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Kevin Paulose

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Education

University of Pennsylvania **exp. May 2025**
Master of Science in Engineering, Robotics, ***GPA: 3.9/4.0*** *Philadelphia, PA*
Coursework: Control and Optimization with Applications in Robotics, Learning in Robotics, F1/10 Autonomous Racing Cars, Machine Perception, Linear Systems Theory, Design of Mechatronics Systems

Indian Institute of Technology, Bhubaneswar **May 2023**
Bachelor of Technology, Mechanical Engineering (Robotics), ***GPA: 3.62/4.0*** *Bhubaneswar, India*

Technical Experience

The Autoware Foundation, TIER IV **May - November 2024**
Autonomous Systems Engineer *Philadelphia, PA*
- Led the US deployment of the EVE Autonomy platform with Yamaha and Tier IV, showcasing advanced ADAS features like pedestrian detection, Automatic Emergency Braking (AEB), and automated parking using ROS2-based SLAM and localization.
- Constructed a detailed HD map with lanelets of the Pennovation site and implemented hybrid A* path planner. Developed an Extended Kalman Filter localizer to fuse data from 3 Livox Horizons, a Velodyne VLP-16, and RTK from Fixposition AG, enhancing navigation accuracy.

MITACS Globalink Research **May - Aug 2022**
Research Intern at Laboratoire de Robotique et Systèmes Autonomes, Université du Québec en Outaouais *Quebec, Canada*
- Engineered a Holybro X500 V2 drone mounted with RPLiDAR A1m8, Occipital Structure Core camera, CUAV V5+ Autopilot running PX4, and Neo V3 Pro GPS for real-time flight tests to validate obstacle avoidance algorithms.
- Developed and optimized a deadlock-free indoor obstacle avoidance algorithm for a 6-DOF quadcopter in unknown environments using Nagumo's invariance theorem and Bouligand tangent cones, achieving an 86% success rate in flight tests.

Competitions

SICK $10K Challenge | *Warehouse Automation, Autonomous Mobile Robot, LiDAR, Cameras* **September 2024 - present**
- Prototyping NIMBUS, an AI-powered autonomous inventory bot addressing costly warehouse issues like stockouts, inaccuracies, and space inefficiency, with real-time barcode scanning, WMS connectivity, and anomaly detection to optimize stock levels. Validated with Raymond Corporation, enhancing warehouse efficiency and safety in the expanding $54.53 billion automation market.

SICK Solution Hackathon, Germany | *ROS2, Cobots, LLM, LAM, Robotic Arms* **October 2024**
- Developed the T2A (Thought-to-Action) framework with NTT DATA, using a Language Action Model to translate human intent into robotic actions, transforming manufacturing automation. Demonstrated real-time intent-based operations with ABB and Universal Robots, supported by SICK sensors, with SCHUNK end-effectors enabling responsive, command-driven AI in dynamic environments.

Bots & Bento Competition, ICRA 2024, Japan | *ROS2, Gazebo, AprilTags, Stereo cameras, KLTs* **May 2024**
- Led a 3-day robotics hackathon as the only U.S. team, building an autonomous robot with Gazebo and Olive Robotics hardware, achieving 85% accuracy in locating and stacking bento boxes using a custom localization stack with odometry and AprilTags.

Projects

L-MPPI | *Iterative Learning Control, JAX, CUDA, Reinforcement Learning* **September 2024- present**
- Formulated a Real-Time Iterative Learning Model Predictive Path Integral (LMPPI) controller for autonomous racing, advancing lap time optimization through systematic constraint management in high-performance, GPU-accelerated simulations.
- Implemented a state-constrained, penalty-based optimization in LMPPI, incorporating RL techniques and active learning for safe, efficient navigation, validated through hardware experiments and multi-track benchmarking.

F1Tenth Autonomous Racing Cars | *C++, Python, ROS2 Foxy, Hokuyo LiDAR, Jetson Xavier NX* **January - May 2024**
- Developed high-performance control and motion planning modules for a 1:10 scale Formula 1 car using ROS2, incorporating RRT* for path planning and pure pursuit for precise steering.
- Utilized Model Predictive Control (MPC) to optimize trajectory, achieving podium finishes in reactive, follow-the-gap, and map-based racing competitions.

Grand Theft Autonomous- Mobile Robot Competition | *ESP32, Arduino, Sensors, Embedded C, Opamps* **Sep - Dec 2023**
- Manufactured a 4-wheel autonomous mobile robot using ESP32 S2 as an access point, TB6612FNG motor drivers and ATMega32u4, IR phototransistor-opamp frequency detection circuit
- Enhanced remote control capabilities with UDP, ESP-NOW, CAN protocols, optimizing performance of the mobile robot.

Pick and Place with 7-DOF Franka Emika Panda Arm | *ROS, Gazebo, Inverse Kinematics* **Sep - Dec 2023**
- Developed an E2E pipeline for the arm using ROS and Gazebo, integrating geometric inverse kinematics for precise manipulation.
- Implemented bidirectional RRT for motion planning, achieving efficient pick-and-place operations for static and dynamic objects.

Adaptive Control in UAVs & High Performance Aircrafts | *MATLAB, Simulink, Control Systems* **Jul 2022 - May 2023**
- Engineered a guidance algorithm for a 6-DOF Flying Wing UAV using L1 adaptive control with integrated LQR-based safe landing strategies, achieving 92% accuracy in reactive collision avoidance and enhancing system performance through Simulink, Gazebo, and ROS.

Technical Skills

Programming: Python, C, C++, MATLAB, ROS/ROS2, JAX, Arduino, PyTorch
Software: Linux, Windows, RViz, Gazebo, Simulink, PX4, QGroundControl, SolidWorks, ANSYS, UAV & Robotics System Toolbox
Hardware: ATMega32u4, ESP32, NVIDIA Jetson, CUDA, LiDAR, INS, stereo cameras, UDP, ESP-NOW, I2C, CAN, SPI