Sauman Raaj

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EDUCATION

Boston University, Master's in Robotics and Autonomous Systems, Boston, MA, US ***Aug 2024 - Aug 2026***
Courses: Machine Learning, Robot Learning, Embedded Systems, Computer Vision, Probabilistic Analysis

Anna University, Bachelor's in Manufacturing Engineering, Chennai, India ***Jun 2020 - Apr 2024***
Courses: CAD, Rapid Prototyping, SLAM, Python, Control Systems, Robot Kinematics, Mechatronics

Warsaw University of Technology, Certification in Modern Robotics, Warsaw, Poland ***Jun 2023 - Jul 2023***
Courses: Robotics, Robot Operating System (ROS), Autonomous Vehicles, Deep Learning, CARLA

WORK EXPERIENCE

Agency Robotics, Cambridge, MA | ROBOTICS SOFTWARE ENGINEERING INTERN ***Jun 2025 - Present***
Software and simulation design and testing

- Working on motion control systems for autonomous mobile robots (AMRs), including planning, execution, and real-time debugging in ROS2 environments.
- Designed Python-based scheduling and control APIs for testing autonomous decision-making, fault recovery, and route planning optimization in ambiguous, high-load environments.
- Benchmarked control algorithms under varied latency and load conditions using custom test scenarios across a multi-agent simulation.
- Collaborated cross-functionally to align system behavior with real warehouse constraints, contributing to an ongoing physical deployment effort.

Caterpillar Inc., Chennai, India | INTERN TRAINEE ***Jul 2022 - Aug 2022***
Led defect reduction and assembly optimization using lean methods

- Applied lean methodologies like Six Sigma, reducing assembly inefficiencies by 30% through process optimization.
- Implemented defect analysis to enhance quality control, reducing assembly errors by 50% & improving efficiency.
- Developed and implemented automation solutions using industrial robots (SCARA), resulting in a 2x increase in production efficiency and demonstrating practical application of automation principles.

PROJECTS

Graduate Researcher, Boston, MA | ***Sept 2024 - Present***
LLM guided manipulator research

- Designed and implemented a full-stack manipulation system using GPT-4 and the Sawyer robot, converting natural language to executable ROS2 actions using Inverse Kinematics and MoveIt.
- Developed perception-to-action loops by integrating spatial reasoning with LLM-generated task plans in robotic pick-and-place pipelines.
- Built Isaac Sim scenarios for testing learning-based whole-body control and evaluated Sim2Real latency profiles.
- Conducted physical tests using the Sawyer arm to validate LLM-generated manipulation sequences under varied constraints.

Vision-Language Model Controlled Robotic Arm (Gazebo + ROS2) **Jan 2025- Present**
Simulation of a robot arm using VLM

- Created a ROS2 + Gazebo-based robotic system where VLM interprets images and language to generate action sequences.
- Applied depth estimation for object pose inference and dynamic trajectory generation via MoveIt.
- Demonstrated end-to-end vision-to-action loop for pick-and-place operations, aligned with real-time system constraints.

LocusEdge (Offline LLM-based Mobile Robot, Jetson + ROS2) ***Sept 2024 - Dec 2024***
Offline LLMs for Edge Robotics

- Built a Jetson-deployed mobile robot powered by Whisper ASR and quantized LLaMA 3 for offline natural language control.
- Designed ROS navigation stack triggered by speech for indoor autonomy.
- Optimized performance under power-constrained edge conditions, simulating deployment-level behavior.

BEAR Lab x GCS Project | Phase 1 **April 2025 – Present**
LLM-Centric Reasoning with Scientific Parameters

- Curated and embedded domain-specific research from the BU Shape Lab's GCS system into an LLM to simulate expert reasoning on physical experiments.
- Evaluated model behavior on 30K+ parameterized experiments, testing knowledge retention, failure prediction, and parameter influence chaining.
- Explored memory-based grounding via RAG and prompt engineering to measure decay and knowledge transfer under incremental dataset exposure.

TECHNICAL SKILLS

Motion Planning & Control: MoveIt, Inverse Kinematics, Task Planning, Collision Avoidance, PID Controllers, Waypoint Tracking, Trajectory Optimization, **Perception & Sensor Integration:** SLAM, Pose Estimation, Intel RealSense, Camera Calibration, Sensor Fusion (IMU, Encoders, Cameras), **Programming & Middleware:** ROS, ROS2, Python, C++, Embedded Linux, TF2, URDF, **Simulation & Prototyping:** Gazebo, Isaac Sim, RViz, HIL Simulation, CARLA, Jetson, Docker, Fusion 360, 3D Printing, **AI & Intelligence:** GPT-4, LLaMA 3, Vision-Language Models, Whisper ASR, Prompt Engineering