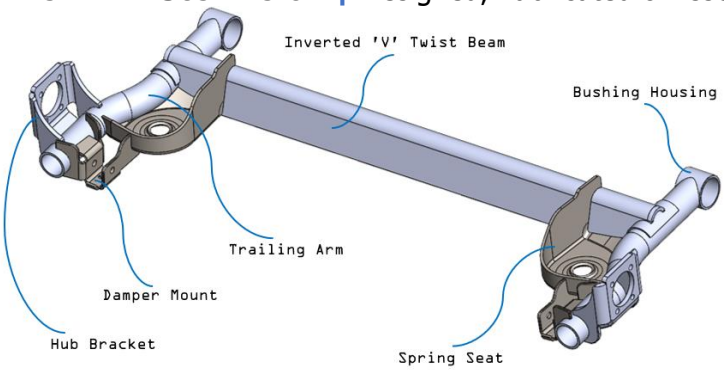
Syed Muhammad Usman

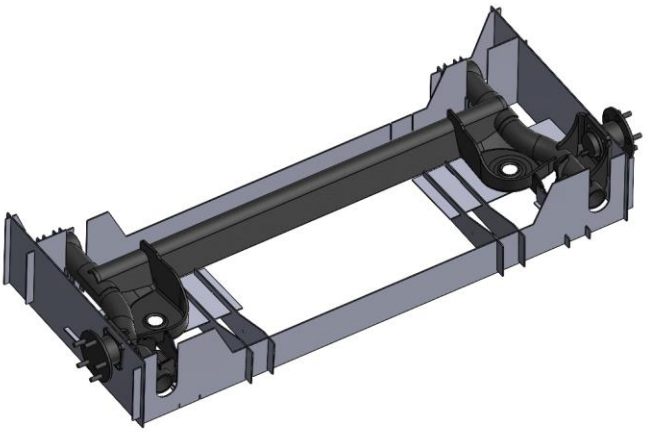
Mechanical Design & CAE Engineer

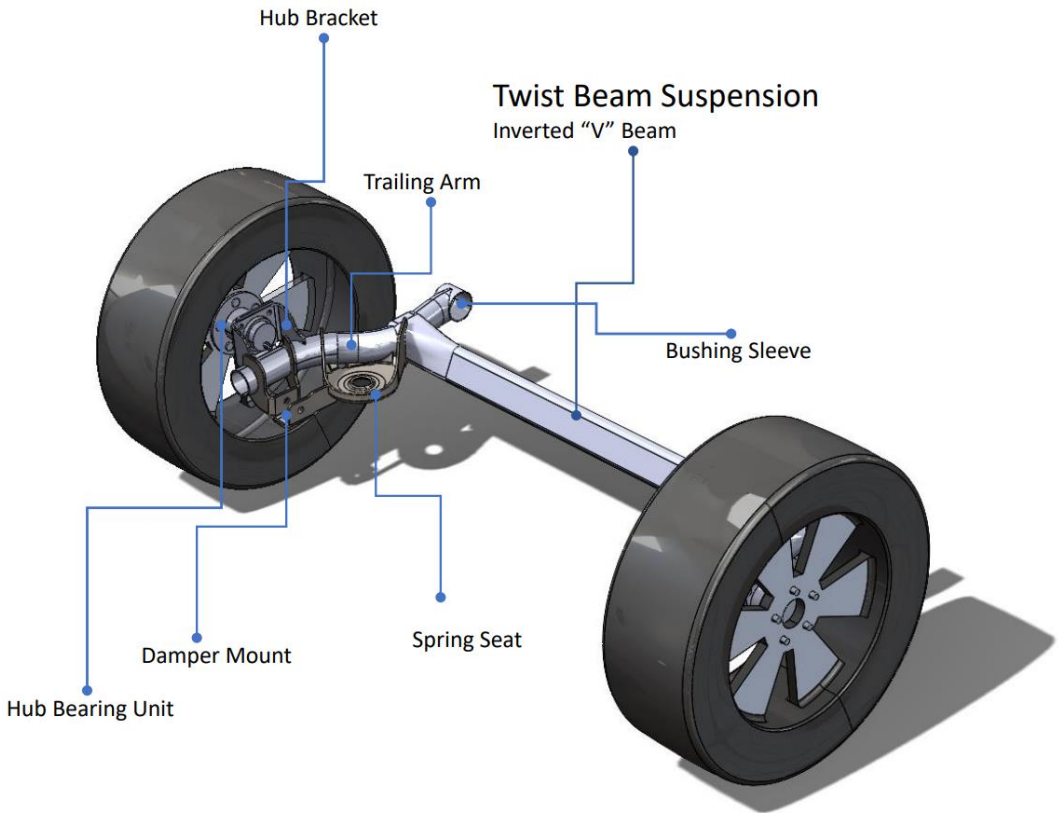
London, United Kingdom
syedmuhammadusman74@gmail.com
syedmusman74

Design Portfolio

Twist Beam Suspension | Designed, Fabricated & Assembled







What?

- Design & Fabrication of Rear Twist Beam Suspension for a prototype EV based on **DFM/A** principles.
- Performed **static FEA** for design validation through 10+ load cases.

How?

- Designed using sheet metal and weldment features in **SolidWorks**.
- Applied **GD&T** on all technical drawings
- Components and jig manufactured using laser cutting, and sheet metal bending.

Results

- **15%** overall mass reduction compared to typical twist beam suspensions.
- The design was deemed production feasible based on expert manufacturing assessments.

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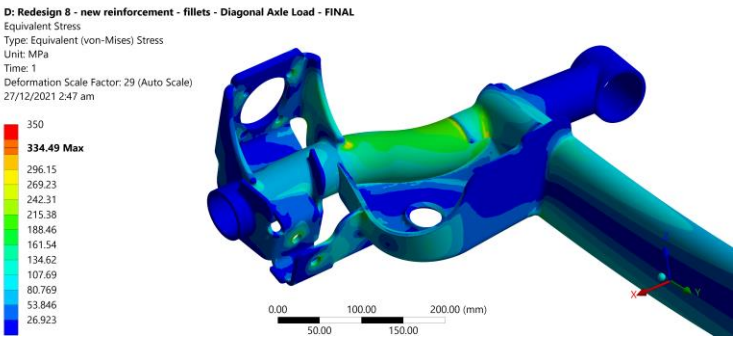
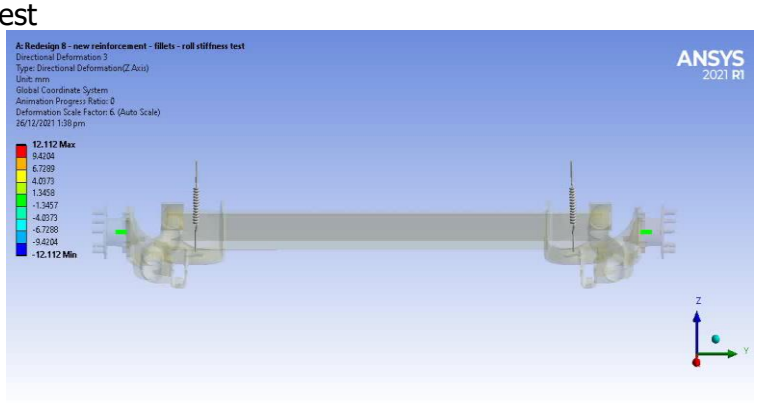
Twist Beam Suspension | FEA Analysis & Roll Stiffness Test





What?

- Performed static & dynamic FEA for design validation through **10+ load cases.**
- Performed a simulation in ANSYS to analyse the **roll stiffness** of the Twist Beam Suspension.

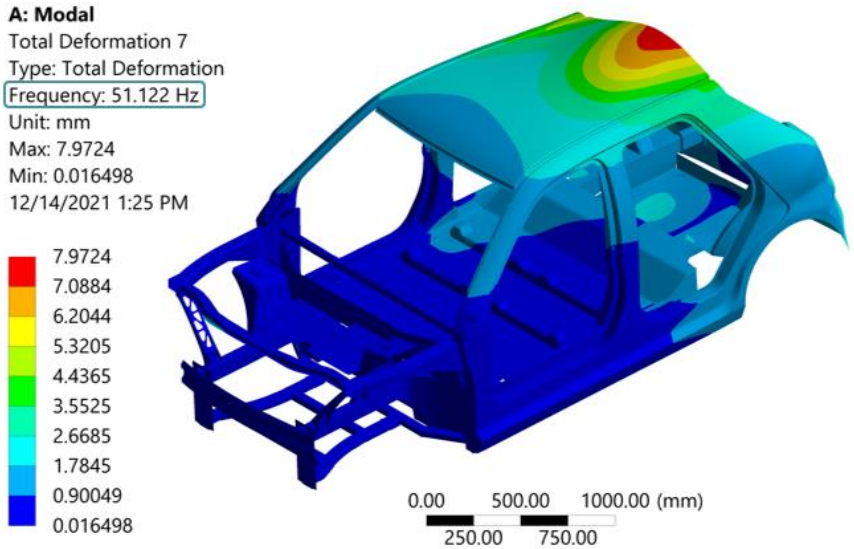
How?

- The suspension is tested under load cases obtained through vehicle dynamics testing in CarSim and FEA is performed in ANSYS Mechanical 2021.
- Equal and opposite force is applied on each wheel centre to produce opposite wheel displacements and calculate the roll stiffness.

Results

- The maximum stress obtained during static FEA across all load cases is less than the yield strength and the safety factor obtained is approximately **2.1**
- The torsional stiffness of the design was found to be **841 Nm/deg.**

Modal Analysis of Vehicle Body In White (BIW) | Simulation in ANSYS



What?

- An EV's BiW (Body-in-White) is tested for its natural frequencies under free-free conditions

How?

- A modal analysis is performed in ANSYS, where the BiW was not constrained in any way and the frequency of interest was set up to 500 Hz.

Results

- **First Natural Frequency** or the 7th mode of the system was found to be 51 Hz with first 6 modes being the rigid body motions.

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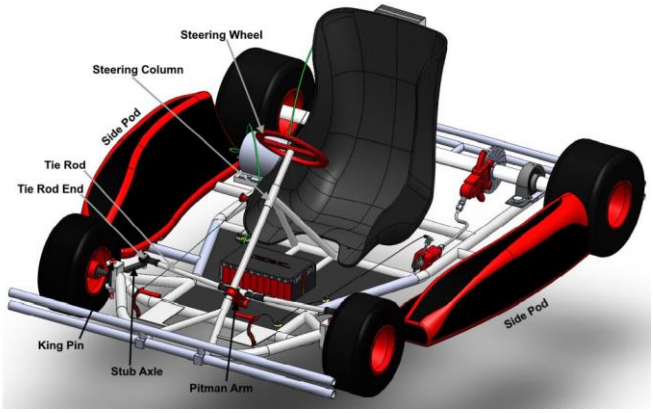
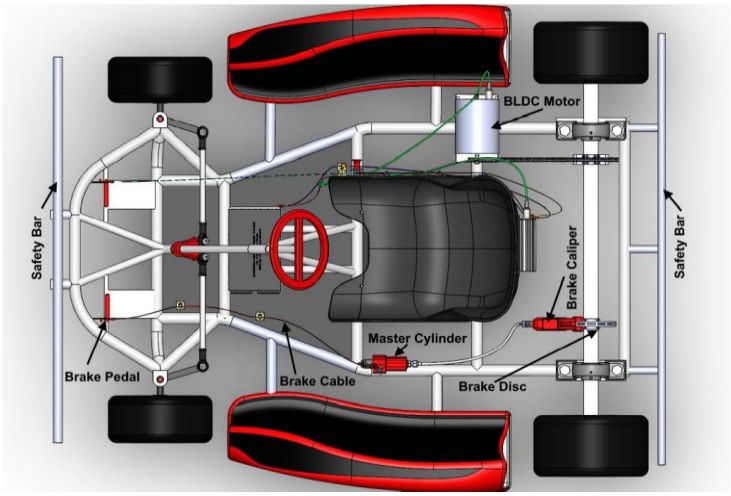
Electric Go Kart | Design, Analysis, & Lap Time Simulation



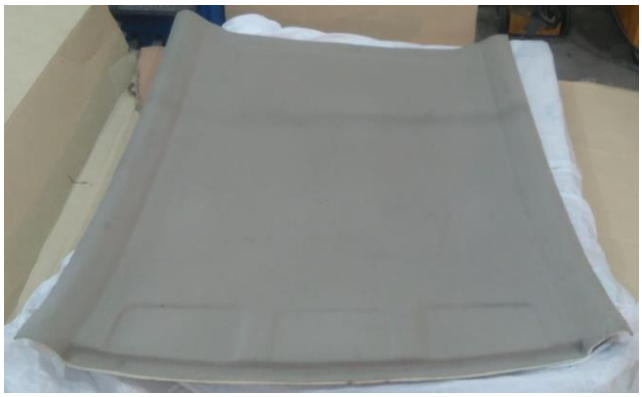


What?
- Design of an electric go kart in compliance with CIK-FIA regulations
- Designed to compete in recreational kart racing while being eco-friendly.

How?
- Designed in **SolidWorks** using weldments, surfacing modelling.
- Performed hand calculations for design and sizing of all sub-systems.

Results
- Designed The Lap-time simulation performed in Optimum Lap proves the go-kart performance to be capable of competing in recreational kart racing.

Vehicle Headliner | Designed & Fabricated



What?
- Design of a vehicle headliner with indentations for sun visors and rear-view mirror.

How?
- Designed using surface modelling in **SolidWorks**.
- Used fiberglass for fabrication.

Results
- The fabricated headliner fitted perfectly and fulfilled its purpose.

Vehicle 'A' Pillar Trim | Designed & Fabricated

What?
- Design of an interior 'A' pillar trim used to conceal electrical wiring and serve as a decorative surface over the vehicle 'A' pillar.

How?
- Designed using surfacing features in SolidWorks.
- Used fiberglass for fabrication and applied plastic texture coating.

Results
- The design is deemed production feasible and can be manufactured through plastic injection moulding for bulk quantities.

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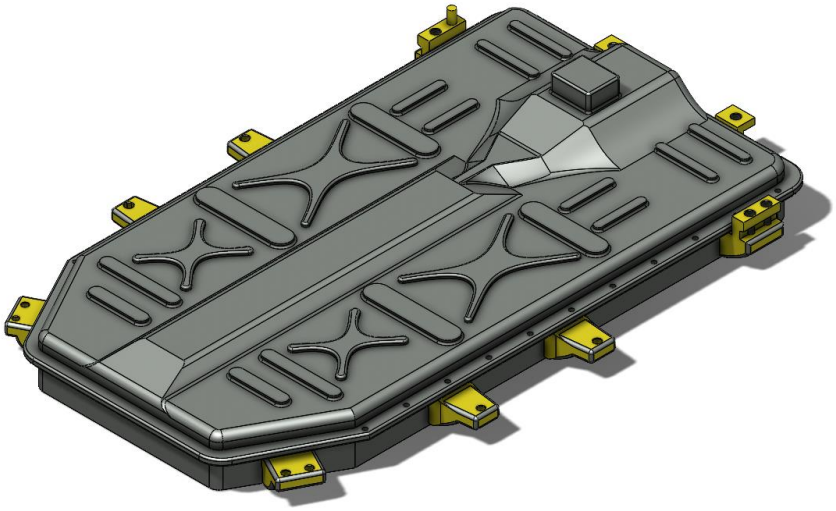
EV Battery Pack Outer Casing | Reverse Engineered CAD



What?

- Created CAD model of a vehicle battery pack outer casing using only technical drawings to validate CAD assembly packaging and evaluate design constraints.

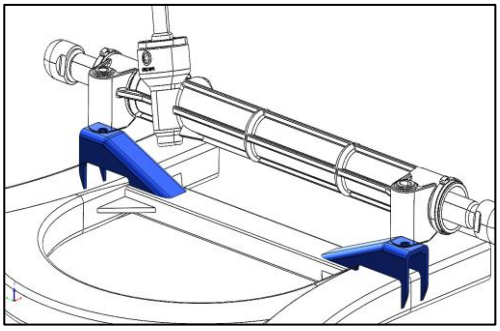
How?

- Designed in **SolidWorks** using sketch picture tools in multiple planes and the power surfacing add-in.

Results

- The dimensions of CAD model matched perfectly with given dimensions in technical drawing.
- Successfully performed CAD assembly packaging evaluation.

Steering & Spaceframe Mounts | Designed & Fabricated

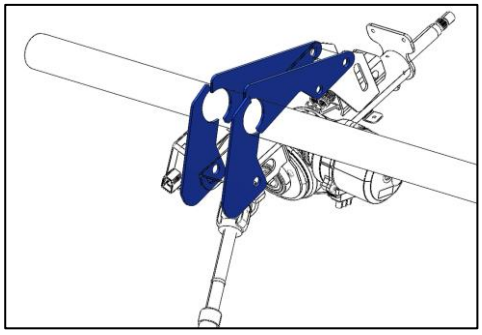


What?

- Designed compact steering rack mounts able to withstand peak steering rack forces and aligning moments.

How?

- Designed in **SolidWorks** using sheet metal features.

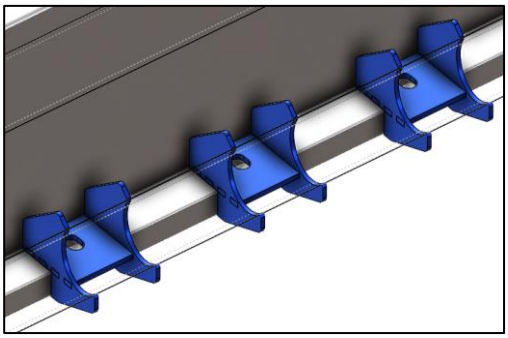


What?

- Designed lightweight sheet metal mounts strong enough to hold the vehicle spaceframe.

How?

- Designed in **SolidWorks** using sheet metal tab and slot feature.
- Performed FEA in **ANSYS** to validate design.



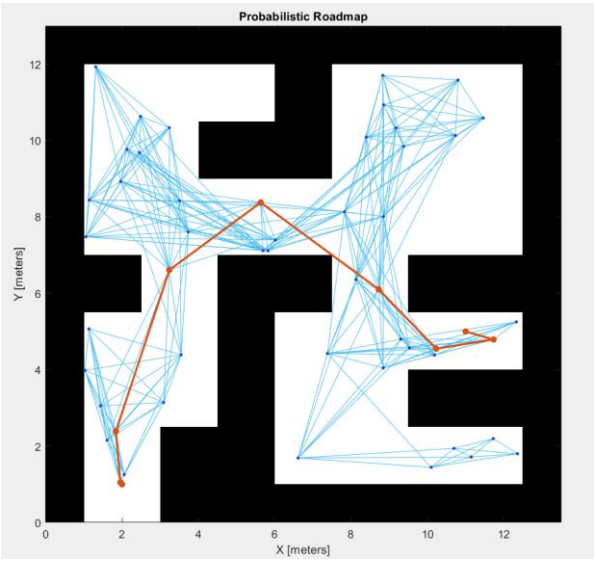
What?

- Designed low-cost steering column mounts supporting the "tilt & telescope" functionality of the steering wheel.

How?

- Designed in **SolidWorks** using sheet metal features.
- Performed FEA in **ANSYS** to validate design.

Mobile Robot Path Planning Using PRM | Coded in MATLAB



What?

- MATLAB code implementing path planning using Probabilistic Roadmaps (PRM) for mobile robots in given environments.

How?

- Loaded map data, created a binary occupancy grid, and adjusted for robot size.
- Initialized a PRM with the map, set parameters, and specified start and end points.
- Employed PRM to compute an efficient path for the robot.

Results

- Generates graphical PRM representation.
- Successfully generates optimized paths for mobile robots, navigating efficiently through complex environments while avoiding obstacles.

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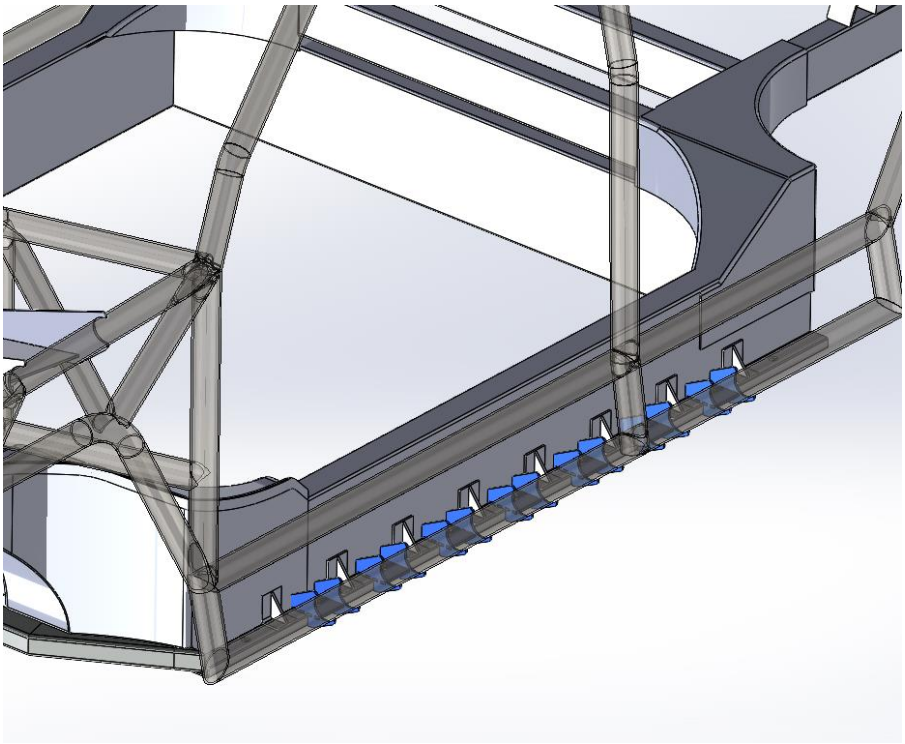
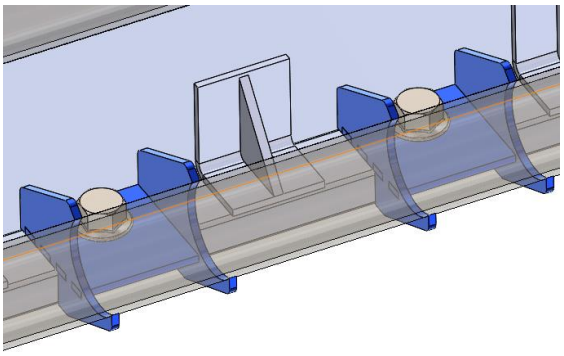
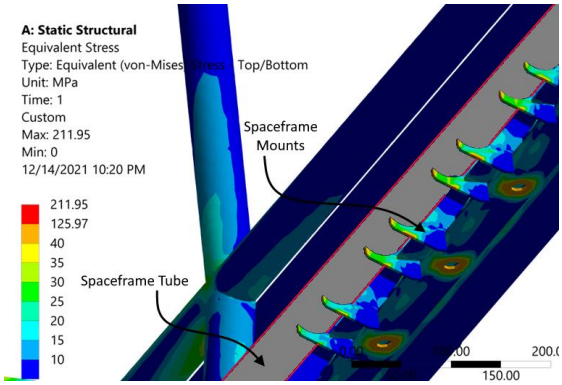
EV Spaceframe Bolt-On Mounts | Designed & Fabricated







What?
Designed strong and durable **bolt-on mounts** to hold the **spaceframe** of a prototype electric vehicle

How?
Designed using **sheet metal** tab-and-slot feature in **SolidWorks** with design validation through FEA in ANSYS.

Results
The mounts were bolted on to the **chassis** and successfully supported the weight of the EV's spaceframe and other **BIW** components.

Vehicle Dynamics Simulations in CarSim | 1D Simulations

What?

- An electric vehicle is modelled within CarSim and various vehicle dynamics 1D simulations are run to generate load cases as input for further CAE as well as to analyse performance of the vehicle.

How?

- Some of the tests that are performed include:
  1. Double Lane Change (ISO 3888-1)
  2. Braking Distance test (ISO 21994)
  3. Steady State Cornering (ISO 4138)
  4. Vehicle Road Roughness Response (ASTM E1364:2005)

Results

- Generated comprehensive load cases for further CAE analysis based on 1D simulations in CarSim.
- Evaluated electric vehicle performance across various dynamic tests

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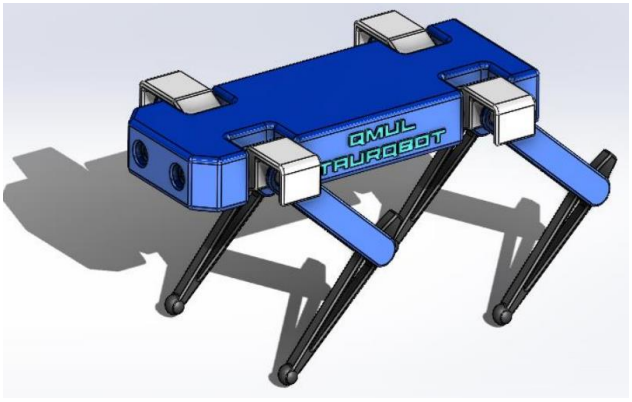
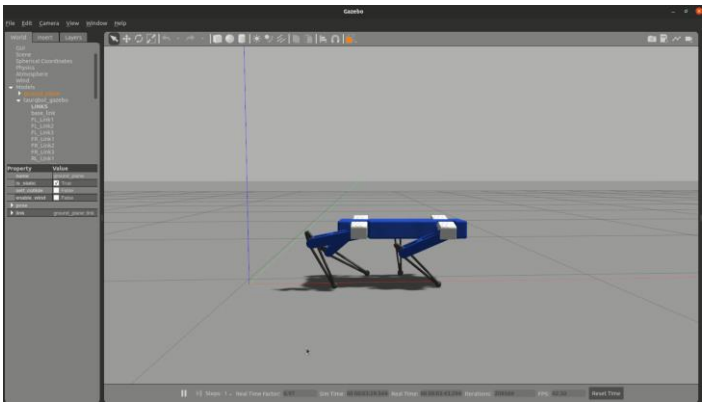
TaurqBot Quadruped Robot | Designed & Simulated in Gazebo





What?

- A Quadruped Robot with real-time control architecture built in ROS & Simulated in Gazebo

How?

- Designed from scratch in SolidWorks.
- Uses the ros_control package and has dynamic foothold positioning and leg trajectory algorithms.

Results

- The robot is successfully simulated in Gazebo and is capable of walking stably with Trot and Crawl gaits.