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by Patrick T

A COMPARATIVE STUDY ON IC ENGINE VEHICLES, HYBRID VEHICLES AND ELECTRIC VEHICLES ON INDIAN ROADS: CASE OF PASSENGER VEHICLES IN BANGALORE, INDIA

TABLE OF CONTENTS

Introduction

Background

This research will dive into the factors of efficiency of five vehicles which are categorized into three sections, depending on the traffic roads in Bangalore in India. The comparative study will determine the calculating factors, which vehicle is considered adequate, and provide proficient expectancy on which the customers are relying. Generally, these five are passenger vehicles and are one of the most popular models in India. The estimations on efficiency will be dealing with the respective 5 to 10 km in the traffic roads in Bangalore. Speaking about traffic roads, in this proposal, the roads are too varied into three categories like most traffic roads, moderate traffic, and low traffic. The vehicles will show their potencies like their energy consumption, momentum, torque, power, and speed depending on the traffic, costs for these vehicles, and distances.

Problem Statement

The problem statement here from the professional side indicates that, since taking the notes about the variables for calculation in the traffic roads, then it may occur that, sometimes whatever the denseness of the traffic is predicted from the beginning for testing the efficiency of the vehicles, the required traffic won't come out. Though this can be predicted from the start, another thing is wherever the traffic is determined to have less dense, then may during the experiment the traffic gets dense. The one thing that is missing from the current knowledge is that vehicles, whose efficiency will be calculated, won't show that much productivity, or in simple words, they may turn out to be old junk or lose their efficiency compared to their former state (Rohan, 2020). Even for two or three vehicles the cost sheet which will be required to estimate depending on the price whether the efficiency of the car is justified or not, can not be provided by the company, though they can get it from the internet since the car owners can feel a little obligated issue over here.

Relevance and Importance of the Research

The relevance of this project to undertake is that it can provide insight into which model is capable of giving higher performance than a customer can expect. From the beginning, it has been delivered that by the application of R programming and software appliances the productivity of these five models according to their categorization would help to evaluate

which model needs to be efficient in the busiest road, moderate roads, or low busiest roads in Bangalore (Waseem, *et al,* 2019). This insight can be delivered to those researchers as a helping gesture who will carry out more advancements through this study, and also to those companies who can upgrade their models to pass through the busy roads, efficiently with the required proficiency. The cost analytics will also be produced through which a considerable situation of the customers can also be known that what is the rate of Indian people who can buy cars according to their varying financial strength.

The scientific problem for the research

The scientific problem for this research would be thoroughly measuring the efficiencies. But another, may sometimes the correct estimation could get vary along with torque or power for a car, so on that respective more focus is to be given.

Objectives of the research

This research will aim to evaluate parameters like speed, torque, power, and cost of cars for traveling 5 to 10 km distances in Bangalore's most, moderate, and low busiest roads in India. The respective objectives are as follows:

- To calculate the speed of the cars within 5 km in a limited period applying normal power in the most, moderate, and low busiest roads.
- To calculate the torque along with the power of those cars.
- To identify the initial costs of the cars while buying them and their servicing costs after using those cars.
- To know that those cars are quite efficient according to their cost range.

Research Questions

- What is the speed of the cars after driving 5 km in a given limited period, applying normal power in the most, moderate, and low busiest roads?
- What is the torque of those cars after applying varying powers according to the distances?
- What are the initial costs of the cars during the time of their purchase and after using them what pricing rate turns out to be the costs?
- What is the efficiency rate the car can give to the customers, according to their cost range, whether they are justifiable?

Literature Review

Key Concepts, Theories, and Studies

According to Goel *et al,* 2021, the paper deals with the IC engine, hybrid engines, and electric cars in India. With the proper calculations and systematic procedures, the paper shows the structural features of electric vehicles in India. Also to carry out this car different notions have been developed. A characteristic has been featured over here, as through regenerative braking system which controls the power of most of the hybrid electric vehicles that enhances the range of the EV, which makes it easily and widely adopted in a form of hybrid and BEV models.

According to Bejgam *et al* 2021, hybrid vehicles are being standardized to gain the manual standards which many non-hybrid vehicles need to have while sustaining good fuel efficiency. There are other non-conventional electric vehicles but there are some disadvantages like they turn out to be imperfect and sometimes impaired with limited charging points that can be achieved by hybrid vehicles.

Key Debates and Controversies

The debating points from these two journals, which are like from the first journal, more emphasis has been given to electric hybrid vehicles other than two categories, and the second one gives importance to non-hybrid electric vehicles.

Gaps in Existing Knowledge

There is no particular estimating calculation regarding IC cars or hybrid cars. The second journal fails about electric cars and does not properly mention the disadvantages of non-conventional cars.

Research Design and Methods

Research Design

The research will be conducted as **primary research** and it will be based on **quantitative methods**.

It will be an **experimental procedure**, as because through the parametric variables the determination of the comparison will be inscribed.

The **methodological approach** will be carried out like this, as there are three categorizations of passenger vehicles: IC engine vehicles, Hybrid vehicles, and electric vehicles (Dhar, *et al,*

2020). Now the models that are taken in this aspect are the Mahindra, TATA as hybrid vehicles, Renault as IC engine vehicles, Hyundai, and Maruti Suzuki as electric vehicles or hybrid vehicles.

For **access**, permission will be needed to be granted from the model's owned companies.

For this research the **cases** will be three according to the category and depending on which the five vehicles will be phased and in the cost, torque, momentum, distance traveled specifically 5 to 10 km, speed, and power will be determined. So basically there will be moreover thirty cases for each variable (halia, *et al,* 2021). The **cases** regarding the calculations on the vehicles will be selected in an orderly way. One by one the vehicle's characteristics through the efficiency parameters will be evaluated. The **duration** of the research will be nearly 24 days.

The **point of indicators** will be cost, torque, momentum, distance traveled specifically 5 to 10 km, speed, and power.

The data will be **recorded** in an online format and as primary participants, they will be observed. The data will be **coded** according to their parameters. It will be taken as an **inductive** method (Saini, *et al,* 2023). The analysis through the coding will be **quantitative**, as the parameters will be calculated.

Methods and Source

The **tools** that would be required over here is the software R for implementing the machine learning programming for the datasets. The data will be visualized in a simulation way which is why the R programming will be required over here.

The **procedures** will be chronological in this aspect at first the determination of the busiest, moderate busiest, or low busiest roads in Bangalore will be selected, as there are many like Mahatma Gandhi Road, Mekhri Circle, Sarjapur, etc. After that, the vehicles according to their categorization will be selected. Since it will be an estimated experimental data processing work so for that in a selective way according to the roads the parameters of the vehicles will be tested. Even there will be an evaluation of their efficiencies according to their price manual (Kambli, 2022). This will be calibrated through the customers or users, like during buying the car what were their investment for it, and its servicing costs after using them. After the collection of the data, the dataset will be sent forward to calculate the experimental assumptions.

Speaking about the **participants** there will be no such one, cause the estimations will be made on vehicles efficiently but if looking for the audience poll regarding these vehicles then as an outsource the participants will be the customer.

The data will be collected two times a day, one in the daytime and another in the nighttime. The data will be collected in a speedometer for speed, a dynamometer for power and torque, and an odometer for distance. For the **sources** of costs regarding each car, then a permit for cost sheet or catalogs for each car will get from the internet or can be received from the main office (Kesari, *et al*,2019). Now all these data will be put into the software for performing their analytical diorama and the data will be assessed through the R programming in a simulated visualized way. An experimental estimation will be provided according to the cost, power, and torque on roads, in Bangalore.

Practical considerations

For ethical considerations, it will be strictly followed that fellow participants who will participate in this research, will not be harmed. Moreover, the data will be kept confidential and knowledge that is required from the company will also be kept confidential (Karali *et al*, 2019). But many times since in the problem statement it has been discussed that many companies won't open up about their fallacies on their cars, so regarding that part, collection of data will be a limited obstacle. In that case, choosing another company, while keeping it as a backup will be a sorted way for this issue.

Implications and Contributions to Knowledge

Practical Implications

Speaking about improvement this research will not break the policy factors but it will make an increment in that procedure. For example, this research's importance lies in its effectiveness to improve in the procedure and how different alternative ways can be applied to know the efficiencies of cars while driving on the busiest roads in Bangalore.

Theoretical Implications

This theory will have the strength to provide the information to those people, who want to have their dream model cars, who look into the speed, and power torque under cost friendly category. Not from the side of customers but also from the side of companies who produces these vehicles must have information that what their cars are lacking, if any, according to different price variations that their customer can afford (Gupta, and Garg, 2022). This would

create functionality for the future as other researchers do that, for learning more about the efficiencies of cars on the busiest roads in India or in any other places, then how to calculate and extrapolate the ideas and data through limited resources effectively by R programming for learning more about more evolving cars functional efficiencies according to cost chart (Kumar and Padmanaban, 2019). This is the strength of the proposal. The weakness is kind of perceptual in this matter, as particular sets of cars according to hybrid, electric, and IC engine will be evaluated. May there be other cars, which will be effective more than these sets?

Time Plan for Master's Project Proposal and Master's Thesis

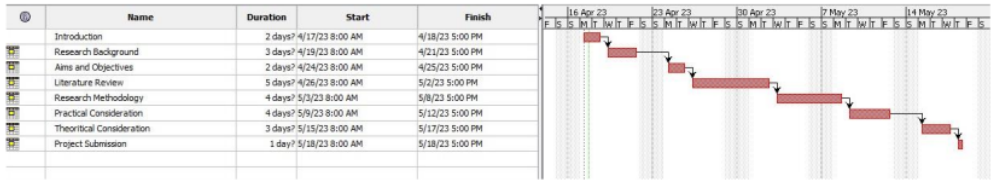|	Name	Duration	Start	Finish
	Introduction	2 days?	4/17/23 8:00 AM	4/18/23 5:00 PM
	Research Background	3 days?	4/19/23 8:00 AM	4/21/23 5:00 PM
	Aims and Objectives	2 days?	4/24/23 8:00 AM	4/25/23 5:00 PM
	Literature Review	5 days?	4/26/23 8:00 AM	5/2/23 5:00 PM
	Research Methodology	4 days?	5/3/23 8:00 AM	5/8/23 5:00 PM
	Practical Consideration	4 days?	5/9/23 8:00 AM	5/12/23 5:00 PM
	Theoritical Consideration	3 days?	5/15/23 8:00 AM	5/17/23 5:00 PM
	Project Submission	1 day?	5/18/23 8:00 AM	5/18/23 5:00 PM

Figure: the Gantt chart for the work plan

(Source: Self-created in ProjectLibre)

If any issue happens while having permission on calculating a particular model's efficiency then the timeframe would extend according to collecting data from the model.

Refernce List

Journal

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PRIMARY SOURCES

1	Tulasi Krishna Gannavaram V, Rahul Bejgam, Saideep Sunkari, Sai Bhatt Keshipeddi, Madhava Rao Rangaraju, Venu Dunde. "A Brief Study on Hybrid Electric Vehicles", 2021 Third International Conference on Inventive Research in Computing Applications (ICIRCA), 2021 Publication	**1**%
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