VARUN LAKSHMANAN

<u>varunlakshmanan150@gmail.com</u> | (240) 940 8559 | <u>www.linkedin.com/in/varunlakshmanan11</u> | <u>https://varun-robotics.com/</u> | https://github.com/varunlakshmanan11 | College Park, MD, USA

EDUCATION

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

August 2023 – May 2025

GPA: 3.62/4

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.
- Simulation and Frameworks: ROS 2, Gazebo, MoveIt, LiDAR, Nvidia Isaac 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% 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.

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.