Logic Engine v9 Audit Report

Date: December 24, 2025
Version: v9.0 (Live)
Status: Active

1. System Overview

The **Logic Engine v9** (`CompatibilityEngine`) is the core intelligence behind the Car Part God interchange system. It has been significantly upgraded from v8 to include **Transmission Matching**, **Advanced Lighting Logic**, and the **"Maria's Advice" Spare Tire System**.

Core Components

- **Class:** `CompatibilityEngine` (in `script.v9.js`)
- **Data Sources:**
    - `relationships.json` (Platforms, Engines, Transmissions)
    - `lighting_interchange.json` (Headlight/Taillight Generations)
    - `spare_tires.json` (Bolt Patterns & Hub Bores)
    - `transmissions.json` (Transmission Families)

2. Scoring Algorithm (v9)

The engine calculates a compatibility score (0-100) based on a hierarchy of match types.

Match Type	Score	Description
Explicit Match	**100%**	Part is explicitly listed for this vehicle in the database.
Platform Mate	**80%**	Vehicle shares the same chassis/platform (e.g., VW Golf Mk4 <-> Audi TT Mk1).
Engine Share	**70%**	Vehicle shares the same engine (e.g., Silverado 5.3L <-> Corvette LS1).
Transmission Share	**65%**	**(NEW)** Vehicle shares the same transmission (e.g., 350Z CD009 <-> G35).

Modifiers & Penalties

The engine applies penalties based on text analysis of part notes and vehicle attributes:

- **Fabrication Required:** `-40` (Keywords: "cut", "weld", "drill")
- **Adapters Required:** `-20` (Keywords: "bracket", "spacer", "adapter")
- **Unverified Match:** `-10` (Platform/Engine match with no specific notes)
- **Facelift Mismatch:** `-30` **(NEW)**
    - Detects if a user has a "Pre-Facelift" car but the part is for a "Facelift/LCI" model (or vice versa).
    - Prevents generation mismatches common in BMW (LCI) and JDM (Facelift) parts.

3. New Features Audit

A. Transmission Logic

- **Status:** Active
- **Function:** Identifies vehicles sharing transmission codes (e.g., ZF 8HP, CD009, T56).
- **Data Source:** `transmissions.json` linked via `relationships.transmissions`.
- **Risk Level:** Rated at 65% (Major Mods/Match Possible) because transmission swaps often require bellhousing or driveshaft modifications even if the core unit is the same.

B. Lighting & Facelift Logic

- **Status:** Active
- **Function:** "Deep Dive" analysis for Headlights and Taillights.
- **Logic:**
    1. Identifies if the part is a lighting component.
    2. Checks `lighting_interchange.json` for generation details.
    3. Scans vehicle name for year/facelift keywords (e.g., "2003", "Pre-LCI").
    4. Scans part notes for restriction keywords (e.g., "06+", "Facelift only").
    5. Applies `-30` penalty if a conflict is found.

C. "Maria's Advice" (Spare Tires)

- **Status:** Active
- **Function:** Specialized UI for spare tire interchange.
- **Trigger:** Vehicle belongs to a group in `spare_tires.json`.
- **Display:** Pink-accented card (`#e91e63`) at the top of the results.
- **Data Points:**
    - **Bolt Pattern:** (e.g., 5x114.3)
    - **Hub Bore:** (e.g., 67.1mm vs 60.1mm)
    - **Advice:** Specific warnings (e.g., "Must use hub centric rings").
    - **Donors:** Lists compatible vehicles, filtering out the user's current car.

4. Engine Data Audit (`relationships.json`)

The `engines` database maps vehicles to their powerplants, enabling the 70% "Engine Share" match.

Key Engine Groups Identified:

- **VAG_18T:** VW Golf/Jetta/Passat, Audi A4/TT (1.8T 20v)
- **GM_LS_GEN3:** Corvette C5, Camaro/Firebird (LS1), Silverado (Gen 1 LS)
- **GM_LS_GEN4:** Corvette C6, GTO, TrailBlazer SS (LS2)
- **GM_LS_TRUCK:** Silverado/Sierra/Tahoe/Suburban (4.8/5.3/6.0 Vortec)
- **BMW_N54/N55:** E90/E92 335i, 135i, 535i
- **HONDA_K_SERIES:** Civic Si, RSX Type-S, TSX
- **NISSAN_VQ35:** 350Z, G35, FX35, Altima V6

5. Recommendations

1. **Expand Transmission Data:** The `transmissions.json` file is new; continue populating it with more manual transmission families (e.g., Honda K-Series transmissions, Subaru 5MT/6MT).
2. **Refine Facelift Data:** Ensure `lighting_interchange.json` covers more models beyond the initial set to fully leverage the new logic.
3. **Monitor "Maria's Advice":** User feedback suggests this is a high-value feature. Ensure Hub Bore data is 100% accurate to prevent safety issues.