Komal Porwal

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Summary

Robotics and embedded systems engineer with hands-on experience in real-time control, modeling, simulation, and hardware integration. Proficient in ROS2, C++/Python, FPGA/STM32, sensor fusion, and diagnostics. Skilled at translating advanced technology into reliable, field-ready solutions through collaboration with design, manufacturing, and quality teams.

Professional Experience

Laboratory for Atmospheric and Space Physics (LASP) (Boulder), Research Intern   May 2025 – Aug 2025

- Developed Python-based data assimilation pipelines for satellite agricultural monitoring by processing NetCDF and ASCII observation data, improving model accuracy and reducing manual data handling by 50%.
- Built automated diagnostic and visualization tools for magnetic field analysis and satellite trajectory validation, accelerating validation time for mission datasets by 30%.
- Engineered robust, maintainable code for real-time multi-sensor fusion, enabling near-real-time monitoring and enhancing operational reliability.

Physical Research Laboratory - Project Trainee   Aug 2023 – Apr 2024

- Designed and optimized sensor-conditioning electrical circuits and LabVIEW-based hardware interfaces, reducing system noise by 40% and cutting calibration time by 25% for planetary instrumentation.
- Developed FPGA-based real-time control systems for the Near-Infrared Mapping Spectrometer, optimizing state machine architecture to increase data throughput by 30% and improve component test consistency.
- Implemented Python-based, ML-assisted calibration algorithms alongside automated diagnostics, improving optical system calibration precision and overall operational efficiency.

Institute for Plasma Research - Project Intern   May 2023 – July 2023

- Developed real-time fault detection system for three-phase power grids using neural networks and decision trees, achieving 95% classification accuracy and enhancing grid monitoring reliability.
- Generated and processed 105,000+ MATLAB Simulink simulation data points for ML training, accelerating model development by 40%.
- Designed and tested multiple classifier architectures (DT, SVM, Neural Networks) for embedded deployment, improving fault detection speed and deployment readiness.

Academic Projects

Autonomous Mario Kart Racing Robot   Aug 2025 - Present

- Addressed real-time navigation and strategy challenges by designing and building an autonomous racing robot with embedded control systems and multi-sensor fusion.
- Implemented a computer vision system using Pixy/Pi Camera and C++ on microcontrollers for line tracking, obstacle detection, and dice collection, increasing task completion accuracy by 25% in test runs.
- Developed a finite state machine behavior architecture for navigation, collision avoidance, and strategic gameplay, enabling fully autonomous race execution with minimal human intervention.

Model-Based Reinforcement Learning for Robotics (MuJoCo + PyTorch)   Jan 2025 - Apr 2025

- Developed neural dynamics models for sample-efficient robot learning, reducing training data needs by 40% and enabling faster deployment of control policies on robotics platforms
- Implemented behavior cloning and imitation learning pipelines for Pendulum and Hopper locomotion, improving policy stability and reducing task failure cases during early training.
- Deployed MPC-based controllers in MuJoCo with iterative hardware-in-the-loop validation, cutting integration/debug time by 30% and improving controller robustness for real-world robotic systems

Education

MS in Aerospace Engineering (Autonomous Systems), University of Colorado Boulder   **Aug 2024 - Present**
Courses: Advanced Robotics, Guidance Navigation and Control, Decision Making under Uncertainty   *GPA: 3.9/4.0*

BS in Electrical Engineering, The Maharaja Sayajirao University of Baroda   **Aug 2020 - Apr 2024**
Courses: Artificial Intelligence, Control Systems, Embedded Systems, Industrial Automation   *GPA: 8.79/10.00*

Skills

- **Programming Languages:** MATLAB, C/C++, Python (PyTorch, TensorFlow, Scikit-learn, OpenCV)
- **Simulation:** ROS/ROS2, Gazebo, MuJoCo, Isaac Sim, Gym
- **Control System:** PID, MPC, LQR, State-Space Modeling, Kalman Filtering, PWM, Motor Control
- **Embedded Systems:** Arduino, STM32, FPGA, LabVIEW, Real-time System Integration
- **Hardware:** Sensor Integration, LiDAR, IMU, Motor Drivers, Safety Systems, Automated Diagnostics
- **Soft Skills:** Teamwork & Collaboration, Project Management, Stakeholder and Vendor Communication, Building Analytical Reports, Troubleshooting