

Aditya Varun Dhayapulay

Robotics & Autonomous Systems Engineer

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SUMMARY

Robotics & Autonomous Systems Engineer with 3+ years of experience developing ROS2-based autonomous vehicle and industrial robotics systems. Strong experience in C++17, Python, multi-sensor fusion, SLAM, perception, autonomous navigation, LiDAR/radar/camera integration, simulation, and robotics validation across autonomous off-highway vehicles and industrial automation environments.

CORE SKILLS

Programming & Software:	Python, C++ (C++14/17), CUDA, MATLAB, Bash Scripting, Git, Docker, Linux/Ubuntu
Robotics & ROS:	ROS, ROS2 (Humble/Iron), Navigation2 (Nav2), MoveIt2, RViz2, ros2_control
Autonomy & Perception:	SLAM (Cartographer, RTAB-Map), Sensor Fusion (EKF/UKF), Computer Vision, Object Detection, Lane Segmentation, Deep Learning
AI/ML Frameworks:	TensorFlow, PyTorch, TensorRT, OpenCV, Point Cloud Library (PCL)
Sensors & Integration:	LiDAR (Velodyne, Ouster), Radar, Camera Systems, IMU, GPS/GNSS, Sensor Calibration, CAN Bus, EtherCAT, Ethernet/IP, I2C, SPI
Industrial Automation:	Siemens S7 PLC, Allen-Bradley PLC, Beckhoff PLC (TwinCAT 3), SCADA, HMI, Profinet, Modbus, OPC-UA
Simulation & Digital Twin:	Gazebo (Classic & Ignition), CARLA, MuJoCo, Simulink, Digital Twin Development
Hardware & Embedded Systems:	NVIDIA Jetson, Arduino, Raspberry Pi, Actuators, Motors, Valves, Embedded Systems
Testing & Debugging:	Sensor Bring-up & Calibration, Cross-System Debugging, QA Testing, Test Infrastructure, CI/CD, Oscilloscope, Multimeter, Logic Analyzer
Design & CAD Tools:	SolidWorks, NX, CAD
Robot Platforms:	ABB, FANUC, KUKA Industrial Robots, Caterpillar CAT Autonomous Systems

PROFESSIONAL EXPERIENCE

Robotics System Engineer | Caterpillar, USA

Aug 2025 - Present

- Developed a ROS2 (Humble)-based autonomy stack for Cat 777 quarry trucks using LiDAR, radar, stereo cameras, and GNSS/IMU sensors to support autonomous navigation across quarry environments.
- Built a multi-sensor fusion pipeline in C++17 using an Unscented Kalman Filter (UKF) to combine LiDAR odometry, radar velocity, GNSS, and IMU data for reliable vehicle localization.
- Evaluated and integrated RTAB-Map and Cartographer-based LiDAR-inertial SLAM pipelines in ROS2 to support real-time mapping, localization, obstacle detection, and autonomous navigation.
- Developed a YOLOv8-based perception pipeline using OpenCV and PCL for detecting trucks, loaders, personnel, and light vehicles, achieving 93.8% mAP across quarry scenarios.
- Integrated localization, SLAM, and perception outputs with Nav2 costmaps to enable waypoint navigation, collision avoidance, and dynamic trajectory replanning around moving equipment and temporary haul-road obstacles.
- Created digital twin simulation environments in CARLA, Gazebo Ignition, and MuJoCo to validate perception, navigation, sensor behavior, and Cat 777 vehicle dynamics across representative quarry operating scenarios.
- Built Docker-based automated regression testing workflows to validate localization, perception, SLAM, and navigation modules across degraded-GPS, obstacle-avoidance, intersection, loading-zone, and haul-road simulation scenarios.
- Supported camera-IMU calibration using Kalibr and Python automation scripts, alongside LiDAR and radar validation routines, helping standardize sensor integration workflows across autonomous off-highway vehicle test platforms.

Robotics Engineer | Tata Motors, India

Jun 2022 - Jun 2024

- Designed and commissioned robotic assembly and material-handling stations using ABB IRB 6700, FANUC R-2000iC, and KUKA KR QUANTEC robots, developing motion sequences, interlocks, and PLC handshaking to reduce cycle time by 12%.
- Developed Siemens S7-1500 PLC programs in TIA Portal for conveyor sequencing, fixture control, pneumatics, robot coordination, safety interlocks, and automatic/manual operating modes.

- Configured Profinet communication between Siemens PLCs, ABB/FANUC/KUKA robots, vision systems, remote I/O, drives, and HMIs, troubleshooting network and device-level faults during commissioning.
- Integrated Cognex In-Sight vision systems for component presence, orientation, position, and assembly verification, enabling automated quality inspection and rejection of defective assemblies.
- Built Python/OpenCV validation tools to process inspection images and validate vision performance, improving defect detection accuracy by 10% while reducing manual quality checks.
- Created Siemens WinCC HMI/SCADA screens for robot monitoring, equipment status, alarm diagnostics, production counts, cycle-time tracking, and KPI visualization, improving operator troubleshooting.
- Implemented Python/OPC-UA data acquisition to capture PLC tags, robot status, cycle times, fault codes, and equipment performance data in Grafana dashboards for real-time production monitoring.
- Performed robot and PLC commissioning and optimization, including I/O validation, TCP calibration, safety-interlock testing, root-cause analysis, and fault recovery, reducing unplanned stoppages by 8%.

PROJECTS

Autonomous Mobile Robot Digital Twin & Fault Recovery

NVIDIA Isaac Sim, ROS 2, Python, Reinforcement Learning

- The project involved debugging and improving a robotic simulation in which the robot would stop unexpectedly during operation.
- I investigated the issue using robot-state, coordinate, LiDAR, and orientation/tilt telemetry and identified that the robot was tilting during operation, causing the LiDAR to incorrectly detect obstacles.
- I developed a monitoring and recovery strategy that detected excessive tilt and triggered recovery behavior when required.
- The improved system successfully completed a 63-minute simulation and a 10×10 order workload with zero failures.

PCB Defect Detection Capstone | [GitHub](#) | [Live Demo](#)

Python, YOLO11, RT-DETR, ONNX, Hugging Face, GitHub

- Trained and benchmarked YOLO11s/m/l and RT-DETR-L for six-class PCB defect detection, achieving 98.3% precision, 98.8% recall, and 0.99 mAP@50 with YOLO11l at 1280px and 31 ms/image inference.
- Deployed a live Hugging Face Spaces inspection app with annotated detections, per-class counts, pass/review verdicts, and JSON/CSV export; added ONNX export and documented a Jetson/TensorRT edge-deployment path.

EDUCATION

Master of Science in Computer Science

California State University, Fullerton

GPA: 3.8 / 4.0

Aug 2024 - Aug 2026

Bachelor of Technology in Computer Science

JNTUH College of Engineering

Aug 2020 - May 2024

PUBLICATIONS

Aditya Varun Dhayapalay and Paul Salvador Inventado. “Real-Time PCB Defect Detection for Embedded Visual Inspection: A Same-Split Comparison of YOLO11s and RT-DETR-L.” Accepted, 24th Int. Conf. on Embedded Systems, Cyber-physical Systems & Applications (ESCS’26 / CSCE’26), Springer Nature; Scopus / DBLP / EI indexed, 2026.