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A DEEP LEARNING MODEL FOR AVERAGE FUEL CONSUMPTION IN HEAVY VEHICLES

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ABSTRACT ___A deep learning model for heavy vehicle fuel consumption prediction is presented in this study. The model takes a look at how things like vehicle type, load, route parameters, and driving behaviour affect fuel economy by using sophisticated algorithms and massive datasets. Our main goal is to provide operators and fleet management precise projections that will help them make better operational choices, optimise routes, and save fuel costs. The significance of data-driven strategies in improving transportation sustainability and efficiency is further emphasised in this research.

I. INTRODUCTION

Heavy vehicles, including trucks and buses, account for a disproportionate share of the world's fuel consumption and greenhouse gas emissions, which are mostly caused by the transportation industry. Efficient management of fuel resources is becoming more important as fuel costs keep going up. Optimal fleet operations, cost reduction, and environmental impact mitigation all depend on accurate fuel consumption forecast. Estimating fuel usage using traditional techniques often makes use of oversimplified

models or averages over time, which could not capture the intricacies of actual driving situations. A more complex knowledge of the elements influencing fuel economy in heavy trucks may be gained from this project's proposed deep learning model, which uses several data inputs to provide accurate average fuel consumption estimations.

II.LITERATURE REVIEW

Abstract: 1. Zhang et al. (2020): This work investigates how heavy-duty vehicles' fuel consumption may be predicted using machine learning approaches. The authors demonstrate the shortcomings of conventional regression models by using a variety of techniques, such as support vector machines and decision trees. When taking into consideration current driving conditions and vehicle load, the findings show that fuel consumption projections made using machine learning models are far more accurate.

In their 2019 abstract, Wang and Li explore how route optimisation affects commercial vehicles' fuel usage. They use neural networks to predict fuel efficiency and create a hybrid model that incorporates both past fuel data and current traffic conditions. Their research highlights the significance of data-driven decision-making in fleet management, suggesting that fuel consumption may be reduced by as much as 15% when sophisticated analytics are integrated with route planning.

Kumar et al. (2021) 3. The use of internet of things (IoT) technology to track how much gas heavy trucks consume is the main subject of this article's abstract. The authors suggest a system that monitors fuel economy by collecting data in real-time from sensors installed aboard and analysing it using deep learning algorithms. According to the research, these kinds of devices may improve fuel economy and decrease emissions via proactive maintenance and operating modifications.

Abstract: In their 2018 paper, Patel and Joshi survey the state of the art in fuel consumption modelling, with a focus on how machine learning is replacing more conventional approaches. In order to train models efficiently, they emphasise the significance of having solid datasets and talk about the pros and downsides of using deep learning for fuel consumption prediction.

This study presents a deep learning architecture developed for the purpose of predicting the fuel consumption of heavy vehicles (Gupta et al., 2022). Incorporating data from several sources, such as GPS, load information, and previous performance indicators, the authors show that their forecast accuracy is far higher than that of typical statistical approaches. The report goes on to discuss the consequences for eco-friendly fleet management and beyond.

Building a deep learning model to forecast heavy vehicle average fuel consumption is an undertaking with several critical modules, each of which performs an own function. The data collection module is in charge of collecting a wide range of information from several sources. These include sensors installed in the car, which measure things like fuel flow rate, speed, and engine load. It also includes GPS data, which is used to track where the vehicle is and how it got there. Additionally, it takes into account environmental factors, such as temperature and road conditions. Data cleaning, feature normalisation or scaling, missing value management, and categorical variable encoding are all steps in the data preprocessing module's process of getting the acquired data ready for analysis. This makes sure the data is ready for processing in the best possible way. Finding and making useful features to improve the model's performance is the main goal of the Feature Engineering Module. This may include things like averaging data, finding trends in drivers' actions, and producing new features from raw environmental data. After deciding on an appropriate neural network (e.g., LSTM or CNN) and optimising its hyperparameters, the Model Development Module trains the model using a variety of deep learning approaches. The Model Evaluation Module compares the trained model's predictions to a validation dataset and uses metrics like Mean Absolute Error (MAE), Root Mean Square Error (RMSE), and R^2 to evaluate the model's performance after model creation. Drivers and fleet managers may benefit from the Prediction Module's real-time fuel consumption projections, which are based on data input from the vehicle. To further aid in the comprehension of patterns, trends, and forecasts, the Visualisation Module displays data and model outputs in the form of dashboards and visual representations. A thorough report summarising the model's predictions, insights, and suggestions for optimising fuel use is generated by the Reporting Module. In the end, the Integration Module links the model that was built with current fleet management systems. This allows for easy access to statistics and forecasts about fuel usage, which improves operational efficiency. These components work as a whole to enhance heavy vehicle fuel economy with the help of cutting-edge deep learning algorithms.

III.EXISTING SYSTEM

Current fuel consumption prediction systems for large trucks often use simplistic statistical approaches or regression-based models with small datasets and predetermined parameters. Because traffic, vehicle performance, and operational factors are always changing, these methods often don't account for them. Consequently, they can only provide approximate fuel consumption predictions, which might cause ineffective route planning and higher operating expenses. Additionally, conventional systems could not use real-time data, which makes them less flexible and gives a static picture of fuel usage metrics.

IV.PROPOSED SYSTEM

Incorporating a large number of factors, such as car specs, real-time GPS data, previous fuel consumption records, and driver behaviour patterns, the suggested method presents a deep learning model. Aiming to discover intricate correlations between input factors and fuel consumption results, the model makes use of sophisticated algorithms like neural networks. More precise and flexible forecasts suited to individual driving situations are made possible by this method. Improved operational efficiency and sustainability in the heavy vehicle industry may be achieved via the use of data-driven techniques to optimise fuel consumption, which the model can provide to fleet operators.

V.CONCLUSION

To sum up, transportation analytics has taken a giant leap forward with the creation of a deep learning model that can forecast heavy trucks' average fuel usage. The goal of this study is to improve upon previous techniques of prediction by using a variety of data sources, such as current driving conditions, vehicle load, and fuel consumption trends across time. Incorporating state-of-the-art machine learning methods improves operational efficiency and decreases environmental impact by making fuel consumption projections more reliable and providing fleet managers with actionable information. The results of this study might lead to significant improvements in the management and operation of heavy trucks, which is important since the transportation sector is trying to optimise fuel consumption and minimise emissions.

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