SANIYA PATWARDHAN

Mechanical Engineering — Robotics — Indian Institute of Technology Gandhinagar
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RESEARCH INTERESTS

Robotic Manipulation and Grasping, Robot Control, Robot Perception.

EDUCATION & EXPERIENCES

Indian Institute of Technology Gandhinagar, India — June 2024
B.Tech in Mechanical Engineering (Minor in Robotics) — Director's Silver Medallist — CPI: 8.75/10

IITGN Robotics Lab — Aug 2024 - Present
Predoctoral researcher — Sabarmati Bridge Fellowship

PUBLICATIONS

Accepted Publications

1. V. K. Jonnalagadda, C. K. Mullapudi, **S. Patwardhan**, E. U. Samani, and A. G. Banerjee, "Extremum-Seeking Active Object Recognition in Clutter Using Topological Descriptors," *Presented at the 2024 IEEE International Conference on Robotics and Automation*, PACIFICO Yokohama: 2nd Workshop on Mobile Manipulation and Embodied Intelligence. Link to paper
2. A. Dan, **S. Patwardhan**, S. K. Saha, and K. RamaKrishna, "A Novel Control Strategy for Stance Stability of a Quadruped Robot against External Disturbance," *Presented at Advances in Robotics 2023, 6th International Conference of the Robotics Society.* Link to paper
3. **S. Patwardhan**, A. Dan, S. K. Saha, and K. Rama Krishna, "Simscape Modelling of Quadruped Robot under External Disturbance," *Poster presented at the 2nd International and 14th National Conference on Industrial Problems on Machines and Mechanisms (IPRoMM 2022).* Link to poster

Publications in Review

1. **S. Patwardhan**, S. Barat, and H. J. Palanthandalam-Madapusi, "Experiences from Experiments with Dynamic Sequential Multi-object Grasping for Cylindrical Objects," *Submitted to the 2025 IEEE International Conference on Robotics and Automation*, Atlanta, USA.
2. V. K. Jonnalagadda, C. K. Mullapudi, **S. Patwardhan**, V. K. Knight, X. Yang, E. U. Samani, and A. G. Banerjee, "Extremum-Seeking Active Object Recognition in Clutter Using Topological Descriptors," *Submitted to the 2025 IEEE International Conference on Robotics and Automation*, Atlanta, USA.

ACHIEVEMENTS

- **Student Travel Grant for ICRA 2024:** Received a total grant of USD 1000, sponsored by Mobile Manipulation TC and Robot Learning TC, for attending ICRA 2024 and participating in the 2nd Workshop on Mobile Manipulation and Embodied Intelligence.
- **Sabarmati Bridge Fellowship, IIT Gandhinagar:** Awarded a fellowship to conduct full-time research at the IITGN Robotics Lab as a Predoctoral Researcher for the academic year 2024-25.
- **Director's Silver Medal:** Awarded for outstanding overall performance at the 13th Convocation Ceremony of IIT Gandhinagar.
- **UW Mechanical Engineering Summer Research Grant:** Received a grant of USD 5700 to pursue a 10-week research program at the University of Washington.
- **MITACS Globalink Research Internship:** Selected for a fully funded summer research internship at Queen's University, Canada.
- **Dean's List, IIT Gandhinagar:** Recognized on the Dean's List for excellent academic performance.
- **Excellence Scholarship in Sports, IIT Gandhinagar:** Awarded for outstanding performance in both inter-college and intra-college sports leagues.

SELECTED PROJECTS

Multi-object Grasping with LEAP Hand — *Aug 2024 - Present*
Sabarmati Bridge Fellowship, IIT Gandhinagar

- Developing a dynamic sequential grasping strategy for the robotic LEAP hand, utilizing pinch and power grasps, enabling object transfer between these grasps, and determining the optimal order for picking the objects.
- Implementing a dynamical systems controller for the synchronized motion of fingers for in-hand object grasp transfer.

Grasping on LEAP Hand with 6D Object Pose Feedback *Sep 2024 - Present*
Sabarmati Bridge Fellowship, IIT Gandhinagar

- Developed a system to acquire live 6D object pose information of a single object relative to a robotic LEAP hand using FoundationPose, while guiding the fingertips of the index finger and thumb to the desired point on the object in real time.
- Implemented nullspace control and object impedance control to enhance interaction grasp prescision and stability.

Autonomous Campus Shuttle *Aug 2023 - May 2024*
IIT Gandhinagar •Video link• •News article•

- Converted an electric vehicle into an autonomous shuttle for intra-campus transport with lane-following capabilities, ensuring the shuttle remains centered in the lane, and integrated object detection to stop the vehicle when an obstacle is detected in its path.
- Actuated the vehicle using motors for braking, acceleration, and steering and implemented a closed-loop feedback system with a Pixhawk controller, RGBD cameras, and Lidar sensors to enable both autonomous and remote-controlled operation.

Active Robot Perception for Object Recognition in Clutter *May 2023 - Sep 2023*
University of Washington •Paper link•

- Improved object recognition scores in cluttered scenes with occluded objects by predicting the next best view using an extremum-seeking controller, demonstrating improvements across various lighting conditions, clutter levels, and object distances.
- Implemented the pipeline using ROS Kinetic on NVIDIA Jetson AGX Orin with Intel RealSense, incorporating a 3D point cloud slicing-based topological descriptor for object recognition.

Novel Control Law for Quadruped Robot Locomotion *Mar 2022 - Sep 2022*
IIT Delhi •Paper link•

- Developed a control strategy using centroidal dynamics and the Momentum Jacobian Matrix to reject external disturbances for a quadruped robot on flat and inclined surfaces.
- Recognized with the best paper presentation award at Advances in Robotics 2023.

SKILLS

Programming: Python, C++, MATLAB, ROS 1 & 2, Arduino
Tools: Mujoco, Gazebo, Simulink, Docker, Git
Prototyping: CAD Modelling, 3D Printing, Laser Cutting, CNC Machining, Lathe, Welding

RELEVANT COURSES

Robotics: Introduction to Robotics, Advanced Robotics, Introduction to Robot Grasping, Control Theory, Synthesis and Analysis of Mechanisms
Mechanical Engineering: Dynamics and Vibrations, Mechanics of Deformable Bodies, Manufacturing Processes and Systems, Solid Mechanics, Fluid Mechanics, Thermodynamics

EXTRA-CURRICULAR ACTIVITIES & POSITIONS OF RESPONSIBILITY

Captain, Women's Basketball Team, IIT Gandhinagar 2022 - 2024
Led the institute's basketball team at the 55th and 56th Inter-IIT Sports Meet, organizing training sessions and fostering team spirit.
Secretary, StepUp - The Dance Club of IIT Gandhinagar 2021 - 2022
Coordinated club events, choreographed performances, and managed rehearsals for inter-college competitions, building a vibrant dance community.
Core Committee Member, Marketing Head, Blithchron '22, Annual Cultural Festival 2022
Led a 120-member team to conduct IIT Gandhinagar's offline cultural fest, managing marketing strategies and sponsorships for successful event participation.
Core Team Member, Mean Mechanics - The Robotics Club 2021 - 2022
Organized workshops on Arduino IDE and OpenCV, and supported club projects, mentoring members on basic robotics and coding.

REFERENCES

Prof. Harish Palanthandalam-Madapusi - Professor and Dean of General Administration at the Indian Institute of Technology Gandhinagar (email)
Prof. Ashis Banerjee - Associate Professor at the University of Washington (email)
Prof. Madhu Vadali - Associate Professor at the Indian Institute of Technology Gandhinagar (email)
Dr. Ekta Samani - Postdoctoral scientist at Amazon Robotics (email)