

# RAGHAVENDRA R RAO

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## SUMMARY

Multifaceted and result-driven engineer entrenched in a challenging career in the engineering domain. Equipped with reliable skills and the ability to transform ideas and concepts into robust technical designs. Expertise in creating & managing complex mechanical & hardware systems applying reliable techniques as per industry-standard procedures.

## SKILLS

- MATLAB, Simulink, Stateflow
- Python, C++, Functional Safety (FuSa)
- Root Cause Analysis, FMEA, DVPR
- HIL/SIL testing, dSPACE, CAN/LIN
- CarMaker, CarSim, CARLA
- Vector tools, CANoe, CANape
- GD&T, Tolerance analysis
- JAMA, ISO26262, DFSS
- PLC, AMESim, PID controller
- ANSYS, VisualDOC, ModeFrontier
- TIA Portal, EPLAN, P&ID
- UG-NX, SolidWorks, CATIA V6

## EDUCATION

- **Master of Science: Mechanical Engineering at Clemson University SC, US | GPA: 3.72/4.0** Dec 2020  
Modern controls, Autonomous driving, Systems Engineering, Mechatronics, Advanced Controls, Hybrid Vehicles, FEA
- **Nanodegree: Self-Driving Car Engineer | Udacity** Jan 2021
- **Bachelor of Engineering: Mechanical Engineering at Bangalore University, IN | GPA: 3.67/4.0** July 2013

## WORK HISTORY

### Autonomous Vehicle Algorithm Modeling Program | Dorle Controls | Detroit, MI Sept 2020 – Nov 2020

- Developed algorithms for perception and planning for the autonomous vehicle architecture using MATLAB & Simulink
- Modeled and implemented SLAM using the point cloud Lidar dataset for localization & mapping of the environment
- Built and validated Model-Based Design (MBD) architecture using FMEA & FTA to generate safety goals per HARA
- Effectively improved the algorithm accuracy for building binary occupancy map using various sensors for path planning
- Worked on developing the Driver Monitoring System (DMS) for detecting the alertness of driver in automation level 3
- Generated and tested the driving scenarios for cruise control, Lane Keep Assist (LKA), and Lane Change Assist (LCA)
- Established & validated Operational Design Domains (ODD) per J3016 for dynamic driving tasks & driver assistance
- Defined and analyzed the vehicle system architecture for trajectory optimization per agile development methodology

### Automation & Controls Intern | Sedron Technologies | Greater Seattle, WA June 2020 – Aug 2020

- Established toolbox & automated libraries in the TIA portal using STL Programmable Logic Controls (PLC) algorithms
- Developed controller for anti-surge & hysteresis tuning of a sequential compressor, ensuing improved efficiency by 6%
- Structured feed-forward controls for the condensate pump and steam injection system impacting 90gpm processing
- Designed Human Machine Interface modules (HMI), dashboards, and alarms for motor torque monitoring and infeed pump systems reducing downtime by 1hr/day. Effectuated microcontrollers for implementing test design solutions
- Developed Manufacturing Execution Systems (MES) & PPAP to ensure quality and efficiency in integrating controllers
- Facilitated neural network integration for automated identification of ammonia concentration (savings up to USD 50k)
- Collaborated in developing Piping & Instrumentation diagram (P&ID) with control devices & hardware per ISA standard

### Senior Engineer - Powertrain | General Motors | Bengaluru, India / Michigan, US Aug 2013 – Dec 2018

- Continually improved methods & procedures for design in UG-NX as per Bill of Materials (BOM), measurements, documentation & PLM using techniques from FMEA, DOE processes with a time saving of 20 hours/week
- Collaborated with cross-functional program management teams in diagnosing potential failures & packaging issues. The design iterations and concepts were optimized using DFM to obtain up to 8% improvement in first-time quality output
- Directed design and fabrication of prototype components per V-cycle development for testing, validation & integration
- Centralized the Design Thinking and Six Sigma (DFSS) approach for engineering design and CFD analysis of engines
- Facilitated digital clearance & tolerance stack-up analysis of engines with applied GD&T (ASME Y14.5) using 3DCS
- Spearheaded Lubrication & Ventilation (HVAC) circuit extraction, Oil slosh analysis, Oil level calibration & Mass Roll-up of engines for analysis and improvement in cooling efficiency by 1.5% using FEA optimization techniques
- Implemented ANSI/RIA15.06/OSHA compliant control reliable safety system & validated the electrical schematics
- Streamlined the control system and integration of vehicle dynamics for validating the test data algorithm for hybrid operating systems using MATLAB & Simulink along with regression analysis performed for the validation results
- Standardized test reports and trained over 200 engineers in x-SDE & HFV6 engine teardown and build mock-up sessions
- Validated control system models with HIL/SIL testing against the requirements and recommended corrective actions
- Testing & validation of vehicle on DYNO using CAN/LIN network and analyzing data using CANalyzer & Vector tools

## PROJECTS

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### **Design & develop test methods for autonomous vehicles to qualify failure modes and validate functional safety (FuSa)**

- Led & structured test methods for failures and quantified the failure rates for autonomous vehicle test and development
- Directed the software deployment in the embedded control environment using C++, MATLAB in SIL test environment
- Conducted safety analyses using HARA, FMEA & Fault Tree Analysis (FTA) and implemented verification & validation plan against requirements per MISRA and ISO26262 establishing safety methods for Operational Design Domain (ODD)

### **Optimization of oil pan for Small Block (SB) Gen-VI engine for casting failure issues | GM Award – Work of Wonder**

- High-performance Corvette oil pan to be re-designed to avoid casting failures at the supplier manufacturing facility
- Hydrostatic pressure & ultrasonic testing proved the elimination of failure in the oil pan even when the profile tolerance was lowered to 1mm for precision. Robust design validation using SPC & Cpk enabled quality improvement of 2.4%

### **Autonomous Navigation on Road | International Center for Automotive Research | Clemson University**

- Built an autonomously controlled RC car with Arduino & MATLAB to perform lane detection, tracking & navigation
- Implemented Machine Learning, tracking controls and lane detection using Stanley controller and Kalman filter. Tsai's camera calibration method and image processing with inverse projection were implemented for optimum results

### **Hybrid and Electric vehicle (HEV) unit test case vehicle controller validation | GM - Cross-functional Integration**

- HIL/SIL testing were performed for the initial build of control systems for HEV on multiple platforms of vehicle build
- Validation of unit-level test cases for Start/Stop condition using LabVIEW and MATLAB with Model-In-loop in run time environment (RTE) as per AUTOSAR standards, attesting 1.2% improvement in real-time simulation

### **Develop & integrate perception algorithm using ADAS controls for self-driving vehicle framework | Dorle Controls**

- Modeled the driving scenarios for autonomous vehicles by developing HD occupancy grid maps using Baye's rule
- Formulated simultaneous localization & mapping (SLAM) algorithm using Velodyne lidar point cloud, odometry, GPS & IMU data in C++ & MATLAB. Implemented the algorithm & validated the test results using Veloview & Simulink
- Performed frequency analysis & parameter tuning of the integrated system level models resulting in accuracy up to 97%

### **Model mapping & motion control algorithm to develop robust autonomous vehicle for various driving scenarios**

- Develop a novel SLAM & motion control algorithm using the non-linear optimization and 3-D reconstruction techniques
- Lidar point cloud processing, sensor registration & calibration methods were implemented using Python along with model-based design integration in Simulink. Efficient mapping & vehicle controls led to integration in the 3D setup
- Ensured a seamless and robust implementation of the software architecture per SOTIF standards, V-cycle development process and testing the self-driving capability for various driving scenarios per ISO 26262 safety standards

### **Testing brushless DC motor (BLDC) & permanent magnet synchronous motor (PMSM) for EV-Hybrid vehicles**

- Trapezoidal controls algorithm was developed for BLDC motor with six-step commutation and multiple pole-pair combinations. PID controller was implemented with a pulse-width modulation generator for system stability
- Field-oriented controller (Vector) was used for the variable frequency drive (VFD) control of the AC synchronous motor
- Both tests conducted proved responsive & controlled outputs with an ability to generate full torque. The dynamic performance efficiency improvement during motor characterization was 1.4% against the peak torque of 110 Nm

### **Develop an Arduino controlled robotic arm to perform pick-and-place material movement for industrial purpose**

- SainSmart 6-axis robotic arm was used to develop and test the algorithm for material movement considering parameters in compliance with industry automation level 4 where the requirements were characterized for multiple scenarios
- Sensors like Xbox 360 Kinect camera, RGB, proximity sensors and accelerometers were integrated for robust operation
- High-level sensor fusion for servo control & computer vision integration helped to train the robot using Machine learning techniques and was used in the University laboratory for segregation and material selection resulting in cost saving

## CERTIFICATION

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- Motion planning for self-driving cars | **Coursera**
- Six sigma certification – Black Belt
- PLC programming | **Udemy**

## INTERN

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- Engineering Intern at **Volvo and Bosch (2012)**
- Manufacturing Intern at Rail wheel and Axle factory **(2013)**

## CO-CURRICULAR

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- Principal lead of SAE-BAJA and facilitated GM rally racing in Raid de Himalaya (world's highest rally raid) car build
- Active member of SAE and IEEE. Organized various conferences, Auto exhibition shows, and product launch events
- Trained cross-functional teams with tech talks, engine teardown sessions and technical presentations for engineers
- Participated in various Design, Build and Race events, as the lead member, which helped me hone my leadership skills