Information System for Vehicle Antitampering based on OBD Data

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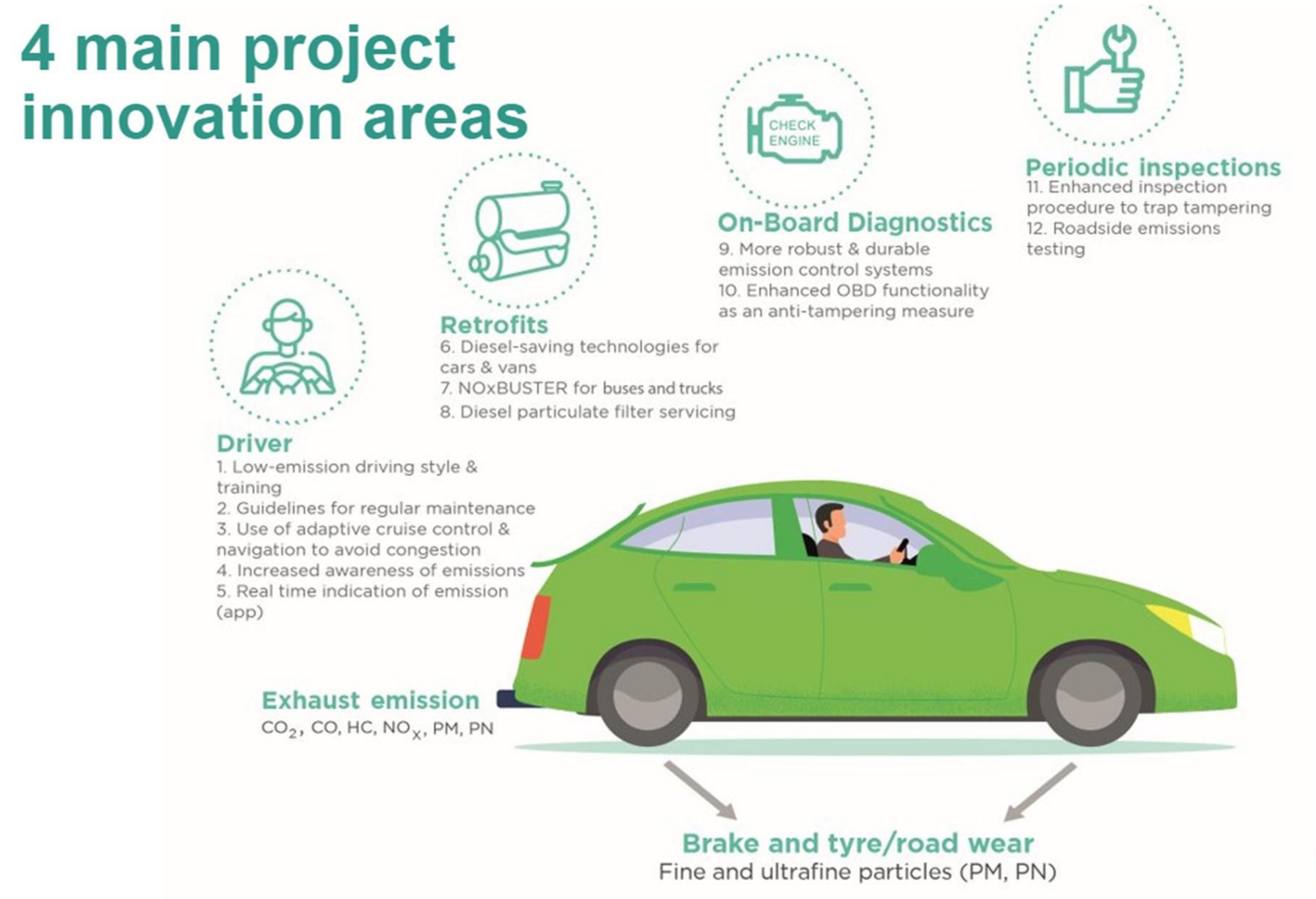
MODALES project



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ITS: The Game Changer.

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Introduction

- The use of EATS has brought significant reductions to the actual emission levels
- Tampering is very common to manipulate the EATS
- Motivations for tampering:
  - money savings by avoiding repair costs of malfunctions,
  - costs for consumables,
  - performance tuning, etc.
- **Our proposal**: *Information system identifying and notifying possible tampering or insufficient engine maintenance issue or higher engine horsepower of a vehicle*
- **Objective**: Protection of the environment and improvement of air quality

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Tampering techniques

- The most common method is to disable the EGR or DPF system
- ECU re-flashing: Alters the ECU flash and perform checks using test drives or dyno tests
- Emulators: Devices that attack the SCR system
- Modifiers: Hardware solutions that are simpler to emulators and aim to alter the control state of an EATS
- OBD Suppressors: These devices sent specific CAN-bus messages to suppress the onboard diagnostics of the vehicle

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Research efforts to detect and address tampering

- **DIAS** research project dias-project.com
  - Worked to make vehicle EATS more robust against tampering
- **CARES** research project cares-project.eu
  - Worked to detect vehicle tampering through contactless measurement of vehicle exhaust emissions
- **VetaDetect** methodology to detect tampering
  - The Dempster-Shafer theory of evidence is used to combine an ensemble of multiple-input single-output Auto Regressive Moving Average models

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Information System: Functionality

- A vehicle data collection and control unit send information to a central server
- The system tries to identify any significant discrepancies per vehicle
- Comparison of OBD values collected per second with manufacturer performance values about the:
  - engine power
  - engine torque
  - engine speed
  - vehicle speed
  - vehicle acceleration
- Notification to authorities when the measured values are above a threshold (e.g. 10%)

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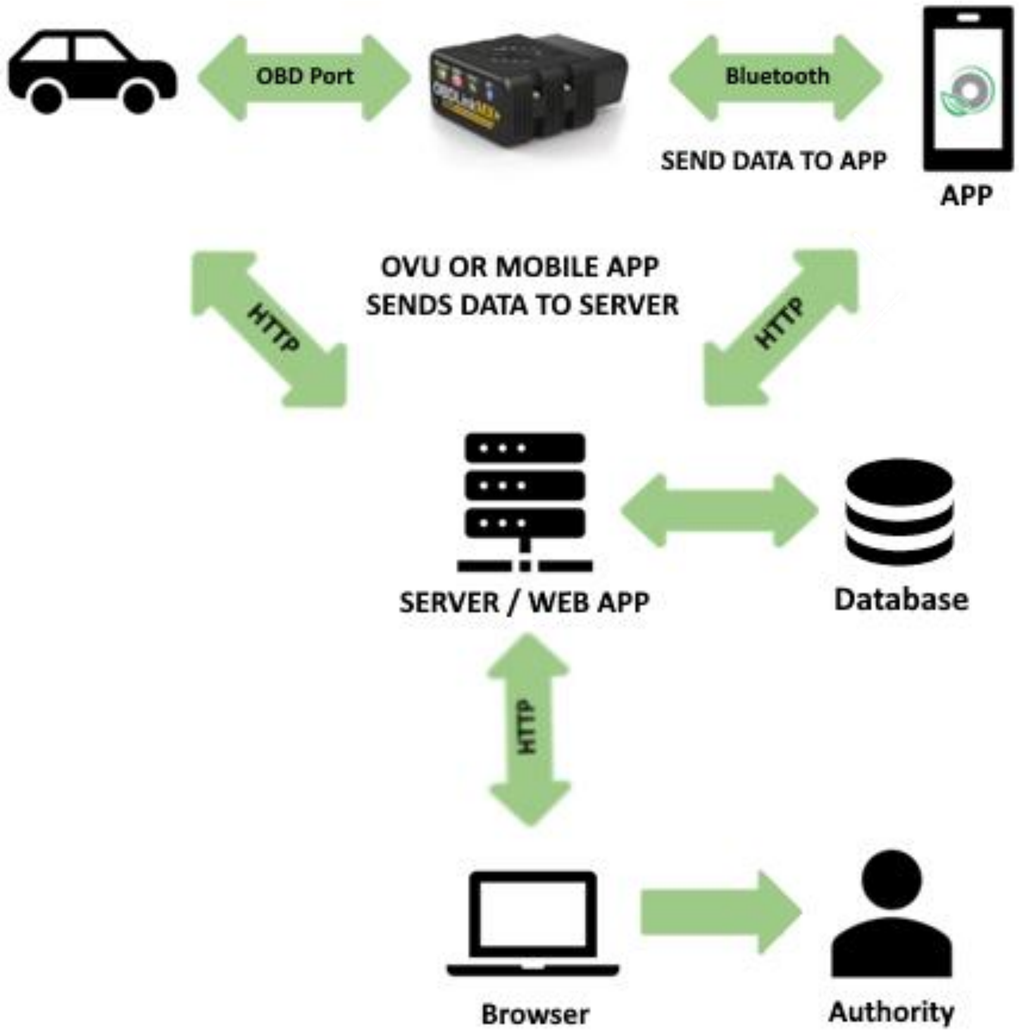
Information System: Architecture

- A mobile phone application receives vehicle data via OBDLink MX+ dongle device
- The mobile app transmits data to the server
- The server
  - processes the data (e.g. missing values)
  - transforms the data
  - loads the data to the database
  - implements data analytics
  - generates notifications
- Website presents the aggregated data



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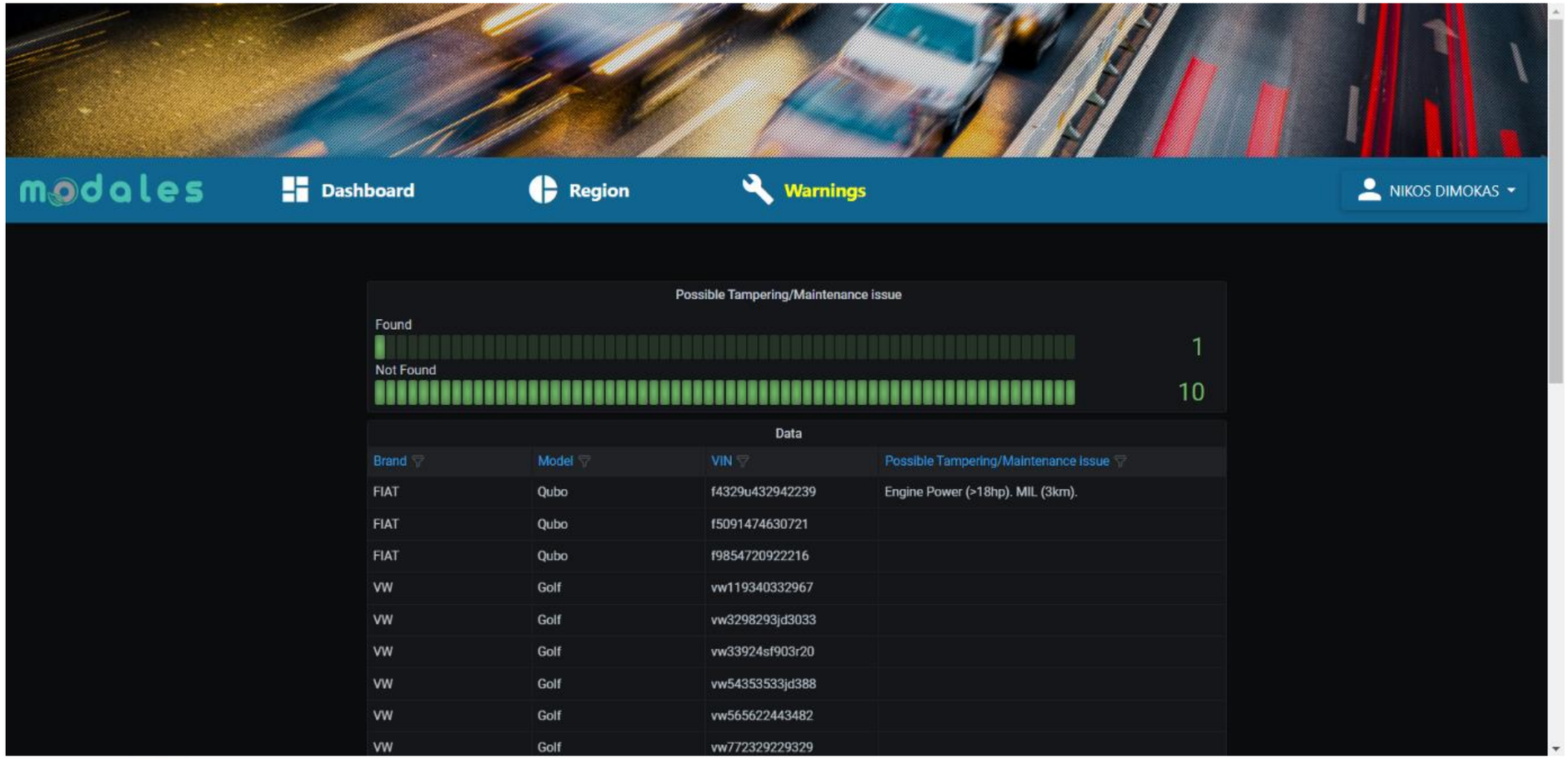
Dashboard



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Evaluation & Conclusions

- Limited validation phase (vehicle data feed)
- The system identified a vehicle with 20% more engine power than the engine performance factory figures
  - A passenger vehicle, with a diesel engine, which produces 75 hp at 4000 RPM.
  - There were several logs with the engine power above 85 hp, with a maximum of 92 hp at 4300 RPM
  - According to a tuning market search, this is a common tampering for this brand and engine type

The above is an example of the usefulness of the system.

Advanced tampering systems will not be identified, as long as they can by-pass or manipulate OBD or CAN-Bus messages. In this case, vehicle-embedded and secure data logging systems are needed to prevent unauthorised tampering

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Thank you!