

VARUN LAKSHMANAN

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EDUCATION

University of Maryland, College Park, MD

Master of Engineering (M.Eng.) in Robotics

GPA: 3.66/4.00

August 2023 – May 2025

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.

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, Computer Vision, Deep Learning, 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 Detection

- Developed an **Autonomous UAV** system using **ROS 2**, **PX4**, and **YOLOv8** for real-time fire and human detection with 3D localization using **computer vision**, **monocular projection**, and **monocular depth estimation** methods.
- Recorded a **1.2m** localization error using state-based planning and implemented GUI for monitoring drone behaviour.

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 Centralized and Decentralized Monte Carlo Tree Search

- Applied **Monte Carlo Tree Search (MCTS)** in centralized and decentralized setups, enabling four **TurtleBots** to navigate in **Gazebo** simulation environment with moving obstacles.
- Analyzed navigation efficiency, revealing that the decentralized approach improved the speed of reaching goals by **30%** compared to the centralized method.

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

- Collaborated with a team of four to program a real-world TurtleBot3 to autonomously navigate unknown environments using perception-based techniques like **Horizon Detection**, **Homography**, **Stop-sign Detection** and **Optical Flow**.
- Achieved more than **90% success rate** in obstacle avoidance and path optimization across simulation and hardware tests.

Alpha – Mobile Pick and Place Manipulator

- Designed and simulated a mobile robotic manipulator featuring four-finger claw using **SolidWorks** and **ROS 2** in **Gazebo**, integrating **forward and inverse kinematics**, an **open-loop control** system, and **teleoperation** capabilities.

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.