Aryaman Shardul

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EDUCATION

Northeastern University, Boston, MA **Dec 2026**

Master's in Robotics (ECE Concentration), **GPA 3.92**

Relevant Courses: Robotics Sensing & Navigation, Robot Mechanics & Control, Mobile Robotics, Control Systems

Veermata Jijabai Technological Institute, Mumbai, India **May 2024**

Bachelor of Technology in Computer Engineering, **GPA 8.14/10**

Relevant Courses: Machine Learning, Data Structures and Algorithms, C++, Python, Internet of Things (IOT)

TECHNICAL SKILLS

Programming Languages: C, C++, Python, Lua, Octave

Web Developer Tools: HTML, CSS, JavaScript

Software/Frameworks: Linux, Git/GitHub, ROS, ROS 2, Gazebo, Rviz, CoppeliaSim, MATLAB, CasADi, Simulink, Arduino IDE, Raspberry Pi, TensorFlow, PyTorch OpenCV, NumPy, GTSAM, Open3D

WORK EXPERIENCE

Silicon Synapse Lab, Northeastern University, Boston, MA **Feb 2025 – Present**

Graduate Research Assistant

- Developing a control strategy to enable tumbling locomotion for the Cobra robot by modulating its elliptical posture during movement by using Model Predictive Control (MPC) and analyzing Impact Mitigation Factor (IMF)

Multi-Robot Autonomy Lab, IISER Bhopal, Remote **Jan 2023 – March 2024**

Robotics Research Intern

- Designed a Model Predictive Controller (MPC)-based UAV path-planning algorithm using MATLAB and CasADi to account for the dynamic wind field present around the UAV
- Created a neural network using Computational Fluid Dynamics and DeepXDE to simulate the rapidly changing wind patterns, demonstrating the use of deep learning for environmental modeling in robot autonomy
- Integrated obstacle avoidance constraints, ensuring control and navigation in complex environments

Embedded Real-Time Systems Lab, IIT Bombay, Mumbai, India **June 2022 – July 2022**

Summer Research Intern

- Developed "Prota: The ROS Bot," an autonomous ground vehicle, integrating LiDAR, IMU, optical encoders, depth camera, and proximity sensors for multi-sensor fusion and navigation in a GPS-denied environment
- Calibrated and synchronized sensor data streams to enable reliable localization and mapping, and performed real-time SLAM using ROS packages and Python, both in Gazebo simulation and on physical hardware
- Built the robotics software stack for motion planning and perception, gaining hands-on experience with the robotics middleware ecosystem, including ROS topics, services, and parameter tuning

PROJECTS

Branch-and-Bound for 3D Global Localization **March 2025 – April 2025**

Recreating a simplified version of the 3D-BBS algorithm from ICRA 2024 for 3D perception and global robot localization in autonomous driving SLAM pipelines, overcoming limitations of methods based on ICP that require accurate initial guesses

- Implemented hierarchical Branch-and-Bound (BnB) search in C++ for 4-DOF pose recovery (x, y, z, yaw) using voxel hash maps and candidate pruning, leveraging 3D LiDAR scan matching with the BnB search algorithm
- Evaluated alignment performance on KITTI Sequence 00, achieving less than 5m ATE and less than 1-degree AOE across fake initializations and perturbed inputs
- Emulated GPU-based methods on CPU-only setup, revealing key trade-offs in voxel resolution, scoring heuristics, and search expansion, and visualized scan-to-map alignment using Python and Open3D

Pick and Place Using a Robot Manipulator **Nov 2024 – Dec 2024**

Designed a motion planning solution for a pick and place task using a 4-DOF PincherX100 robot arm, coding in MATLAB

- Employed Forward Kinematics and Numerical Inverse Kinematics to calculate the end-effector's position and to determine the joint configurations needed to achieve a desired end-effector pose, respectively
- Designed a Trajectory Planner using linear interpolation for a smooth and time-optimal trajectory
- Implemented obstacle avoidance for the arm to generate a collision-free trajectory in the presence of an obstacle

Sensor Fusion Of GPS And IMU Data **Oct 2024**

Collected GPS and IMU data using the NUANCE autonomous car to perform automotive dead reckoning

- Developed custom ROS 2 messages, nodes, and drivers with custom parameters for GPS and IMU sensors using Python, integrating them into a unified driver for synchronized multimodal sensor fusion and integration
- Analyzed the IMU's noise characteristics using Allan Variance and calibrated the magnetometer by correcting hard and soft iron distortions, alongside error compensation for both IMU and GPS data
- Designed a sensor fusion pipeline using complementary filters to estimate yaw and forward velocity for dead reckoning, improving understanding of sensor calibration and SLAM in GPS-degraded conditions