Visualizing Pedestrian Safety Testing:

A novel Web-Based Tool for Regulatory Analysis of Vehicle Hood Tops

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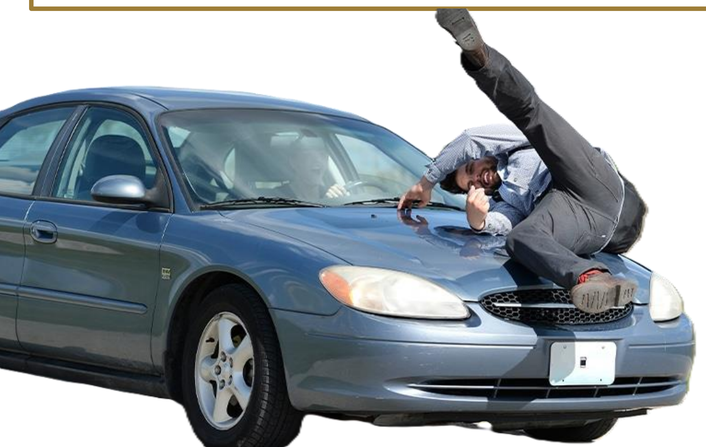
BACKGROUND

- The National Highway Traffic Safety Administration (NHTSA) must **verify safety test results** for all newly developed vehicles.
- To improve this process, NHTSA is developing WebSAT: a web app platform for **efficient visualization** and analysis of vehicle safety tests.
- This project contributed to WebSAT by building a **"Pedestrian Hood Visualizer"** component.



DESIGN

Tools Used: WebSAT used four key tools:

Vue.js – Front end components, interactions, real-time updates.

django REST framework – Backend structure for API endpoints, data management, signal processing.

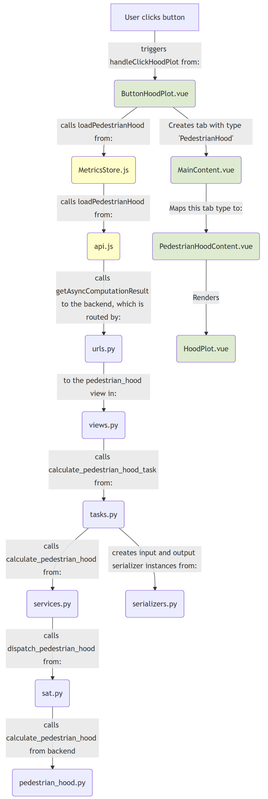
plotly – Interactive charts, graphs, diagrams.

docker – containerization for dependency management and cross-platform deployment.

Full Stack Development: The Pedestrian Hood Visualizer included full stack integration across all these layers, creating a **one-click pipeline** for dynamically generating labeled diagrams of hood test areas, landmarks, impact points, and Head Injury Criterion (HIC) threshold labels.

App Testing: This pipeline was then tested using JSON data from 6 vehicles of varying weights: 2024 Honda Accord, 2024 Ford Mustang, 2024 Volkswagen ID.4, 2023 Jeep Gladiator, 2025 Ram Pro Master, and 2021 Ford F250. All input data followed NHTSA database formatting conventions. Output was then assessed for code errors, diagram rendering time, and diagram consistency with FMVSS 228 documentation.

Button Cascade Structure



RESULTS

Successful real-time diagram generation across all car models:

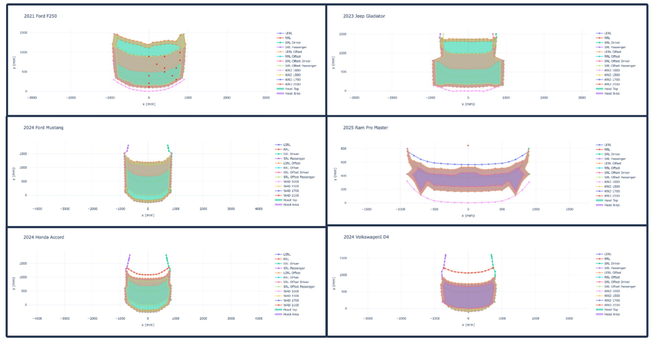


Diagram generation time in all models was less than 0.1 sec.

FUTURE WORK

Future enhancements to the tool could:

- Include 3D hood surface representations
- Evaluate additional safety metrics beyond HIC thresholds such as automatic emergency braking, crash prediction, and autonomous driving features.
- Add greater flexibility on input formats.

Such expansion would further contribute towards user-centered design in regulatory technology, impacting the efficiency of safety assessments.

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