

Education

Carnegie Mellon University | Pittsburgh, PA | GPA: 4.0

Master of Science in Mechanical Engineering – Robotics & Controls | August 2024 – May 2026

Coursework: Planning & Decision-making in Robotics (16-782), Intro to Robot Learning (16-831), ML & AI for Engineers (24-787)

Purdue University | West Lafayette, IN

Bachelor of Science in Mechanical Engineering, Minor in Electrical Engineering | December 2019

Honors Dean's List & Semester Honors

Skills

Motion planning: graph search (A*, weighted A*, dynamic programming), sampling-based planning (RRT, RRT*, PRM)

Trajectory optimization: constrained (boxed) CHOMP, Laplacian smoothing, velocity profiling

Safety: whole-body collision detection (occupancy grids, signed-distance fields), simulation-in-the-loop validation

Learning: imitation learning (behavior cloning, DAgger), policy gradients, DQN, actor-critic

Languages: C++ (CMake), Python (PyTorch, NumPy), MATLAB, SQL, Git

Research Experience

Carnegie Mellon University | Pittsburgh, PA

Graduate Research Assistant → Research Assistant, Advisor: Prof. Kenji Shimada | August 2024 – Present

- Designed and built a C++ motion planner for concrete spray 3D printing over pre-placed rebar: outputs nozzle pose and velocity at every waypoint, planning each layer from the prior layer's simulated deposit
 - Orientation smoothing: Laplacian yaw diffusion of the surface-normal orientation
 - Lowered 99th-percentile angular velocity by 56–63% and acceleration by 95–97% vs. the surface-normal baseline
 - Collision correction: configuration-space feasible windows, DP-seeded homotopy classes, boxed CHOMP over SDF costs
 - Cleared all 5,100+ colliding poses across three freeform builds
 - After correction, angular velocity and acceleration remained 50–63% and 79–96% below the baseline's values
 - Velocity adaptation: per-waypoint velocity profiling from each layer's simulated deposit
 - Cut per-layer deposition unevenness by 33–43% (IQR) vs. a constant-velocity baseline
 - Finished prints fill 96–99% of target volume
 - Held planning 4–16× faster than spray execution at each shape's worst-case layer
 - Confined optimization to colliding segments inside their feasible windows
 - Shared one precomputed SDF between detection and correction; coarsened collision costs to a sphere cover
 - Accelerated the simulate-plan loop with occupancy-cached obstacle loading (6.8×, 5.4 s → 0.8 s), validated byte-identical
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Publications

D. Lal, K. Vazquez-Santiago, S. Yamakawa, and K. Shimada, "Nozzle-Motion Planning for Concrete Spray 3D Printing of Freeform Structures with Rebar," in preparation for IEEE conference submission, 2026.

Selected Projects

Robot Planning Suite (16-782, C++): A*/weighted-A* multi-goal interception, RRT/RRT*/PRM arm planners, symbolic PDDL planner

Deep RL Agents (16-831, PyTorch): DQN/Double DQN, policy gradients with baselines, and actor-critic agents

NL-to-PDDL Planner Interface (Likhachev group, ongoing): LLM translation of natural-language task descriptions into formal PDDL domains and problems, solved by a classical C++ planner; targeting logistics, manipulation, and travel domains

EMT Assisting Robot (Purdue senior design): obstacle detection and emergency stops; Python vision/drive/safety test framework

Industry Experience

Intel Corporation | Hillsboro, OR

Process Engineer | March 2022 – May 2024

- Built and deployed a wafer-recipe repository database with tool pairing, reducing error-detection time by 25%
- Calibrated PID controller gains for nozzle dispensing-rate control in semiconductor manufacturing

Tesla | Fremont, CA

Energy System Designer II | August 2021 – January 2022

- Designed code-compliant residential solar installations in proprietary CAD across multiple state, county, and utility jurisdictions
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Awards

Jeremiah Mpagazehe Graduate Student Service Award | Carnegie Mellon University, Dept. of Mechanical Engineering | May 2026

- MS-student award for graduate community leadership and service; recognized for work as the MechE MS Student Ambassador

Department Safety Award | Intel Corporation | December 2023

- For improving preventive-maintenance procedures for etch dispense length optimization