VARUN LAKSHMANAN

varunlakshmanan150@gmail.com | (240) 940 8559 | www.linkedin.com/in/varunlakshmanan11 | College Park, MD, USA

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.
- **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.
- **Tools:** Linux**,** Jupyter Notebook, Google Colab, VS Code, Git.
- **CAD Software:** AutoCAD, SolidWorks, Fusion 360, Creo Parametric.
- **Motion Planning Algorithms:** A*, Dijkstra, Breath First Search (BFS), RRT, RRT*.
- **Mathematical & Engineering Foundations:** Linear Algebra, Probability, Thermal Engineering, Fluid Mechanics, Finite Element Analysis, Thermodynamics, Heat and Mass Transfer.

PROJECTS

Design & Simulation of LQR/LQG Controllers
- Developed LQR and LQG controllers for a nonlinear crane system by deriving system equations, linearizing dynamics, and integrating Kalman filtering—reducing state estimation error by 25%.

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.

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:
- Coordinated 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.