VARUN LAKSHMANAN

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EDUCATION

University of Maryland, College Park, MD — **GPA: 3.62/4**
Master of Engineering (M.Eng.) in Robotics — August 2023 – May 2025

Panimalar Institute of Technology, Chennai, India — **GPA: 3.52/4**
Bachelor of Engineering (B.E.) in Mechanical — August 2018 - July 2022

SKILLS

- **Programming Languages:** Python, C++, MATLAB.
- **Simulation and Frameworks:** ROS 2, Gazebo, MoveIt, LiDAR, Nvidia Issac Sim.
- **Robotics Concepts:** Control Systems, Motion Planning, Human Robot Interaction, Kinematics, Perception, Robot Learning. UAV's.
- **Machine Learning and AI:** PyTorch, TensorFlow, OpenCV, Scikit-learn, NumPy, SciPy, MediaPipe, NLP, Computer Vision, LLMs, Deep Learning, Reinforcement Learning, Supervised and Unsupervised Learning.
- **Tools:** Linux**,** Jupyter Notebook, Git.
- **CAD Software:** AutoCAD, SolidWorks, Fusion 360, Creo Parametric.
- **Mathematical & Engineering Foundations:** Linear Algebra, Probability, Statistics.

PROJECTS

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% accurac**y 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.

Intelligent Robot Navigation:
- Enhanced obstacle avoidance in a **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.

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:
- Coordinated with a team of four to program a **real-world TurtleBot3** to autonomously navigate unknown environments using perception-based techniques such as **Horizon Detection, Homography, Object Detection and Optical Flow.**
- Achieved a **98%** success rate in obstacle avoidance and path optimization.

Motion Planning of a Panda Robot Arm Using MoveIt:
- Leveraged a **Panda robot** simulation in ROS 2 with **MoveIt** to enable robust motion planning, grasping, and advanced manipulation, culminating in a complete pick-and-place workflow from default pose to object pickup, placement, and return.

CERTIFICATIONS:

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