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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: Learning and Control for Adaptive and Reactive Robots, Learning in Robotics, F1/10 Autonomous
Racing Cars, Linear Systems Theory, Control and Optimization in Robotics, 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 Lane Follow using ROS2-based SLAM and localization.
- Constructed a detailed map of Pennovation, and an Extended Kalman Filter localizer to fuse data from 3 Livox Horizons, a Velodyne VLP-16, and RTK (Fixposition AG) for precise localization, and implemented a hybrid A* planner for navigation.

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 an AI-powered robotic system to automate warehouse inventory monitoring and space optimization, leveraging a SICK MultiScan 100 3D LiDAR, Basler cameras, and an AgileX Scout AMR. Simulation is implemented in NVIDIA Isaac Sim with ROS bridge, utilizing Action Graphs to define and manage all system nodes, ensuring seamless integration and real-time autonomy.

SICK Solution Hackathon, Germany | *ROS2, Cobots, LLM, LAM, Robotic Arms*   **October 2024**
- Developed T2A (Thought-to-Action) framework using a Language Action Model to translate human intent into real-time robotic actions. Enabled intent-driven control with UR5e robot arm and SICK Visionary 3D camera for precise scene analysis and improved safety with SICK End-of-Arm-Safeguard (EOAS), ensuring seamless human-robot collaboration in dynamic environments.

Bots & Bento Competition, ICRA 2024, Japan | *ROS2, Gazebo, AprilTags, Stereo cameras, Mechatronics, 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

RL4Racing | *PPO, IsaacLab, IsaacSim, Reinforcement Learning, Visual Simulator*   **December 2024- present**
- Developed a PPO-based reinforcement learning model in Isaac Lab for the F1Tenth platform, using domain randomization to bridge the sim-to-real gap and improve policy robustness.
- Building a robust sim environment with elevation and friction variations to support adaptive, transferable policies.

L-MPPI | *Iterative Learning Control, JAX, CUDA*   **September 2024- March 2025**
- Formulated a Real-Time Iterative Learning Model Predictive Path Integral (LMPPI) controller for autonomous racing, optimizing lap times with systematic constraint management in GPU-accelerated simulations.
- Implemented a state-constrained, penalty-based optimization in LMPPI, ensuring safe and 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 for a 1:10 scale F1 car using ROS2, integrating RRT* for path planning, pure pursuit for steering, and MPC for optimized trajectory, achieving podium finishes in racing competitions.

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.

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.

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 and ROS.

Technical Skills

Programming: Python, C, C++, MATLAB, ROS, ROS2, JAX, Arduino, PyTorch
Software: Linux, Windows, RViz, Gazebo, IsaacSim, IsaacLab, Simulink, PX4, QGroundControl, SolidWorks
Hardware: ATMega32u4, ESP32, NVIDIA Jetson, CUDA, LiDAR, IMU, Stereo Cameras, F1Tenth, UDP, ESP-NOW, CAN