**TRIP BASED MODELING OF FUEL CONSUMPTION IN MODERN FLEET VEHICLES**

**PROBLEM STATEMENT:**

* A new asymmetric twin-scroll turbocharged engine with two [EGR](https://www.sciencedirect.com/topics/engineering/exhaust-gas-recirculation) circuits is first presented.
* Experiment and simulation are combined on the [diesel engine](https://www.sciencedirect.com/topics/engineering/diesel-engine) with asymmetric [turbocharger](https://www.sciencedirect.com/topics/engineering/turbocharger).
* Effect laws of [turbine](https://www.sciencedirect.com/topics/engineering/turbines) critical parameters and EGR valves control strategy are explored.
* The new system has the maximum EGR rate and fuel economy improvements of 8.59% and 1.98%.
* The research collects bus fuel consumption data for diesel buses.
* Models are developed to compute the fuel consumption levels of buses.
* The optimum bus fuel economy cruising speeds range between 40 and 50 km/h.
* The model is more consistent with empirical observations compared to the MOVES and CMEM models.

**IDEA / SOLUTION DESCRIPTION:**

* **Monitor fuel costs**. They incorporate data about fuel transactions into analytics and learn what brands of fuel bring better economy, compare fuel usage across vehicles, break down fuel spend, and generally improve your fuel buying behaviour.
* Incorporate good driving habits. By collecting information about unnecessary speeding, harsh braking, and excessive engine idling, you can support efficient drivers with incentives and provide training for drivers who have inefficient driving habits.
* Capture and prevent fuel theft and leakage. Fuel monitoring and anti-siphoning devices can update you on fuel amounts in trucks and on-site tanks and send alerts about fuel levels.
* **Calculate and report fuel taxes**. Integrated with your vehicle’s GPS, a fuel management system can automatically calculate travelled distance and purchased fuel to help file your IFTA tax reports.
* The ultimate benefit of fuel management systems is automation — operations that used to be done manually in spreadsheets can happen automatically in the background, providing analytics for you to base your decisions on. Now, let’s cover the main opportunities and how they work.

**NOVELTY / UNIQUENESS:**

* Use the intuitive charts and reports provided on the Onboard Cloud to analyze safety trends for your fleet.
* Deep dive into vehicle and driver-level analytics to pinpoint safety issues and identify actions.
* Onboard Cloud also combines collision avoidance alerts with other telemetric parameters to provide a powerful picture of how your fleet safety is improving.
* Track vehicle health with In tangles Digital Twin technology. Get alerts for mission critical systems such as engine cooling, battery charging, and fuel-air metering systems. Service routine automation with recommendations based on real time odometer and engine hours.
* In one go, you get insights on your fleet’s health condition. Also monitor various vehicle parameters and get timely updates on any potential failures ensuring maximum uptime of your vehicles and preventing on route breakdowns.

**SOCIAL IMPACT / CUSTOMER SATISFACTION:**

* Using computer vision and Artificial Intelligence (AI) and with the help of an in-cabin IR sensor, Cipia-FS10 Driver Monitoring System tracks the driver's head pose, eyelids, and direction of gaze to provide real-time assessment of the driver's state (attentive, distracted, drowsy), actions (smoking, not wearing a seatbelt, and holding a phone), and driver identity (recognition of enrolled drivers).
* Use these driver state alerts to enable fleet management interventions. Driver Monitoring alerts can also be combined with Safety Analytics to give a complete safety view of the fleet and driver.
* With distraction, drowsiness, and compliance alert data metrics, you’ll have up-to-date metrics on driver behaviour and corrective actions to help improve driver and vehicle safety.
* Our unified driver scoring system also combines driver state alerts along with collision alerts to assign a driver score and rating to each driver.

**BUSINESS MODEL:**

**Vehicle specifications and experimental approach:**

* The fuel consumption test data for the five types of gasoline and diesel passenger vehicles (total 10 vehicles) was implemented to validate the prediction accuracy of the simulation results. In this study, it is appropriate to select diverse vehicles which have different weights and engine displacements because the wider range of comparative analysis was enabled and it can increase the reliability of the calculation result. Therefore, each test vehicle has a gap in vehicle weight and engine

**Investigation of the relationship between pedal sensor position and engine torque:**

* Gear shifting position curves data was set to be entered as a pedal sensor position (%, *x*-axis) according to vehicle speed (km/h, *y*-axis). In order to proceed the calculations, data format should be changed because the CRUISE program offers the input data format regarding to gear position as an engine load (%, *x*-axis) according to vehicle speed (km/h, *y*-axis). The simplest approach is to assume that engine load is proportional to the pedal sensor position and directly entered raw data

**SCALABILITY OF SOLUTION:**

* Track fuel efficiency, filling, and pilferage with In tangles Digital Twin technology with accuracies >98%3. Trace fuel thefts, under fillings, and idling losses with geo-location. View fuel efficiency statistics as a function of routes, engine operating modes, and time series trends.
* Look at fuel efficiency metrics to identify and implement optimizations to improve mileage and improve vehicle health.
* Keep a tab on your daily fuel burn against distance travelled. Fuel consumption shown is the actual diesel burnt in the combustion cylinder and not dependent on tank level based top-up.
* The gear utilization graph gives you a fair understanding regarding the wear and tear of two major mechanical components (gear box and clutch plate) which ensures the uptime of the vehicle when on route.
* Understand fuel pilferage situations along with details on quantity and location. Take preventive steps to save on fuel.
* Idling is a cost that every fleet owner bears unknowingly. Monitor idling and see an immediate effect in the monthly revenue by reducing diesel wastage.

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