ELECTRIC VEHICLE LONG RANGE DISTANCE PROBLEM

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ABSTRACT

Due to the restricted range and significant recharge times of electric vehicles, good battery energy utilization is crucial. Existing methods for estimating the range of electric vehicles do not permit drivers to employ driving strategies based on trip characteristics associated to power savings. Based on appropriate journey characteristics, a driver's range of travel can be anticipated in advance. This research study suggests a novel technique that displays the driver with a number of appropriate trip speeds and a forecasted range of total trip duration. Solving a multi-objective optimization problem that maximized electric motor efficiency and decreased power usage yielded the best speeds. This research study describes the extensive range of an electric vehicle. The project involves a direct current permanent magnet motor. The total driving distance increases, making car travel a realistic option for daily transit. Increased energy security because the vehicle does not run on an IC engine directly.

Keywords: EVs, extensive range, optimization problem, battery, motor efficiency

1. INTRODUCTION

The battery recharge for most of the time was supposed to take long-speed electric vehicles (LREVs) or REEVs with a low charge, with gasoline or diesel motors (Albatayneh, A.; 2020). However, the range can be extended through series or parallel hybrid design. The combustion engine powers an electrical generator directly in the serial hybrid system instead of motors. The generator generates electricity by charging batteries (Ayaz, H., 2017). Briefly, electric motor traction with an electric generator is a simple car. This is only a hybrid. A unique vehicle in the size of battery and propulsion system, the long-range electric vehicle (LREV) is unnecessary for vehicles to function whilst power in battery. For the vehicle as a fully efficient electronic car, battery, engine and power electronics should be built. For speed or power demands LREV does not need to start the engine, so it does not need battery power (Al-Adsani, 2010). The engine can only be used when the battery is low and if necessary the battery can be charged. Electric motors with extremely high energy-to-weight ratios, albeit extremely efficient, offer an appropriate torque while running with a wide range of speeds (B. O. Varga, 2019), as does an internal combustion engine. Internal combustion motors work most efficiently during rotation. To run at optimum efficiency with constant speed, a spinning engine can be modified. Conventional transmissions increase motor weight, weight and capacity for sapping with advanced automatic shifts. A single constant gearbox can adjust the electric motors to your vehicle, which can remove numerous transmissions, unlike regular transmission mechanisms (Burch, I. 2018).

1.1. RESEARCH AIM AND OBJECTIVES

1.1.1. Research aim

There are several obstacles to widespread adoption of electric vehicles in our country, and this research aims to identify and address them. This research will look at consumer preferences and willingness to pay, as well as industry limits on production capabilities and resource availability.

1.1.2. Research objectives

1. Identify how private charging at home might help electric two-wheelers.
2. Identifying acceptable long range problem and solution for EVs.
3. Understand the role of electric vehicles in India's transportation system.

2. RELATED WORK

Albatayneh, A.; et al. (2020). As per his research analysis about long range distance and intended range of 79 homes were compared before and after the trial. According to them, the average daily distance travelled is far less than that. The ideal driving range of an electric vehicle (EV) is becoming less and smaller as time goes on. Historically, electric vehicles have been more expensive to purchase than vehicles fueled by petrol. Ayaz, H., (2017). According to his research study EV may reduce the intended range based on the same data. As more charging stations become available, electric vehicles are still constrained by their battery capacity. When charging my father's Nissan Leaf from 0% to 100% with a standard wall plug, it takes the better part of the night. Al-Adsani, et al. (2010). Performed PHEV drivers and prefer to charge their cars away from home and drive longer distances in a vehicle with a larger battery, according to a study of 3,500 PHEVs. Many folks are concerned about how we'll be able to charge all the new electric vehicles that will be released next year. Bogdan Ovidiu Varga, et al. (2019). According to statistics from 166 vehicles, an EV with a 60-mile range and a home charging station can accommodate more than 90% of daily commuting. With the help of this research, we examined the many types of electric vehicles (EVs), the technology that powers them, the advantages they offer over conventional ICEVs, sales trends over the previous few years, charging options and predicted future developments. Burch, I. and Gilchrist, J., (2018). Study about GPS data and shows that 58 percent of vehicles can be replaced even if rapid charging is not available. In terms of driving range and self-reliance, the quality of an electric vehicle's batteries is a critical factor to consider. Based on these specifications, we evaluated a slew of batteries.

3. RESEARCH METHODOLOGY

The only secondary sources of data used in this study were academic publications, eBooks, and case studies from the publishing industry, all of which were obtained through the Internet. It was only as a result of the results of the Google search that the researchers were able to reach statistically meaningful conclusions (Albatayneh, A.; 2020). A case in point is the corporation Tesla Motors, which is used to highlight the multiple restrictions and leverage points that the company is faced with. The search phrases that were used included a wide range of issues, including Tesla mergers and worldwide expansion, customer demand for automobiles and the “going green” trend, as well as the environmental impact of electric vehicles and the future of transportation (Bellekom, S., 2012).

For the purpose of developing a broad perspective on the research findings, content analysis procedures based on logical reasoning were used in conjunction with a range of different methodologies to produce a general viewpoint. Using extra visual resources, such as YouTube visuals, we were able to help enterprises and government parastatals (an organization with political influence that works alongside the government) more effectively communicate with their customers about the adoption of electric vehicles. Authors who provided in-depth information and outcomes relevant to the automobile sector had an impact on the research and writing processes in this study, according to the findings (E. Baby Anitha, 2012).

3.1. DATA COLLECTION

In order to gather information, the researchers had to look through secondary sources such as books and journal articles for information. Access to important information has become possible thanks to databases such as ABI/Inform and the General Business Files, among other things. One of the study's primary objectives was to evaluate whether or whether the findings had an impact on global brand trust, which was one of the study's primary objectives (Burch, I. 2018).

3.2. DATA ANALYSIS

Data analysis is used in quantitative research to limit, organize, and analyze the information gathered by the investigators during the research process. The research data was subjected to a statistical analysis by a statistician. A variety of data representations are available, including visual and numerical representations. The aforementioned statistics were derived by averaging, meditating, and summing the relevant data in the appropriate ways (Albatayneh, A.; 2020).

According to (Ayaz, H., 2017), a good indicator of how popular electric vehicles will be is how far they drive each day. In order to predict the distribution of daily trip distance, a set of distribution parameters were estimated. According to this estimate, electric vehicles have a big market opportunity despite their limited range (160 km). It was determined that 91% of the 484 automobiles evaluated by Al-Adsani, (2010) could go more than 160 kilometers over the course of a year. B. O. Varga, (2019) analyzed data from 235 households in Los Angeles and New York who participated in an EV trial usage experiment to assess the perceptions of EV users. They found that 81% of those polled had postponed or cancelled trips because of their EVs' poor range and lengthy charging times (Berjoza, D.; 2017).

4. RESULT AND DISCUSSION

In order to combat climate change, a growing number of governments are promoting the use of electric vehicles, which are intended to run on electricity rather than fossil fuels. Global warming has been blamed for flooding and the expansion of desert conditions in some locations, according to some theories. It will be increasingly difficult for many people to get out of their beds each morning in the near future, due to rising light intensities in the atmosphere.

Because people are unable to accept personal responsibility for their rubbish, it is improbable that our planet can survive. Autos, particularly in industrialized countries such as China and the United States, are the leading source of air and water pollution in the environment. Berjoza, D.; (2017) cites a number of significant milestones in the development of electric vehicles, including reducing charging times to make the vehicles more practical, adding super capacitors to hold more charge, and achieving higher effective electromotive force as just a few examples.

Certain steps must be taken in order to prevent pollutants from entering the atmosphere, such as carbon dioxide and carbon monoxide, from entering the atmosphere. Alternative energy sources, through pollution reduction and climate change mitigation, can contribute to environmental protection and the decrease of this sort of pollution (Chan, 2010).

4.1. Testing procedures

The following measures have been taken to realize the concept of the long range distance in an electric car.

1. Mounting the IC engine on a footboard for an electric vehicle.
2. The PMDC motor connects the IC engine flywheel and it connects battery charging circuits.
3. The IC motor is mechanically switched on when the charge indicator is lower, and the PMDC motor creates electricity that keeps the battery level to the point of the source plug.
4. Enhanced electric car range testing.

4.2. Experimental plan

Experiment – 1

Electrical vehicle procurement (electric scooter), IC motor and working conditions PMDC motor

Range of capacity = 40 – 50 km/h

Battery life = 12000 km to 15000 km

Battery backup = 4 – 6 hrs

Figure.1. Eko Cosmic-I Model of EVs

Eko Cosmic vehicles produced this electric scooter. This car has a high speed of 40 km/h and its length is roughly 40-50 km. This product is not a license for a driver but must be registered. An EKO COSMIC Electric Bike rear-wheel hub and a rechargeable plastic acid battery. It has 12,000 km to 15,000 km of battery. Charging of the battery takes about 4-6 hours (Chan, 2010).

Experiment – 2

In this phase studies have been undertaken with gasoline scooters, conservative electric scooters and our long range electric scooters.

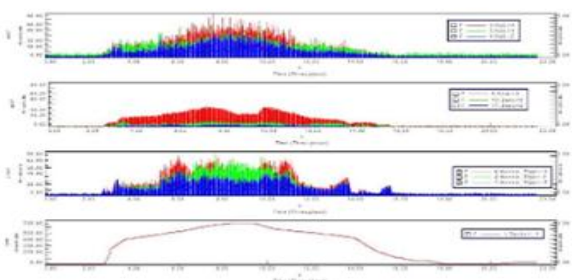
Range of test – 80 km

Used vehicles are,

1. Scooter petrol – Wego TVS
2. Electric scooter conventional
3. Electric scooter expanded range

4.3. Scooter petrol – Wego TVS

Using two scooters, they'll put them to the test. In contrast, the electric motor that propels Wego TVS Pleasure is powered by an IC engine. The wheel hub motor speed of an electric scooter differs noticeably from that of the test automobiles. Order comparison is made using the scooters' whirling back wheels. In order to compare all vehicle vibrations, the speed of the vehicle is measured and compared at zero to 665 revolutions per minute (Eisel, M.; 2016). During acceleration and deceleration, vibration levels are measured with the rider seated on the seat and right handlebars. In other words, these studies are being conducted in a lab, not out in the field. In any case, the road's stimulation has an effect even if it is in keeping with the current research purpose (Bellekom, S., 2012).



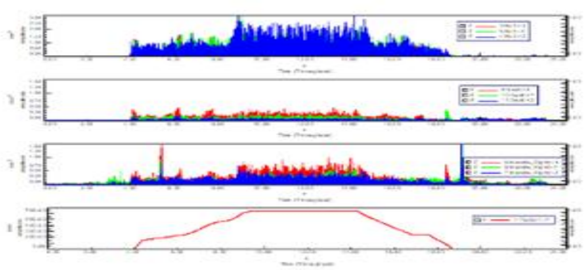


Fig. (a). conventional scooter **Fig. (b). Electric scooter**

Figure.2. Wheel speed and acceleration response measurements

On a route around 30 km from a total charge of power the genuine World Scooter test (without E-REV) can be viewed. It is about Rs 5 that is expensive to travel 40 kilometers. It cannot go more than forty kilometers. Costs are calculated for regular petrol-powered scooters, which are referenced and distant by TVS Wego (110 cc). For the same 40 miles it took Rs 64.

Table.1. Comparative analysis of Electric scooter and conventional Scoter

S.No.	Electric scooter		Conventional Scooter	
	Trip distance in Km/s	Trip cost in Rs	Trip distance in Km/s	Trip cost in Rs
1.	15	20	15	40
2.	30	40	30	80
3.	45	60	45	116
4.	60	80	60	140
5.	75	100	75	160
6.	90	120	90	232

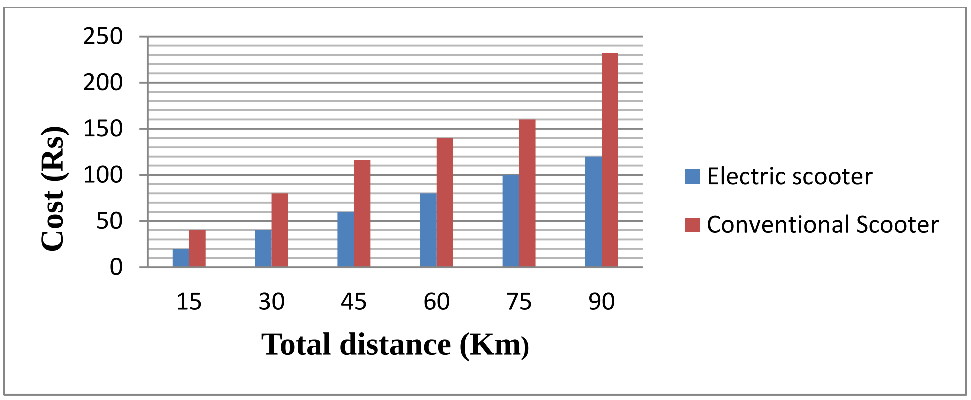


Figure.3. Range of trip v/s Cost of trip

Scooter petrol – Wego TVS problem

It's a good vehicle but only problem of average. Visited authorized service center but proble m not solved. I am always using vehicle in between @40 t0 60 km / hour only. Is there any setting for average? I am getting mileage of 25 KM / Lit only. I am not expecting 62 KM / Lit but app. 40 to 45 Km per lit. So now I am not using the vehicle regularly but using my Bajaj vehicle CT - 100 and now I am going for new platina (E. Baby Anitha, 2012).

4.4. Electric scooter conventional

A rise and decrease in speed may be detected in the amplitude fluctuations between 4 and 18 seconds of data. Traditional scooters have a more strong vibration signature (up to 80 m/sec 2 on the scale) than electric scooters. There is a considerable decrease in vibration in both of the examples of reduced hub vibration (E. Baby Anitha, 2012). It's safe to say that X-direction vibrations are the most prominent in this group of vibrations. Comparative studies included a consideration of vibrations and X directions at various target locations. There is a comparison of Campbell diagrams illustrating longitudinal changes in power amplitudes for conventional and electric scooters (source: wheel hub, target: seat/right handlebar) in Figure.4. A standard scooter's wheel hubs shake at 86.72Hz, but those of a high-end scooter vibrate at 175 Hz.

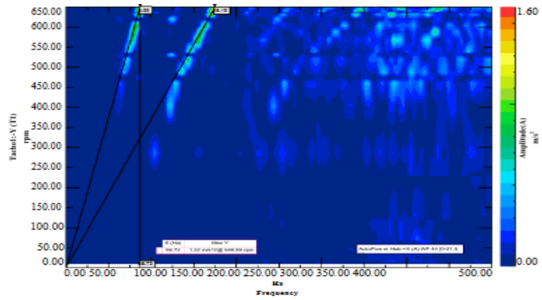


Fig. (a). Conventional Scooter

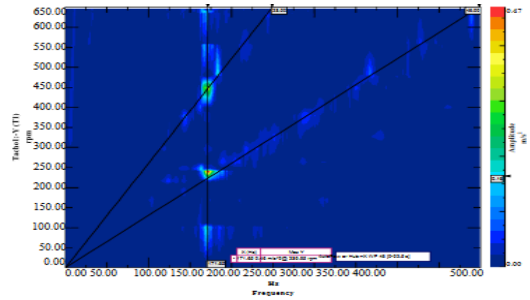


Fig. (b). E – REV

Figure.4. Campbell graphic showing frequency orders at several areas

Our Range Extender concept with less gasoline usage can therefore be driving more than 40 km. The range extensor unit was not employed in the test until the load was low. If the battery is not supplied with a scooter and is approximately 40 km long, then the extender will be added a maximum of 80 km, consuming just 0.5 liters of petrol, and a total cost of 45 Rs is added to the extender (Jhunjhunwala, A. 2018).

Table.2. Comparative analysis of Conventional Scooter and E – REV

S.No.	Conventional Scooter		E – REV	
	Trip distance in Km/s	Trip cost in Rs	Trip distance in Km/s	Trip cost in Rs
1.	15	40	15	15
2.	30	80	30	30
3.	45	16	45	45
4.	60	140	60	60
5.	75	160	75	75
6.	90	232	90	90

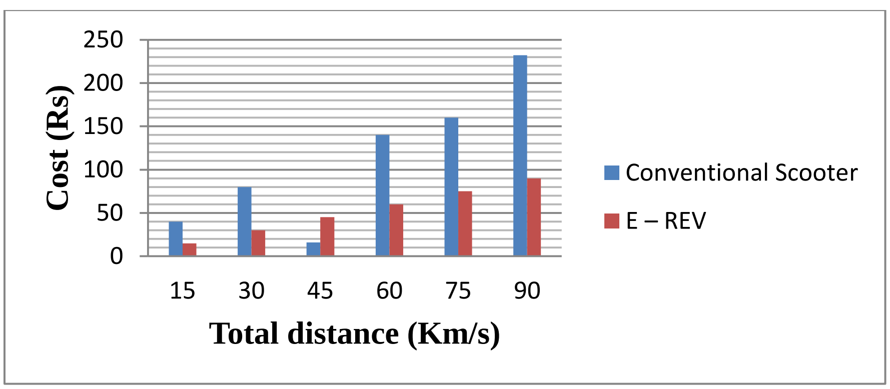


Figure.5. Trip distance v/s Trip cost

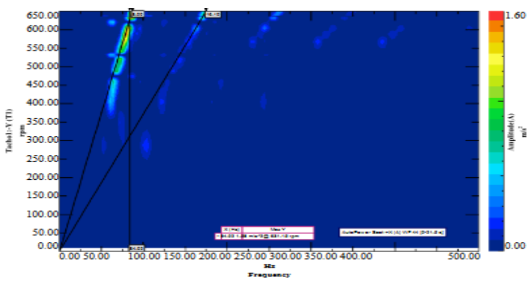
Electric scooter conventional problem

Electric vehicles are currently the subject of investigation. People are more inclined to adopt electric vehicles if they are aware of the challenges they confront and confident in their capacity to overcome them, according to Jhunjhunwala, A. (2018)

opinion, people's willingness to accept EV is determined by their own personal conventions. Our knowledge of the consequences of consumer preference for electric transportation, for example, has a large knowledge gap.

4.5. Electric scooter expanded range

The transmissibility of a source can be determined by comparing the displacement spectra at the source and the target. When seen through Figure.6, one can notice the frequency-dependent changes in both the transmission and response spectra of both the target and source components (seat and handlebars). Lower frequencies appear to have a considerable amount of displacement transmittance in both conventional and electric scooters. This enhances energy transfer to the seat and subsequent accelerations. In contrast, bicycle handlebars vibrate in a distinct way.



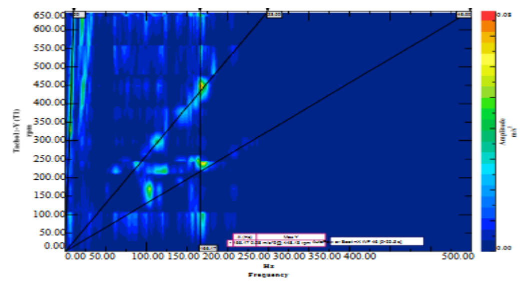


Fig. (a). Conventional Scooter **Fig. (b). E – REV**

Figure.6. A Campbell diagram showing the relative frequencies at various points

An electric automobile with a wider range has considerably lower overall fuel consumption than the conventional type of petrol vehicles. No fuel is to be used for up to 35-40 kilometers, since the car acts as a scooter. The expansion of the range above 40 kilometers seems to have the effect of using fuel. Petroleum gasoline hence requires 0.5 liters just when another 40 km. With only 0.5 liters of petrol only 80 km will be consumed. This is continued until the battery is recharged from a plug-in source. This will improve overall energy security. While the traditional scooter needs approximately 1.6 liter of petrol, they travel roughly 80 kilometers. The energy scarcity will be made worse (Kim, J. 2014).

Table.3. Comparative analysis of Electric scoter and Gasoline Scoter

S.No.	Electric scoter		Gasoline Scoter	
	Trip distance in Km/s	Trip cost in Rs	Trip distance in Km/s	Trip cost in Rs
1.	15	20	15	50
2.	30	40	30	90
3.	45	60	45	116
4.	60	80	60	180
5.	75	100	75	210
6.	90	120	90	232

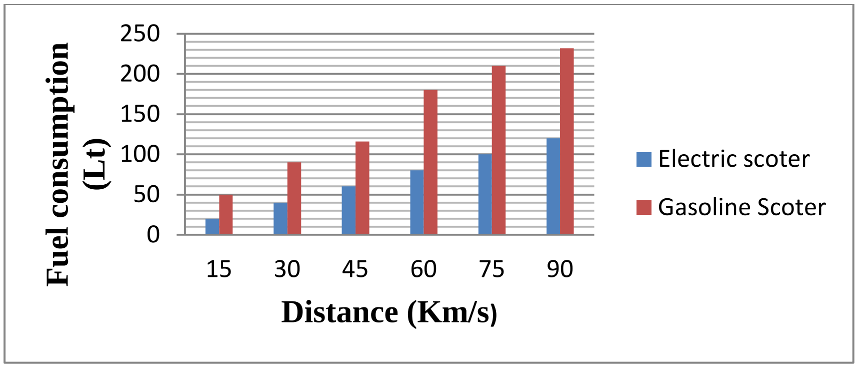


Figure.7. Trip Distance v/s Fuel

Electric scooter expanded range problem

Being able to ride your own electric scooter is both exciting and practical. Because of their tiny size and high battery capacity, these gadgets are convenient to move. Using an e-scooter is similar to operating any other type of vehicle in that you must exercise caution to avoid damage and costly repairs (Kim, J. 2014).

5. CONCLUSION

Achieving a precise estimate of the driving range of an electric automobile prior to the release of the vehicle proved difficult due to the competing needs. A specific test was conducted to determine whether or not it was possible to keep a constant battery voltage or whether it was possible for the SOC to adjust the battery voltage. This technique, which illustrates the form and expected range of Pareto fronts for each specified speed, serves as a foundation for more realistic techniques in the future. Similarly to Approach 1, Approach 2 made use of the same pareto fronts that were employed in Approach 1. This has resulted in a significant reduction in the predicted operating temperature range as a result of these factors. If you are starting a journey without fully charging the battery, you can use this map to determine the range and travel time for various SOC values in two different scenarios: if you are changing the speed of your vehicle after the journey has begun and the battery has already been depleted when the map is displayed, and if you are changing the speed of your vehicle after the journey has begun and the battery has already been depleted when the map is displayed. The GA's selection of solutions from the search range, on the other hand, was not impacted in any way by these considerations.

Trip-related aspects are taken into consideration when discussing driving methods and route planning. In the earlier sections of this paper's MOOP solution, you can find information about important model parameters and assumptions. There is a definite connection between their knowledge and the advancement of car technology, as well as their performance. Trip planning is also of interest to those in the transportation industry. Before embarking on a journey, the driver can select a pace that maximizes the efficiency of the EV's stored energy while also increasing the vehicle's range and range efficiency. It is ultimately the driver's responsibility to determine how fast the car is travelling. By combining this type of route planning with current GPS and traffic data integration systems, it is possible to increase the range and performance of an electric car to their maximum potential.

In the near future, all the issues and challenges presented in this research must be addressed in order to deal with the 'negative' features of ICE vehicles, like autonomy, battery charge stoppage time, and density of the charging stations, high-speed charging techniques that do not adversely affect battery life and timing, new technologies and/or new applications. In building and integrating this sophisticated model, it is necessary to take into consideration expenditures, which are a key obstacle to rapid and important market entry. Research must be further improved and the HVAC systems should be examined for the sake of an energy performance strategy that considers its significant impact on EVs and consumer awareness (B. O. Varga, 2019). It is vital that we address the "negative" characteristics of EVs, such as independence, battery flux time and station density, quick charging technology that does not negatively impact battery life or efficiency or new technologies or new uses.

5.1. Future recommendation

It is really important for automobile industries to model robust systems to develop hybrid electric vehicles. In order to design a more robust range extender to convert this existing electric truck the following future work can be suggested.

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