Ansh Bhansali

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EDUCATION

University of Illinois Urbana-Champaign, IL, USA   Aug 2025 – Present
Master of Engineering in Autonomy and Robotics
Coursework: Humanoid Robots, Computer Vision, Safe Autonomy, Control Systems

SKILLS

- **Languages:** Python, C++
- **Robotics:** ROS2, SLAM, MoveIt, Sensor Fusion (Kalman Filters), Motion Planning (RRT, A*), Control Barrier Functions
- **AI/ML:** Computer Vision (OpenCV, YOLO, Mediapipe), PyTorch, TensorFlow, Reinforcement Learning (PPO)
- **Simulation & Design Tools:** Gazebo, MuJoCo, PyBullet, NVIDIA Isaac Sim, AirSim, KiCad, Altium Designer, Fusion 360

EXPERIENCE

Electronics Engineering Intern - Dimension Six Technologies, Mumbai, IN   May 2024 – May 2025
Project: STM32-Based Autonomous E-Bike Control System

- Enhanced **STM32** firmware with a novel power management algorithm, increasing e-bike range by 40%.
- Designed and routed a 4-layer PCB in **KiCad** for a custom **ESC**, reducing power losses by 15% under peak load.
- Deployed an IoT solution using **ESP32S3** and **RFID** for remote monitoring and secure automated payments.

Robotics Research Intern - Indian Institute of Technology, Bombay, Mumbai, IN   Jan 2024 – June 2024
Project: SLAM-based Autonomous Military Robot

- Developed **SLAM**-based autonomous robot in **ROS2**, achieving **95%** navigation accuracy in dynamic environments.
- Improved localization by **20%** via IMU, GPS, and RGB-D camera sensor fusion.
- Trained and integrated a **YOLOv3** model for real-time human detection and robust stair-climbing navigation.

PROJECTS

Open-Vocabulary 6D Pose Estimation *(FoundationPose, SAM-3, Moondream2)* ([Report](#))

- Developed **zero-shot** 6D tracking architecture with VLM-based **semantic inventory** and Gemini API query enrichment.
- Integrated **SAM-3** prompt segmentation with **Objaverse** mesh retrieval, achieving **76.5-100%** ADD-S AUC on YCBV dataset.
- Built RGB-D variant using **LangSAM** with **InstantMesh** and median-volume ensemble selection for mesh consistency.

Dynamic Object Handover System *(MuJoCo, MediaPipe, ROBOTIS AI Worker)* (*[Demo](#)*)

- Built a vision-based system with real-time dynamic hand tracking for adaptive **human-robot handover**.
- Implemented **Jacobian-based IK** with velocity limiting and command smoothing for stable object transport.
- Integrated **MediaPipe** gesture recognition enabling the robot to mirror hand movement and trigger release.

Pedestrian-Aware Autonomous Vehicle Safety System *(ROS2, YOLOv11, LiDAR)* (*[Demo](#)*)

- Fused LiDAR clustering and RGB-D detection for real-time pedestrian behavior tracking on a **GEM e4** autonomous vehicle.
- Implemented **trajectory prediction** with Time-to-Collision estimation, enabling proactive speed adaptation.
- Achieved **90%** success rate in pedestrian scenarios using a state-machine safety controller with **Stanley control**.

Humanoid Whole-Body Motion Planning *(Drake, MoveIt)* (*[Github](#)*)

- Implemented a motion planner for a humanoid URDF, optimizing trajectories for safe reaching tasks without loss of balance.
- Enforced **ZMP** and support polygon constraints, increasing successful manipulation task completions by **40%**.
- Reduced trajectory execution time by **15%** while ensuring static stability through efficient **trajectory optimization**.

Terrain-Aware Locomotion Pipeline *(ROS2, Gazebo, MoveIt)* (*[Github](#)*)

- Developed a perception pipeline for a quadruped using a depth camera to generate an elevation map for terrain analysis.
- Integrated a terrain classifier with a footstep planner in **MoveIt**, successfully navigating **95%** of the tested complex terrains.
- Demonstrated a gait strategy that reduced fall rates by **50%** compared to a baseline blind-walking controller on uneven surfaces.

RL Locomotion with Safety Layer *(PPO, Control Barrier Functions)* (*[Github](#)*)

- Trained a terrain-adaptive locomotion policy using **PPO** and integrated **CBF** as a real-time safety filter.
- Achieved zero-fall locomotion, with the CBF layer rejecting **99%** of unsafe actions proposed by the PPO policy.
- Maintained **90%** of the original PPO policy's traversal speed, demonstrating high efficiency with a verifiable safety guarantee.

AWARDS & ACHIEVEMENTS

- **Project Showcase, Cal Hacks (2025)** - Developed "[GEST](#)," a real-time, gesture-based teleoperation system for the **XLE** robot.
- **Finalists, Smart India Hackathon (2024) –** Presented a Ganga River water monitoring system for pollution prediction.