *C. elegans* (Worm-Picker).

- Training a neural network to **segment male *C. elegans*** along with hermaphrodite and dauer.
- Developing a **microscopy imaging** pipeline for **data collection, auto-focusing, raster scanning, vignette correction, and denoising**.
- Automated tracking of activity and lifespan of multiple *C. elegans* simultaneously using **machine vision**.
- Built a skeletal **project** and **database management system** for Worm-Picker.
- Working on a morphology-based stage **detection** and **segmentation** of *C. elegans* using **YOLO**.
- Designed 3D printed part for calibration and assembly of Worm-Picker.

The Ohio State University
***Graduate Student Researcher**, Cyberbotics Lab* — *Aug. 2023 — May 2030*
Advisor: Dr. Ayonga Hereid
Worked on sim2real transfer of terrain-aware locomotion using reduced-dimensional representation for humanoids.

- Developed a framework to include the **history of local height-map** to *improve policy performance.*
- Bridged the gap between a physics engine and high-fidelity simulator to aid sim2real transfer.
- Developed *auto-encoders* to **construct local height-map** *from real-world depth images.*
- Built pipelines **to clean and reconstruct depth images** from *noisy real-world data* and **to simulate said noise**.
- **Mentored** undergraduate and graduate students who are new to the field of humanoids and robotics.

Indian Institute of Science
***Research Engineer**, Stochastic Robotics Lab* — *Aug. 2021 — July 2023*
Advisor: Dr. Shishir N Y Kolathaya
Investigated Robust Quadrupedal Locomotion on Sloped Terrains, and:

- Developed a **stepping stone walking controller** *to enable effective quadrupedal locomotion on rough terrain.*
- Deployed a proof-of-concept for **quadrupeds with wheels** to *demonstrate hybrid wheel-leg locomotion.*
- Designed a *long-range* **remote controller** to *transmit commands and telemetry, and visualize it on an LCD.*
- Engineered a **low-power handheld wireless emergency stop** with a range of *1 km line of sight.*
- Deployed **Ethernet communication** between **STM32** and **Raspberry Pi** for *online training of RL agent(s).*
- Built a **Pre-charge** circuit, rated @24V 100A, to *prevent input current surges while powering on.*
- **Mentored** and managed interns newly appointed research assistants..

Indian Institute of Science

***Undergraduate Research Intern**, Stochastic Robotics Lab* *Dec. 2020 — July 2021*
Advisor: Dr. Shishir N Y Kolathaya
Co-developed Stoch Lite, a 3D printed quadruped, to design controllers and firmware for walking robots.

- Wrote **firmware for STM32 and TI-Tiva** to *control and communicate with the actuators, sensors, and Raspberry Pi,* and **designed a Raspberry Pi Hat** for the said STM32.
- *Automated characterization and calibration of various* **ranging sensors** *for static and dynamic conditions.* Ran experiments on Time of Flight and ultrasonic sensors, reducing measurement errors by 5% and 20%, respectively.
- Programmed **firmware for UART, SPI (3 and 4-wire), and CAN** communication protocols *for higher-level controllers, actuators, and peripherals.*
- **Calibrated** *BLDC motors and actuators* to reduced tracking error by 14%.
- Carried out **hardware experiments and fine-tuned linear policies for sim2real** transfer of rough-terrain quadrupedal locomotion.

Publications

[4] **Learning Terrain Aware Bipedal Locomotion via Reduced Dimensional Perceptual Representations** — *IEEE Transactions on Control Systems Technology*
Presents a hierarchical strategy for terrain-aware bipedal locomotion that integrates a reduced dimensional perceptual representation of the terrain to enhance a Reinforcement Learning (RL)-based high-level (HL) locomotion policy for real-time gait generation.

[3] **Reduced Order Representations for Reinforcement Learning-based Terrain-Aware Humanoid Locomotion** — *Masters Thesis*
Presents a hierarchical framework for terrain-aware bipedal locomotion that combines reinforcement learning with compact latent representations, achieving over 85% success rates on challenging terrains and demonstrating practical applicability in real-world environments.

[2] **Force control for Robust Quadruped Locomotion: A Linear Policy Approach** — *ICRA '23*
Presents a linear policy approach to generate end-foot trajectory and a centroidal wrench. The wrench is then distributed among the legs using a quadratic program based on foot contact information, resulting in the desired ground reaction forces.

[1] **Dynamic Mirror Descent based Model Predictive Control for Accelerating Robot Reinforcement Learning.** — *ICRA '22, Poster: NeurIPS '21*
Presents a hierarchical framework integrating online learning for model-based trajectory optimization with off-policy methods for model-free reinforcement learning, significantly accelerating the convergence of reinforcement learning tasks.

Awards

Inclusion@RSS'24 Fellowship *July 2024*
The Inclusion@RSS program awards fellowships to a select few BS, MS, and first and second-year PhD students to attend the Robotics: Science and Systems (RSS) conference and offers a dedicated program and mentorship to help support their journey toward a career in robotics.

Additional Work

Graduate Student Alumni and Peer Mentoring Program
GUIDE Peer Mentor *Jan 2025 — May 2025*

- As a peer mentor, I serve as a resource by providing both personal and professional support to my mentee.
- I act as a helping hand or sounding board and can easily refer my mentees to helpful resources across campus.

VIIT Robotics Club
Team Mentor and Member *Sept. 2018 — May 2021*

- **Educated members** in the *basics of electronics, circuit designing, programming, embedded systems, and robotics.*
- **Mentored junior members** on the process of *robot design, documentation, and project management.*
- *Developed robotic systems* ranging from a **semi-autonomous pick-n-place** to **mobile rugby-ball kicking** robot.
- **Spearheaded work in mechatronics and controls**, *resulting in fast and efficient completion of given tasks.*
- **Designed and manufactured PCBs** for electronic systems like *motor and MOSFET drivers, power supply, and robot control-unit, optimizing space consumption by 40-60%.*

Ratna Gears *Jul 2020 — Aug 2020*
Worked on a easily accessible **Ventilator** during the COVID-19 pandemic.

- Wrote **control software for a ventilator** designed by Ratna Gears and *reduced program execution time by 40-50%.*
- Designed its *user interface on Graphical LCD (GLCD).*
- Hardware used: Arduino Mega, Ramps board, and GLCD.