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++.
- **CAD Software:** Autodesk AutoCAD, Autodesk Fusion 360, Creo Parametric, SolidWorks, CATIA.
- **Tools and Libraries:** OpenCV, MATLAB, NumPy, Scikit-learn, Pandas, SciPy, MediaPipe.
- **Development Tools:** Visual Studio Code (VS code), Jupyter Notebook, Google Colab, ROS 2.
- **Simulation Software:** Gazebo
- **Machine Learning Frameworks:** PyTorch, TensorFlow.
- **Others:** Supervised Learning, Unsupervised Learning, Reinforcement Learning, Deep Learning, Large Language Models, Natural Language Processing. Computer Vision, Motion Planning. Kinematics, Linear Algebra, Dynamics, Probability, Control Systems, LiDAR.

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.
- Integrated ROS2 with LLM for real-time robot navigation, enabling seamless execution of commands.

Multi Robot Navigation using Centralized and Decentralized Monte Carlo Tree Search:
- Designed and implemented **Monte Carlo Tree Search (MCTS)** for both centralized and decentralized setups, enabling **four TurtleBots** to navigate within a Gazebo simulation featuring dynamic obstacles.
- Conducted Performance analysis to evaluate navigation efficiency, identifying trade-offs between **centralized vs decentralized approaches**

Gesture-Based Control in Assistive Technology:
- Developed a **ROS 2 node** to control a **TurtleBot3** using **machine learning-based hand gesture classification**.
- Enabled real-time manipulation of a **DexHand** in simulation via **RViz**, achieving a **95% success rate** in replicating human hand movements captured through a webcam.

Performance analysis of RRT* variants:
- Implemented and evaluated *RRT algorithm variants** for **TurtleBot3 navigation** in a custom simulation environment
- Integrated a **PID controller** to refine movement accuracy and conducted a comparative study, identifying **Q-RRT*** as the most effective approach.

TurtleBot Challenge:
- 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**.**

Intelligent Robot Navigation:
- Enhanced **dynamic 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.

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.