emmtrix Technologies

Ensuring OBD Compliance with the Help of Code Analysis

The California Air Resources Board (CARB) requires car manufacturers to provide a transparent list of all emission-related parts and systems monitored by On-Board Diagnostics (OBD). This ensures that potential problems affecting emissions can be detected, helping vehicles stay within strict environmental standards. At the same time, the requirement makes the monitoring process more secure and harder to manipulate, giving drivers and regulators confidence in the system's reliability.

For your software development this requires:

- ✓ **Full visibility of emission-related signal flows:** Developers need to trace and document signals across ECUs to determine their OBD relevance.
- ✓ **Change detection:** Software updates may alter the OBD relevance of existing signals or introduce additional emission-relevant signals; these changes must be flagged for timely review and integration.
- ✓ **Comprehensive signal flow documentation:** All software/hardware dependencies affecting emission diagnostics must be documented, including sources, communication paths, algorithms, and calibration parameters.

How eDA Supports OBD Compliance

emmtrix Dependency Analyzer (eDA), as deployed in a series project of a German premium OEM, supports compliance with requirements from global certification bodies by providing deep insights into software structure and data flow, ensuring transparency and control of emission-related components.
Based on static source code analysis, eDA precisely examines embedded C code without execution or instrumentation.

eDA extracts and labels data, control, and delayed dependencies within the code, offering a detailed view of internal software logic. This makes it possible to analyze the flow of emission-relevant signals from their origin to their point of use, which is essential for meeting OBD documentation and verification requirements.

eDA supports mapping to AUTOSAR signals by analyzing AUTOSAR models. This capability enables the analysis of data dependencies defined through AUTOSAR interfaces and allows developers to evaluate how components interact at the software architecture level.

eDA offers effortless transparency of signal flows not only in AUTOSAR-based systems but also in legacy applications. Its variant handling feature accommodates configuration parameters (market region, trim level,...) to filter inactive code paths, making it highly effective for multi-variant software environments.

eDA supports a fully automated workflow in CI/CD pipelines, continuously monitoring changes, detecting new emission-relevant signals, and keeping analyses aligned with development. It automatically generates comprehensive reports (XML, JSON, GraphML), streamlining documentation, audits, and compliance. The tool is capable of dealing with multi-million code-line projects.

The Unexpected Sunroof Dependency

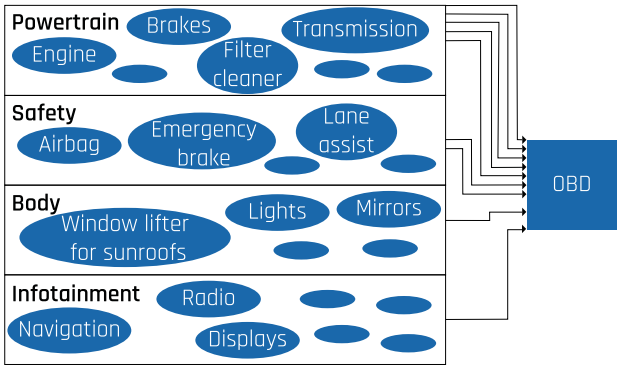

Figure 1: OBD monitoring across multiple domains

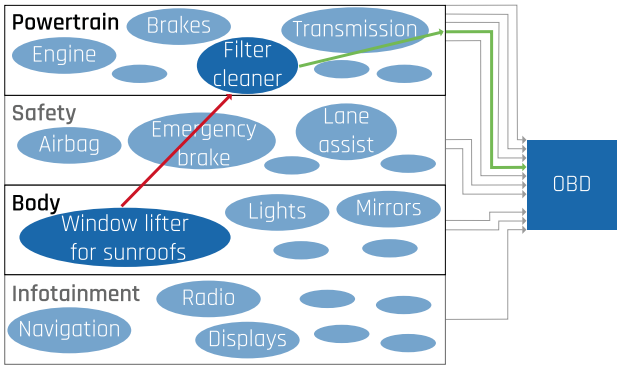

Figure 2: Dependency of sunroof system to emission-relevant OBD function

Background

While OBD traditionally focuses on emission-related powertrain functions, the complexity of modern vehicles introduces dependencies across domains that are not always obvious.

Cross-Domain Impact

A good example is the sunroof system. At first glance, the sunroof and its motor belong to the body electronics domain and are categorized as convenience features. Yet, vehicles with diesel particulate filters depend on active regeneration – controlled burning of accumulated particles – to maintain exhaust efficiency and comply with emission limits.
This regeneration process can be postponed or aborted if the sunroof is open, to prevent smoke and particles from affecting the cabin. What appears to be a comfort function suddenly becomes a factor in emission control, directly influencing OBD-relevant diagnostics. This illustrates how body, powertrain, and even safety functions can interact in ways that challenge traditional system boundaries.

How emmtrix Depencency Analyzer Ensures Compliance

emmtrix Dependency Analyzer (eDA) uses static source code analysis to uncover such hidden connections. It can detect and label data and control dependencies, even when they cross domain boundaries. In the sunroof scenario, eDA makes the non-obvious link between the body control unit and the engine control unit visible. This enables development teams to systematically document all dependencies and integrate them into OBD logic and certification processes.

Outcome:

The sunroof example illustrates how even comfort features can influence emission control and OBD compliance. With increasing system integration, detecting cross-domain interactions is no longer optional – it is essential. eDA ensures that no emission-critical logic goes unnoticed, enabling full compliance, reliable documentation, and system-wide transparency.

No hidden paths. No overlooked signals. No compromise on compliance.

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