

SUMMARY

Systems Engineer with structured test execution and HIL/SIL validation experience across safety-critical electromechanical programs – simulation-based test planning, perception pipeline characterization, and quantitative risk assessment from prototype through production release. At Tennant Company: designed and executed HIL/SIL test campaigns for control and electromechanical systems; authored HARA, FTA, and quantitative residual risk assessments feeding directly into IEC 61508 SIL2 and ISO 13849-1 safety cases. Perception and sensor work on AMR platforms: characterized a 2D camera surface-classification pipeline (KNN/CNN/Random Forest, IoU-based evaluation across surface classes), evaluated and integrated perception sensors for autonomous mobile robots, and worked at the hardware-software boundary with third-party autonomy software. Python test automation for systematic qualification metric tracking. MBSE practitioner. MATLAB/Simulink simulation environments in daily use.

EXPERIENCE

Systems Engineer, Mechatronics

Sep 2023 – Present

Tennant Company | Edina, MN

- Built Python test automation frameworks for systematic signal-level data collection and qualification metric tracking – automated analysis across a multi-platform test fleet, replacing manual log inspection with structured pipeline results that fed directly into system release decisions.
- Defined and maintained metrics for system performance qualification – established acceptance thresholds, tracked performance against specifications across programs variants, and used data evidence to drive design change and release decisions.
- Evaluated and characterized perception sensors and navigation hardware for AMR autonomous platforms – conducted performance assessments against defined requirements, ran structured integration tests, and documented hardware-software interface constraints for autonomous mobile robots operating in unstructured commercial environments.
- Designed and evaluated wireless power transfer systems for AMR autonomous charging and Auto Fill and Dump station docking infrastructure – autonomous docking behavior where the robot navigates to station, aligns, and connects without human input. Trade studies on power transfer efficiency, coil geometry, thermal loading, and foreign object detection.
- Developed and characterized a perception pipeline for surface-type classification – 2D camera input, KNN/CNN/Random Forest classifiers, performance characterized using IoU metrics and cross-validation across surface classes; results drove drive-behavior adaptation decisions for AMR platforms.
- Implemented and validated a SIL2 Steer-by-Wire fail-operational architecture under IEC 61508 and ISO 13849-1 PLd Category 3 – authored HARA, FTA, and quantitative residual risk assessments as structured safety case evidence; first fail-operational system qualified to SIL2 on the platform.
- Authored safety case documentation across program phases – HARA, FTA, functional safety concepts, and V&V reports used directly for fail-operational design justification and qualification sign-offs.
- Created and maintained clear technical documentation across program phases: system architecture documents, interface control documents (ICDs), functional safety concepts, HARA, FTA, and V&V reports. Documentation used directly for design decisions and safety clearance sign-offs.
- Led cross-functional alignment across safety, controls, software, and manufacturing disciplines – ran structured design trade-off discussions, drove stakeholder consensus on architecture decisions, and maintained alignment through design evolution.
- Developed structured test methodology and V&V strategy for electromechanical programs – defined test coverage criteria, fault injection scenarios, and acceptance thresholds per operating condition, with traceability from functional safety concept through subsystem test cases ensuring ODD coverage.
- Designed large-scale system architecture for electromechanical platforms using SysML and MATLAB System Composer; used MBSE models to identify gaps in requirements coverage and edge cases before hardware commitment.

Electrification Engineering Intern

Jan 2023 – Aug 2023

Tennant Company | Edina, MN

- Built MATLAB and Python simulation workflows for performance modelling and data analysis; developed reusable test scripts and reporting templates adopted by the team after the internship ended.
- Motor characterization test setup, data acquisition, and performance analysis (PMAC vs. induction) to support production motor selection.

EV Controls and Validation Engineer

June 2019 – July 2021

HKI Motors | Ambala, India

- Developed BLDC traction control algorithms in MATLAB/Simulink using Model-Based Design.
- Deployed control software to embedded hardware via Rapid Control Prototyping (RCP) on the MotoHawk/Woodward toolchain.
- Defined and executed structured HIL test plans on a dynamometer – test cases covering nominal, boundary, and off-nominal load conditions.
- Characterized motor and control system performance across load conditions; quantified torque-speed response margins against specification targets.
- Performed drive cycle data analysis and system calibration; compiled validation records for production readiness review.

Mechanical Engineering Intern

Jul 2017 – Dec 2017

Maruti Suzuki Pvt. Ltd. | India

- CVT data acquisition, torque transfer analysis, and technical reporting for production integration decision-making.

EDUCATION

Professional Certificate – Model-Based Systems Engineering (MBSE)

Feb 2026 – Jul 2026 (in progress)

MIT xPRO | Systems Architecture, DSM, SysML, Systems Thinking

M.S. Mechanical Engineering | GPA: 3.68

2021 – 2023

Michigan Technological University | Houghton, MI | Control Systems, Signal Processing, V&V, Electrification, Industrial Automation

Graduate Certificate – Hybrid & EV Engineering

2021 – 2023

Michigan Technological University | Houghton, MI | Hybrid Powertrain, BMS, Power Electronics, Electric Drives

B.S. Mechanical Engineering | CGPA: 7.64/10

2015 – 2019

Savitribai Phule Pune University | Pune, India

PROJECTS

- CANviz – Open Source CAN Bus Debugger (github.com/Chanchaldhiman/CANviz) – Real-time multi-protocol CAN debugger built to fill a gap in available tooling. Demonstrates building reusable, practical infrastructure when existing tools are inadequate.
- DSM Optimizer – Spectral clustering and Markov Cluster Algorithm with Simulated Annealing for system dependency matrix partitioning; surfaces hidden coupling in large-scale system architectures.
- Power-Split HEV Control – MPC strategies in MATLAB/Simulink optimizing battery and engine power sharing across drive cycles.
- Battery Sizing Optimization – Kuhn-Tucker optimization for HV battery pack sizing under thermal, energy, and cycle-life constraints.
- Propulsion Architecture Trade-off Study – ICE, BEV, and PHEV comparison in AMESim across motor sizing, gearbox ratios, and energy utilization.

SKILLS

Data & Analysis: Python (data pipelines, statistical analysis, log processing, test automation), MATLAB/Simulink, SQL, Power BI, Azure (CI Pipelines), AMESim

Systems Engineering: MBSE, SysML, MATLAB System Composer, Cameo / MagicDraw, DSM Analysis, Requirements Decomposition, V-Cycle Validation, Requirements Traceability, ICDs, DSM Analysis, Visure Requirements (ALM)

Technical Documentation: System Architecture Docs, HARA, FTA, Functional Safety Concept, V&V Reports, Interface Control Documents

AMR & Perception: Autonomous Mobile Robot hardware integration, Perception Sensor Evaluation, Pipeline Characterization (IoU, cross-validation), Image Classification (KNN, CNN, Random Forest), HIL/SIL Test Environments, MATLAB/Simulink Simulation

Functional Safety: IEC 61508 (SIL2), ISO 26262, ISO 13849-1, FMEA, DFMEA, PFH Analysis, Diagnostic Coverage, Fail-safe Architecture, Quantitative Risk Assessment(HARA, FTA, PFH Analysis)

Protocols & Embedded: CAN, Vector CANoe, J1939, CANopen (CiA 301 / CiA 402), ECU Integration, C/C++ (read/interpret)

Electrification: EV Powertrain, BMS, Motor Control (PMAC / Induction), Inverter Integration, HV Battery Systems