

VARUN LAKSHMANAN

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EDUCATION

University of Maryland, College Park, MD
Master of Engineering (M.Eng.) in Robotics

GPA: 3.62/4
August 2023 – May 2025

Panimalar Institute of Technology, Chennai, India
Bachelor of Engineering (B.E.) in Mechanical

GPA: 3.52/4
August 2018 - July 2022

SKILLS

- **Programming Languages:** Python, C++, MATLAB.
- **Robotics and Simulation:** ROS 2, Gazebo, MoveIt, Motion Planning, LiDAR, Control Systems, Kinematics, Dynamics.
- **Machine Learning and AI:** PyTorch, TensorFlow, OpenCV, Scikit-learn, NumPy, SciPy, MediaPipe, NLP, Computer Vision, LLMs, Deep Learning, Reinforcement Learning, Supervised and Unsupervised Learning.
- **Operating Systems, Software and Tools:** Linux, Jupyter Notebook, Google Colab, VS Code.
- **CAD Software:** AutoCAD, SolidWorks, Fusion 360, Creo Parametric.
- **Mathematical & Engineering Foundations:** Linear Algebra, Probability, Thermal Engineering, Fluid Mechanics, Finite Element Analysis, Thermodynamics, Heat and Mass Transfer.

PROJECTS

Intelligent Robot Navigation:

- Enhanced dynamic obstacle avoidance in **Gazebo simulation** by integrating a **Dueling Double DQN (deep reinforcement learning) model** into an existing **Vanilla DQN architecture**.
- Boosted navigation performance by **30%** compared to the baseline Vanilla DQN implementation.

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% accuracy** in generating correct battery sequences for navigation.
- 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 **goal-reaching speed** by **50%** 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 **95% accuracy** in replicating human hand movements via webcam.

Performance analysis of RRT* variants:

- Implemented and evaluated **RRT** algorithm variants for **TurtleBot3 navigation** in a custom simulation environment.
- Refined movement accuracy with a PID controller, identifying Q-RRT* as the most effective approach.

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**.
- Achieved a **98% success rate** in obstacle avoidance and path optimization.

CERTIFICATIONS:

- **Machine Learning Specialization:** DeepLearning.AI and Stanford University (Coursera).
- **Python Programming:** Udemy
- **Electric Vehicles:** TVS Training and Services.
- **Introduction and Programming using IoT Boards:** POSTECH (Coursera).
- **AutoCAD:** Go Tech Solutions.