SURABHI GADE

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EDUCATION

Northeastern University, Boston, MA **Sept 2023 to May 2025**
Master of Science in Mechatronics, Robotics and Automation Engineering
- **Related Coursework:** Computer Vision, Machine Learning, Data Structures and Algorithms, Reinforcement Learning, Robot Sensing and Navigation, Mobile Robotics, Robot Mechanics, and Control **GPA: 3.59**

Vishwakarma Institute of Technology, Pune, Maharashtra **Oct 2020**
Bachelor of Technology in Mechanical Engineering
- **Related Coursework:** Engineering Mechanics, Kinematics and Mechanics, Mechatronics, Fundamentals of Programming, Linear Algebra, Differential Equations and Vector Analysis **GPA: 8.35/10**

TECHNICAL SKILLS

Programming Languages: C, C++, Python
OS & Tools: Linux (Ubuntu), Windows, Docker, Git, Visual Studio, GPGPU/CUDA
Robotics & Simulation: ROS/ROS2, Gazebo, URDF/Xacro, Nav2, Safety-Gymnasium
Software: MATLAB, Arduino, SmartPlant 3D, MicroStation
Libraries: OpenCV, PyTorch, TensorFlow, NumPy, Scikit-learn
Certifications: The Construct (ROS/ROS 2 Python, ROS 2 Navigation)

RELEVANT PROJECTS

3D Point Cloud Registration using ICP [GitHub Link] **Feb 2025**
- Processed and aligned 3D point cloud data using Iterative Closest Point (ICP) algorithm.
- Computed rigid body transformations and RMSE for accuracy assessment.

Real Time 2D object recognition system project [GitHub Link] **Dec 2024**
- Built a robust 2D object recognition system using thresholding, morphological filtering, and connected components analysis to accurately identify objects under varying translation, scale, and rotation conditions.
- Integrated nearest-neighbor recognition approach with feature extraction for real-time object classification, comparing its performance against an alternative classification method

Reinforcement Learning & Safe AI Project [Code] **Nov 2024**
- Designed and trained a safe RL agent using Constraint Policy Optimization (CPO) algorithm, achieving 95% success rate in collision-free navigation across environments with static obstacles.
- Simulated custon environments using Safety Gymnasium library, implementing CMDP framework to optimize policy networks by maximizing cumulative rewards while calculating collision cost functions to model real-world safety constraints.

Route Planning in Occupancy Grid Maps [GitHub Link] **Oct 2024**
- Developed a path planning framework using A* and Probabilistic Road Map (PRM) algorithms over binary occupancy grid maps.
- Analyzed planning efficiency and robustness across different environments and obstacle densities.

ADDITIONAL PROJECTS

ROS2-Based Autonomous Wall-Following Robot **Jan 2025**
- Programmed ROS2 package to achieve autonomous wall-following behaviour for TurtleBot3 using LiDAR sensor data.
- Optimized the system in Gazebo simulation integrating ROS2 nodes, publishers, subscribers, and launch files for autonomous navigation.

Autonomous Robot Navigation & Control System **Sept 2024**
- Modeled a custom robot using URDF/Xacro**.** Implemented a Virtual Dipole Algorithm with the ROS Navigation Stack, achieving a 90% success rate in object delivery tasks across 10+ randomized environments.
- Implemented Model Predictive Control (MPC) using the ROS Control stack. Conducted Gazebo simulation trials on Ubuntu 20.04, ROS Noetic.

Deep learning for Digit and Fashion item recognition using PyTorch **Mar 2024**
- Trained deep neural network with PyTorch achieving 98.7% accuracy to recognize handwritten digits on the MNIST dataset and 92.3% accuracy on clothing items on the Fashion MNIST dataset.
- Applied transfer learning to recognize Greek letters, achieving 95% accuracy, demonstrating strong model generalization.

Content-based Image Retrieval project **Jan 2024**
- Engineered a content-based image retrieval system, achieving top-5 retrieval accuracy of 85% using traditional feature-based methods and deep neural networks (DNNs).
- Optimized image retrieval accuracy by 20% by integrating color histograms, texture descriptors, and DNN embeddings, demonstrating superior performance across diverse datasets.

WORK EXPERIENCE

Air Products India Pvt. Ltd., Pune, India
Design Engineer **Nov 2020 to Aug 2023**
- Reduced design iteration time by 25% by implementing modularized equipment piping designs and parametric modelling techniques using SmartPlant 3D, enabling the team to complete 8+ complex projects ahead of schedule.
- Designed modular plant layouts in MicroStation, resulting in shortened fabrication timelines.
- Streamlined clash detection and prevention workflows by reviewing GA drawings and generating automated clash reports, resolving 40+ structural conflicts during reviews, preventing $320K in potential rework costs, and ensuring client satisfaction.