Aditya Parameshwaran

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EDUCATION

Clemson University Jan 2022 - Present
PhD. Candidate in Mechanical Engineering
Courses: Advanced Linear Programming, Robust Control, Optimal Control, Data Driven Learning

Purdue University Aug 2019 - Dec 2021
Master of Science in Mechanical Engineering
Courses: Autonomous Systems, Rigid Body Robot Kinematics, Engineering Mathematics

EXPERIENCE

Virtual Prototyping & Research Centre Clemson University, SC
Graduate Research Assistant (PhD.) *Jan 2022 - Present*

- **Semantic 3D Maps using Off-Road Robots**: Integrated the US Army's robotics stack onto a Jackal robot with stereo cameras and LIDAR using ROS2, boosting off-road navigation. Developed a *C++* based tool for providing state-of-the-art semantic segmentation for 3D terrain maps using Octomap library.

- **Robot Motion Planning with Formal Safety Guarantees**: Designed control logic for an autonomous vehicle using *StateFlow* and *MATLAB*, incorporating convex region definitions for obstacles and goals. Implemented Mixed Integer Linear Programming with *Gurobi* combined with linear path planning, resulting in a 50% improvement in computational efficiency in solving navigation problems.

- **Autonomous Navigation with Generative AI**: Developing novel DNN-based navigation tools for robotic manipulators like Baxter, leveraging *PyTorch*, *Pandas*, and Generative AI techniques like autoencoders. Developing faster control techniques for multi-dimensional robots with latent space control using *C++* and *Isaac Sim*

WABTEC Corporation West Lafayette, IN
Robotics Intern *May 2021 - Dec 2021*

- **Development of Autonomous Rail Bot**: Led a 5-member team in designing an autonomous bot on *Solidworks* for railway track data collection, integrating LiDAR, camera, GPS, and IMU sensors with an Nvidia Jetson AGX. Successfully resulted in a 30% reduction in track monitoring downtime, significantly improving overall efficiency.

- **Mechatronics of Rail-Bot**: Spearheaded Mechatronics responsibilities for the project, implementing a PD controller for precise motor control using Embedded C. Developed an Extended Kalman Filter for state estimation, thus achieving substantial performance in GPS-denied areas.

SKILLS

- C/C++	- ROS/ROS2	- PyTorch/Tensorflow	- Git/Linux
- Python	- MATLAB	- Numpy/Pandas	- Docker

PROJECTS

Behavioral Cloning for Autonomous Vehicles: Trained a Deep CNN model on *PyTorch* to autonomously navigate a vehicle based on perception and expert driver data simulated using *CARLA*.

Optimal Control for Landing Reusable Rockets: Designed an *Extended Kalman Filter* for state estimation amidst environmental disturbances using *C++* while deploying a path-tracking model predictive controller for safe non-linear rocket landings.

Real Time Indoor Navigation of a Ground Robot: Led a team of 4 in developing a custom Arduino-based ground robot control system, implementing a PID control architecture for precision and integrating a ResNet-52 CNN model to adapt behavior based on detected traffic sign zones.

Autonomous Vehicle Navigation in ROS environment: Created a software stack capable of path planning and navigation of a vehicle with object tracking, obstacle avoidance, and road sign detection using *ROS, OpenCV, Python* and *Gazebo*.

PUBLICATIONS

- Parameshwaran, Aditya, and Yue Wang. "Safety Verification and Navigation for Autonomous Vehicles Based on Signal Temporal Logic Constraints". No. 2023-01-0113. SAE Technical Paper, 2023.