Machine Learning based Vehicle Performance Analyzer

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Abstract

The monitoring of car performance, especially gas consumption, has so far been approached only very superficially. A typical fuel gauge, when closely monitored, shows an extremely non-linear relationship between needle movement and fuel consumption. Inaccuracies occur especially in the range of critical low fuel values of 5-10% or more. In the past, due to this limitation, some luxury cars had an audible and flashing light alarm function to indicate a low fuel condition. These systems, which add to the existing fuel level, have no more accuracy than the fuel level monitor alone.

In recent years, with the availability of computer techniques and reliable and less expensive computer equipment, a number of systems have been developed to provide somewhat more accurate information about vehicle performance.

Literature Survey

Title	Author Name	Year of Paper	Methodology
Performance Analysis of Vehicle Detection Techniques: A Concise Survey	Adnan Hanif et al	2018	three main detection algorithms; Gaussian Mixture Model (GMM), Histogram of Gradients (HoG), and Adaptive motion Histograms based vehicle detection are implemented and evaluated for performance under varying illumination, traffic density and occlusion conditions.
Effects of A Vehicle's Driver Behavior to The Fuel Economy	Raksit Thitipatanapong et al	2011	The samples of drivers were different driving behavior affecting fuel consumption for 30% between the worse and the best. From the analysis, the rate of fuel consumption and acceleration significantly related.
Performance of Motor Vehicle based on Driving and Vehicle Data using Machine Learning	Punith Kumar Nagaraje Gowda et al	2019	The relevant data for this analysis was taken from the public source, Kaggle which is the data collected from the OBD of the car and models are built using techniques like Multiple Linear Regression, XGBoost, Support Vector Machine and Artificial Neural Network and their performance is compared to discover the first-rate technique in predicting the fuel

			efficiency and to propose the optimum driving behavior in terms of throttle position to achieve better fuel efficiency.
Vehicle Performance Analysis of an Autonomous Electric Shuttle Modified for Wheelchair Accessibility	Dr. Zachary Asher et al	2020	A ride comfort analysis was performed using MATLAB to study the passenger's ride comfort in all three-shuttle designs. Also, energy consumption and lateral dynamic analyses were performed to analyze the operating range and turning radius of the shuttles. Since modern suspension systems are being integrated with an active control suspension system, an active control suspension model was developed in order to observe the benefits of incorporating this technology into our new design. In order to test the control system of the active suspension developed, a co-simulation was performed using ADAMS and MATLAB.
Effects of A Vehicle's Driver Behavior to The Fuel Economy	Raksit Thitipatanapong et al	2011	The samples of drivers were different driving behavior affecting fuel consumption for 30% between the worse and the best. From the analysis, the rate of fuel consumption and acceleration significantly related.

Summary

Of great importance is the fact that the system is user-calibrated to the actual vehicle it is installed on, and the calibration overcomes non-linearities in existing sensors, fuel and vehicle speed, giving the user a true correct reading based on independent observed data. For example, a fuel tank may have a capacity of 20 gallons, but in reality, it may vary by ±5%. Fuel gauges are notoriously inaccurate, sometimes registering half a tank when only one-third is left. Tachometers often show errors of ±5% from actual values. Utilizing this invention, the user calibrates the system by filling the tank to full capacity and entering the full code using the switches 33. After driving until the fuel gauge reads three-quarters full, he then enters the three-quarters input and so on. The system calculates the slope of the fuel consumption curve and then displays the data in accordance with the observed registered inputs until it changes. The user can also drive at different speeds observed in either the highway speedometer control zones or the workshop calibrator and actually calibrate the system to provide an accurate vehicle speed reading on the display 51 with much greater accuracy than a normal vehicle speedometer. Similarly, it can drive to the end of the tank to ensure accurate calibration of the distance to the end of the tank. Then, when the system is switched to operational mode, it provides the user with meaningful and correct information about the performance of the vehicle, which was not available before. If the vehicle's performance changes, e.g., different size tires are installed, the system can be recalibrated by the user. If the user changes cars, the system can be easily removed and installed and calibrated in the replacement vehicle.