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FUEL CONSUMPTION PREDICTION AND ANALYSIS IN HEAVY VEHICLES USING MACHINE LEARNING

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Abstract: When developing customized machine learning models for fuel use, we used vehicle journey distance rather than the typical time period. Using this method along with various variables drawn from vehicle speed, the road, and related things, a highly predictive neural network model for the typical fuel usage of large trucks is produced. To lower fuel consumption overall, the suggested approach can easily be built and applied to each individual car in a fleet. The model's predictors are averaged over predetermined trip distance window widths using machine learning. Using machine learning algorithms like ANNs (Artificial Neural Networks), the author describes an idea for predicting the typical fuel consumption of heavy trucks.

Keywords: fuel consumption, neural network, time, distance.

I. INTRODUCTION

Models of vehicle fuel consumption are important to producers, regulators, and consumers. They are necessary at every point in the life cycle of the vehicle. In this study, we concentrate on modelling the typical fuel consumption of heavy trucks during the operating and repair phases. The methods used to create fuel consumption models can generally be divided into three categories:

• Models based on physics that come from a thorough grasp of the physical mechanism. To describe the dynamics of the vehicle's components at each time step, these models make use of detailed mathematical equations.

In this study, we model the typical fuel consumption of heavy trucks during operation and maintenance. The three main methodologies used to create fuel consumption models are physics-based models, machine learning models, and statistical models. Several earlier models for both current and average fuel use have been created. Physics-based models are the best option for predicting instantaneous fuel consumption because they can explain the dynamics of the system's activity at different time scales.

II. LITERATURE SURVEY

Nowadays, some people find it difficult to pay their fuel bills, whether they are for petrol or diesel. The model we are developing will be useful to lots of people. The system we are generating is a data summary method and will be based on distance rather than the customary time period when building a customised machine learning model for fuel consumption [1]. This mechanism works in concert with the vehicle speed. Starting with a method review, seven additional predictors were inferred to build a machine-learning neural network model. Taking that into account suggests typical car fuel usage. The analysis of different window widths shows that the 1km window can forecast fuel consumption with a coefficient of 0.91 and less than 4% peak to peak percentage error for routes containing both city and highway duty bicycle parts.

Model for Predicting Fuel Consumption Using Machine Learning:

After uploading the dataset, we must train the model. This enables us to examine both the

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overall dataset's number of records and the number of records used for training and testing. Then, by using ANN, we predict test data consumption and arrive at a forecast of 87.12%. We calculated the average fuel consumption per 100 kilo metres for each test record. [2]. The anticipated fuel consumption is shown as a function of the Mass Air Flow, Vehicle Speed, Revolutions per Minute, and Throttle Position Sensor settings. The proposed model is developed and evaluated using the automotive On-Board Diagnostics Dataset. 18 different traits were discovered [3]. The results were more accurate than those of earlier studies that used, with an RSquared measure value of 0.97. We concluded that the SVM significantly influences estimates of fuel consumption. For the same goal, our method might compete with existing machine learning techniques, giving manufacturers more options for effective fuel consumption prediction models [4].

A machine learning model for typical fuel use in big vehicles:

According to this study[5], building customised machine learning models for fuel consumption using a data summary approach based on distance as opposed to the conventional time period is advised.

III. METHODOLOGY

When the projected fuel rates are converted into fuel consumption, the model can forecast total fuel consumption for a 365 km trip with an accuracy of 2%. A similar method was used in. The degree to which the point-wise estimated fuel rates in this study agree with the measured fuel rates is indicated by the coefficient of determination (0.3), which is below average. The current models have time-domain input and output. They were rated based on predetermined window sizes for distance travelled. In order to forecast fuel use, the author has taken 7 predictor features, including Number of stops, duration of stops, average moving speed, characteristic acceleration, square of the aerodynamic speed, change in kinetic energy, change in potential energy, and class. The aforementioned seven characteristics, such as the number of times a vehicle stops and the total amount of time spent halted, are logged for each vehicle's travel up to 100 kilobits. This data was gathered from heavy vehicles and used to train an ANN model.

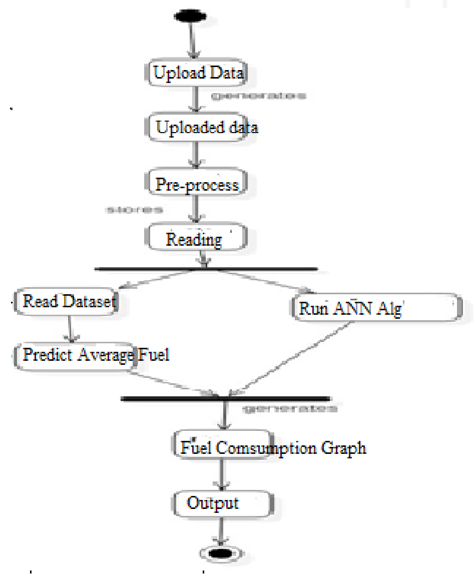

Fig: 1 Process

It is advised to use a tried-and-true design that is simple to adapt for certain heavy vehicles in a large fleet. Based on the anticipated fuel consumption of each vehicle, a fleet manager may optimise route planning for the entire fleet, making sure that the route assignments are compatible to reduce fleet fuel consumption as a whole. This method develops a highly predictive neural network model for the typical fuel consumption of heavy trucks using seven predictors derived

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from the vehicle's speed and the gradient of the road. The findings show that routes including both city and highway duty cycle segments can be estimated to have fuel consumption with a 1 km window that has a 0.91 coefficient of determination and a mean absolute peak-to-peak percent error of less than 4%. An ANN model was trained using values from the dataset that were all collected from large automobiles. The input for this study is time-domain aggregated at 10-minute intervals, and the output is fuel consumption over the same time period. a transferable quality Equation F(p) = o, where F() stands for the system, p for input predictors, and o for the system's response or output, represents a complex system. Feed Forward Neural Networks (FNN) are the type of ANNs used in this study. Training is an iterative process that can be carried out using a variety of techniques, including particle swarm optimisation and back propagation. Future studies will look at different approaches to see if they may increase the model's projected accuracy. Every time the network weights are adjusted during training, a random pair of (input, output) features from Ftr is selected. The difference between the actual output value and the value that the model predicted is calculated to achieve this.

IV. IMPLEMENTATION

1. Heavy Vehicles Fuel Dataset: Using this module we can upload train dataset to application. Dataset contains commaseparated values.

2. Read Dataset & Generate Model: We'll use this module to read a comma-separated dataset and then create a train and test model for an ANN using the values from that dataset. The dataset will be separated into two sections, with 80 percent being used to train the ANN model and 20 percent being used to test it and run

3. Apply ANN Algorithm: Using this model we can create ANN object and then feed train and test data to build ANN model.

4. Predict Average Fuel Consumption: We will upload new test data to this module, and ANN will apply a train model to that data in order to predict average fuel usage for those test records.

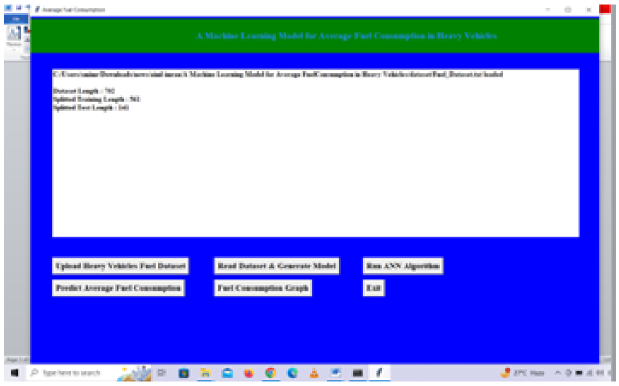
5. Fuel Consumption Graph: Using this module we will plot a fuel consumption graph for each test record

6. Fuel consumption graph: The final predicted output is displayed in the graph.

V. RESULTS

After uploading the dataset, we must train the model. This allows us to examine the overall number of records in the dataset, as well as the number of records utilised for training and testing. Then, using ANN, we acquire a forecast of 87.12%, and we predict the consumption for test data. We calculated the average fuel usage per 100 kilo metre for each test record.

Fig 1 Dataset Uploading



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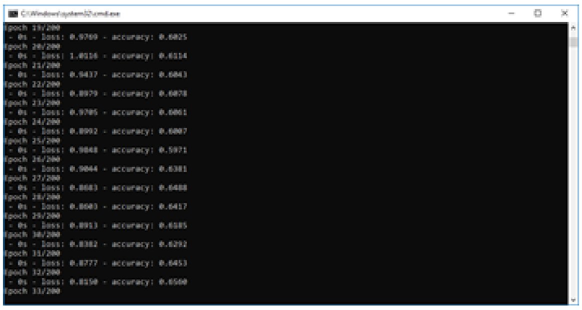

Fig 2 Apply the ANN

Fig 3 ANN processing

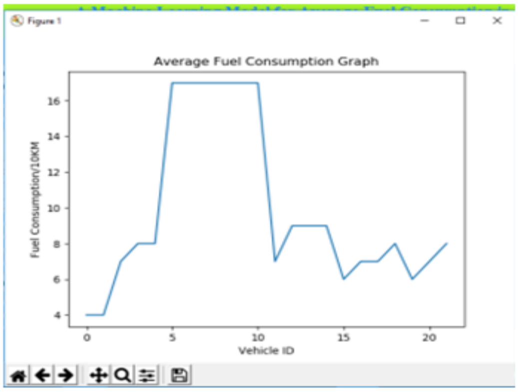

Fig 4 Graph of fuel consumption

VII. CONCLUSION

Machine learning model that can be conveniently developed for each heavy vehiclein a fleet. Data is gathered at a rate that is proportionate to how much it will affect the result. The quantity of data gathered from a vehicle at a halt is equal to the amount of data collected when the vehicle is moving when the input space is sampled with regard to time.

The predictors in the model are able to reflect how the environment and duty cycle, such as the frequency of pauses in urban traffic over a specific distance, affect the average fuel consumption of the vehicle.

On-board aggregation of raw sensor data into a small number of predictors is possible with less storage and communication bandwidth needed.

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