

VARUN LAKSHMANAN

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<https://varun-robotics.com> | <https://github.com/varunlakshmanan11>

EDUCATION

University of Maryland, College Park, MD

Master of Engineering (M.Eng.) in Robotics

Coursework Highlights: Robot Modeling, Robot Programming, Control Systems of Robotics, Planning of Autonomous Robots, Perception of Autonomous Robots, Robot Learning, Natural Language Processing, Decision-Making Robotics, Human-Robot Interaction, Hands on Autonomous Aerial Robotics.

GPA: 3.66/4.00

August 2023 – May 2025

Anna University, Chennai, India

Bachelor of Engineering (B.E.) in Mechanical Engineering

Studied at Panimalar Institute of Technology (Affiliated to Anna University)

GPA: 8.8/10

August 2018 – July 2022

TECHNICAL SKILLS

- **Programming Languages:** Python, C++, MATLAB.
- **Simulation and Frameworks:** ROS 2, Gazebo, MoveIt, LiDAR, Nvidia Isaac Sim, Simulink, Mujoco.
- **Robotics Concepts:** State Estimation, Sensor Fusion, Robot Kinematics, Robot Dynamics, Robot Learning.
- **GPU Programming:** CUDA C/C++, Kernel Fusion, Thrust, NVIDIA Nsight Systems, CUDA Streams.
- **Machine Learning and AI:** PyTorch, TensorFlow, OpenCV, NumPy, Scikit-Learn, LLMs, Reinforcement Learning.
- **Tools:** Linux, Jupyter Notebook, Cursor, VS Code, Git.
- **CAD Software:** AutoCAD, SolidWorks, Fusion 360, Creo Parametric.

PROJECT EXPERIENCE

FireDroneX – Autonomous UAV Fire and Human Localization

- Built a UAV vision pipeline using **YOLOv8** and **Depth Anything V2**, achieving **1.2 m localization error** for fire and human detection.
- Programmed a **ROS 2 mission controller** with SEARCH, HOLD, APPROACH, and CIRCLE states for autonomous flight.
- Integrated with **VOXL 2 hardware**, validating depth models under RTSP streaming with **sub-100 ms latency**.

Adaptive Text-to-Command Translation for Robot Navigation

- Engineered a robot navigation system using the **T5-Small language model** and a custom dataset of **24,581** instructions.
- Achieved **98.5%** accuracy in generating correct battery sequences for navigation using **LoRA** fine-tuning.
- Embedded **ROS 2** with an **LLM model** for real-time robot navigation and command execution.

Multi-Robot Navigation using MCTS – Centralized vs Decentralized

- Implemented **centralized and decentralized MCTS planners** in ROS 2 to coordinate TurtleBot3 teams in obstacle-rich environments.
- Built **Gazebo simulations** with randomized layouts and team sizes to assess path efficiency, collision rates, and planning overhead.
- Demonstrated **decentralized MCTS** scaled linearly with robot count, reducing computation and improving convergence.

Gesture-Based Control in Assistive Technology

- Created a **ROS 2** node to control TurtleBot3 using **machine learning**-based hand gesture classification.
- Enabled real-time **DexHand** manipulation in **RViz**, achieving **93%** accuracy in replicating human hand movements via webcam.

Perception-Based Robot Navigation

- Configured a TurtleBot3 to traverse unknown spaces using **horizon detection**, **optical flow**, and **stop-sign recognition**.
- Applied **homography transforms** to align image frames, strengthening visual geometry for obstacle identification.
- Validated performance on hardware and simulation with over **90% success rate** in navigation and path optimization.

Alpha – Mobile Pick and Place Manipulator

- Designed a four-finger mobile manipulator in **SolidWorks** and integrated the model into **ROS 2 with Gazebo** for motion experiments.
- Implemented both **forward and inverse kinematics** with open-loop control, enabling consistent pick and place execution in simulation.

CERTIFICATIONS

- **Getting Started with Accelerated Computing in Modern CUDA C++** - NVIDIA.
- **Machine Learning Specialization** - DeepLearning.AI and Stanford University (Coursera).
- **Python Programming** - Udemy.
- **AutoCAD** - Go Tech Solutions.
- **Introduction to Programming with IOT boards** - POSTECH.