

# Sunny Nitin Deshpande

+1 (217) 200 0792 | sunnydeshpande9900@gmail.com

Portfolio: sunnydeshpande.com | LinkedIn: linkedin.com/in/sunny-deshpande | GitHub: github.com/SunnyDeshpande

## EDUCATION

**University of Illinois Urbana-Champaign (UIUC)** Aug 2025 - Sep 2026

Master of Engineering in **Autonomy and Robotics** (GPA: 3.75/4.00)

- Current Coursework: **Reinforcement Learning, Advanced Computer Vision, Autonomous Vehicle Safe Autonomy, Humanoid Robotics**

**Singapore University of Technology and Design (SUTD)**

Sep 2021 - May 2025

- B.Eng. (**Eng. Product Development**), **Robotics Focus, Minor in CS** | SHARP Honours, Global Distinguished Scholarship

## TECHNICAL SKILLS

**Control & Dynamics:** PID, Pure Pursuit, Stanley Controller, Admittance Control, **MPC** (validation), **Kalman Filter**, State-Space Control, **Trajectory Optimization**, Bicycle/Ackermann Models.

**Robot Learning:** Reinforcement Learning (PPO), Curriculum Learning, Domain Randomization, Reward Shaping, Sim-to-Real, VLA Models

**Autonomy & Planning** Motion Planning, Trajectory Smoothing (Bezier), Behavior Prediction, Sensor Fusion, A\*, RRT/RRT\*, SLAM (GMapping, AMCL).

**Languages & Libraries:** Python, C++, MATLAB, CUDA | PyTorch, OpenCV, TensorFlow, Pinocchio, Nav2, MoveIt.

**Platforms & Tools:** ROS/ROS2, Isaac Lab, MuJoCo, Gazebo, Simulink, RViz, FoxGlove, Docker, CMake, Git, GitHub Actions CI, Linux/Bash, CAN, DDS, MQTT.

**Hardware:** **Unitree G1 Humanoid (Sim)**, **Polaris GEM e4**, Jetson Orin Nano, Arduino, Ouster OS1-128 LiDAR, OAK-D Stereo.

## WORK EXPERIENCES

**Hyundai Motor Group Innovation Centre Singapore** May 2024 - Sep 2024

Robotics Fleet Software Engineer Intern - Robotics Centre | Singapore

- Overhauled fleet communication for 200+ production logistics AMRs from polling-based REST to event-driven MQTT (QoS-1), cutting command-response latency from **332 ms to 151 ms** and enabling real-time telemetry across fleet.
- Replaced stop-and-wait intersection coordination with velocity-profiled trajectory blending (Bezier smoothing, adaptive-lookahead pure pursuit), increasing multi-robot intersection throughput **by 40%** via staged rollout to **200-AMR fleet**.
- Designed traffic-aware fleet path planner in **C++** with corridor congestion scoring, ETA-based rerouting, and kinematic feasibility validation for constrained warehouse aisles; increased completed missions **by 10%** via staged canary deployments.
- Performed fleet failure analysis via internal simulator log replay of failed missions, diagnosing trajectory tracking and coordination faults; findings fed directly into planner parameter tuning and intersection logic refinements

### Venti Technologies

Sep 2023 - Dec 2023

AV Simulation Engineer Intern - Planning & Control | Singapore

- Built physics-based simulation in VTD modeling port-specific dynamics (trailer articulation, wet-surface friction, restricted turning radii); authored 200 procedurally generated test scenarios from 50 parameterized templates, exposing MPC payload oscillation during high-speed turns.
- Supported on-site AV trial runs at port: performed system bring-up, observed live operations, and logged edge cases; pipeline adopted for regression testing.

### Agency for Science, Technology and Research

May 2019 - Aug 2019

Robotics & AI Research Intern - Perception Team | Singapore (Solo Project)

- Built **end-to-end CNN policy (RGB-D + goal pose to cmd\_vel)** on Pioneer P3-DX: automated 36K+ samples collection via random waypoint patrol (~40 hrs saved), custom ROS synchronization across RGB-D/odometry/planner streams, and **real-time inference at 10 Hz; 95% avoidance** success across **50 real-world trials** including sub-LiDAR-height and resolution along with dynamic obstacles.

## PUBLICATIONS

**Evaluating Visual Odometry Methods for Autonomous Driving in Rain – Published at CASE 2023** May 2023 - Aug 2023

- Benchmarked classical and learned VO/SLAM across 15+ rain sequences; proposed DROID-SLAM heuristic with map priors for robust long-horizon stereo localization under adverse weather.

**Characterization of Focal EEG Signals: A Review - Elsevier Future Generation Computer Systems, 2019**

May 2018 - Feb 2019

## SELECTED PROJECTS

**AutoShield - Safety-Filtered Autonomous Driving on Polaris GEM e4** Oct 2025 - Dec 2025

- Developed modular ROS2 autonomy stack on real vehicle (4-person team): LiDAR-camera fusion (DBSCAN + YOLOv11 + ICP) for TTC-driven behavior planning; achieved **91% pedestrian scenario success** in field tests with **PACMod drive-by-wire**.
- Implemented **Stanley lateral controller** with PID longitudinal control and emergency hard-brake override, gated by **3-state safety FSM** (CRUISE/SLOW\_CAUTION/STOP\_YIELD) with 0.5 s data staleness timeout and 2.0 s recovery buffer.

**Dynamics-Intent Aware Pure Pursuit Controller (DIAPP) - SHARP Thesis**

Sep 2024 - Apr 2025

- Derived novel controller addressing Pure Pursuit failure on consecutive high-speed curves by incorporating **non-linear tire slip angles** and lateral error decomposition (heading + slippage) on a bicycle model with friction circle constraints.
- Benchmarked DIAPP/RDIAPP against PP/APP/RPP baselines in **MATLAB/Simulink** on S-shaped and U-shaped tracks **at 70 km/h**; RDIAPP **reduced RMS cross-track error by 48% (4.83 m to 2.49 m)** on U-turns where existing controllers diverge.

**Curved Glass Cleaning Robot - Changi Airport Group**

Aug 2024 - May 2025

- Led 7-person team: designed force-current-based **admittance controller** with **Kalman-filtered FSR** and ACS712 current sensing, maintaining brush-to-glass contact pressure (**< 150 N**) for cleaning curved surfaces (3 cm depth over 60 cm).
- Architected full ROS2 autonomy stack on Jetson Orin Nano: SMACH-based FSM coordinating AGV navigation, 3-stage cascade lift (15 kg to 2 m in 5 s), and dual Arduino controllers with closed-loop encoder feedback; validated in **live airport deployment**.

**Hierarchical Multi-Agent RL for Humanoid Robot Interaction**

Oct 2025 - Dec 2025

- Designed hierarchical PPO for dual **Unitree G1 humanoids** in Isaac Lab: **29-DOF locomotion** via 7-phase curriculum (30M steps, 512 envs) with 25+ shaped reward terms and **domain randomization** across friction, terrain, and actuator parameters.
- Trained goal-conditioned navigation policy over frozen locomotion primitives: two agents converge from 10 m to 0.5 m target separation with 95% success across randomized spawns.

**Autonomous Underwater Vehicle - SUTD SOAR, Software Lead**

Sep 2022 - Apr 2024

- Architected cascaded PID control loop for 6-DOF underwater stability, fusing depth sensor and IMU via state-space control on embedded system; led integration of real-time CV nodes for autonomous target acquisition under low-visibility conditions