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Review on Electric Hybrid Vehicle

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ABSTRACT: ***The rapid consumption of fuel and increased environmental damage caused by it have given a robust impetus to the expansion and development of fuel-efficient vehicles. Hybrid electric vehicles (HEVs) have evolved from their inchoate state and are proving to be a promising solution to the intense existential problem posed to the earth. Not only do HEVs provide better fuel economy and lower emissions satisfying environmental legislations, but also they dampen the effect of rising fuel prices on consumers. HEVs combine the drive powers of an indoor combustion engine and an electrical machine. The most components of HEVs are energy storage system, motor, bidirectional converter and maximum point trackers (MPPT, just in case of solar-powered HEVs). The performance of HEVs greatly depends on these components and its architecture. This paper presents an in depth review on essential components utilized in HEVs like their architectures with advantages and drawbacks , choice of bidirectional converter to get high efficiency, combining ultra-capacitor with battery to increase the battery life, traction motors' role and their suitability for a specific application. Inclusion of solar cell in HEVs may be a fairly new concept and has been discussed intimately. Various MPPT techniques used for solar-driven HEVs also are discussed during this paper with their suitability.***

KEYWORDS: ***Fuel-Efficient Vehicles, MPPT, Solar-Driven HEVS, Ultra-Capacitor.***

INTRODUCTION

A hybrid electric vehicle (HEV) is a kind of crossover vehicle that joins a customary inward ignition motor (ICE) framework with an electric impetus framework (mixture vehicle drivetrain). The presence of the electric powertrain is proposed to accomplish either preferred efficiency over an ordinary vehicle or better execution. There is an assortment of HEV types and how much each capacity as an electric vehicle (EV) likewise fluctuates. The most well-known type of HEV is the cross breed electric vehicle, albeit crossover electric trucks (pickups and farm haulers) and transports additionally exist.

Current HEVs utilize proficiency improving advances, for example, regenerative brakes which convert the vehicle's dynamic energy to electric energy, which is put away in a battery or supercapacitor. A few assortments of HEV utilize an inward ignition motor to turn an electrical generator, which either energizes the vehicle's batteries or straightforwardly controls its electric drive engines; this blend is known as an engine generator. Numerous HEVs diminish inert emanations by closing down the motor out of gear and restarting it when required; this is known as a beginning stop framework. A hybrid electric produces less tailpipe outflows than a similarly measured gas vehicle since the mixture's gas motor is generally more modest than that of a fuel controlled vehicle. In the event that the motor isn't utilized to drive the vehicle straightforwardly, it tends to be outfitted to run at greatest productivity, further improving efficiency.

A well-knit and coordinated transportation provides mobility to people and goods. The transportation sector mainly consists of road, railway, ships and aviation, where road transportation consumes 75% of the entire energy spent on transportation. The car industry plays a big role in economic process of the planet and hence affects the whole population. Since vehicles mostly run

on combustion engine (ICE), the transportation industry is in charge of 25%–30% of the entire greenhouse gases emission[1]. ICE works within the process of fuel combustion leading to the assembly of varied gases like CO2, NO2, NO and CO which cause environmental degradation within the sort of atmospheric phenomenon and are liable for their adverse effect on human health. To beat this, the transportation industry is trying hard to manufacture vehicles which will run on alternate power sources. Electric vehicles (EVs) were tried as an answer in 1881 where battery alone propelled the vehicle and thus required a bulky battery pack. Absence of an ICE handicapped these vehicles with a brief golf range[2].

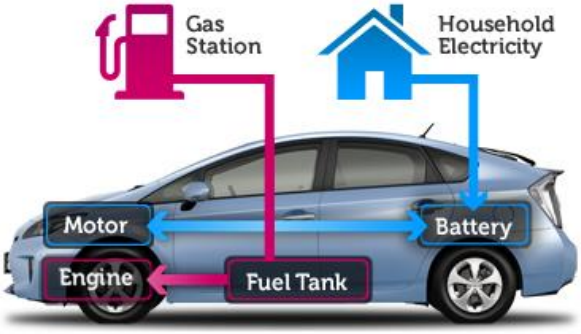

Figure 1: Electric hybrid car

Hybrid electric vehicles (HEVs) were conceptualized to bridge the facility of ICE and therefore the emission-free nature of EVs (figure 1). HEVs offer better fuel efficiency over ICE-based vehicles and usually add charge-sustaining (CS) mode where the state of charge (SOC) of battery is maintained throughout the trip. the difficulty with CS mode is that its charging efficiency relies mainly on regenerative braking and gasoline, so plug-in HEVs (PHEVs) were conceptualized as a possible solution. Unlike HEVs, PHEVs have the extra facility to be charged externally through power outlets. Most of the facility during a PHEV springs from an electrical motor (EM) which acts as a primary source, while ICE acts as a backup. Because the battery SOC reaches a specific threshold, the PHEV behaves sort of a regular HEV, and therefore the ICE kicks in and acts as a primary power source[3]. The PHEVs mainly add charge depletion (CD) mode where SOC is depleted up to an intensity. PHEVs extend the all-electric range, improve local air quality and also may have grid connection capability.

Another possible approach for extending the electrical range of an HEV is to permit continuous charging of the battery while running. The emergence of solar-driven HEVs (PVHEVs) results in continuous charging of batteries by means of solar power, which minimizes the usage of gasoline and hence reduces environmental pollution[4].

Robust and affordable batteries are a primary challenge for hybrid vehicles. Various HEV battery compositions are tried within the past with the simplest results from lithium-ion derivatives. Three levels of integration of battery packs are possible in vehicles:

(1) Singular battery cells

(2) Modules, comprised of individual battery cell

(3) Battery packs, comprised of modules.

Battery should be ready to supply high power over short periods and must be capable of putting up with many transient shallow cycles over vehicle life. to increase the range and lifetime of A battery , it are often interfaced with an ultra-capacitor (UC) which allows longer life cycle, higher rate of charge/discharge and lower internal resistance which end in lesser heat loss and better reliability. UC improves the efficiency cycle to around 90% from 80% the mixture of battery and UC forming a hybrid energy storage system (HESS) is more efficient as compared to their individual performances[5].

Hybrid energy storage system: The choice of ESS depends on various parameters, including charging speed, energy density, anticipation, cost, weight and size. The present trend indicates that batteries and UC remain because the main choices for ESS[6]. Batteries have low cost per watt hour, high energy density but short cycle life and low specific power, while UCs preserve high peak power, long cycle life, high cost per watt hour and low energy density . The UCs are robust, have a quasi-infinite cycle life and may sustain highly dynamic power profiles. The UCs also are responsible to scale back the salvation in lead acid batteries for EVs.[7] Furthermore, the UCs provide high-frequency and high-magnitude power, whereas the batteries fulfill low-frequency requirements. It's impossible for a private energy memory device to satisfy all the wants. However, a mixture of the 2 can help to beat their drawbacks. UCs tolerate the surges during the battery operation and maintain the DC-bus voltage, whereas the batteries maintain the SOC of the UCs. Therefore, the mixture of those two will cause high stability of the whole system

LITERATURE REVIEW

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The presence of the electric powertrain is proposed to accomplish either preferred efficiency over an ordinary vehicle or better execution. There is an assortment of HEV types and how much each capacity as an electric vehicle (EV) likewise fluctuates. The most well-known type of HEV is the cross breed electric vehicle, albeit crossover electric trucks (pickups and farm haulers) and transports additionally exist.

CONCLUSION

HEVs are rapidly emerging as a possible alternative to the prevailing state of transportation thanks to their lower petroleum consumption and toxic emission. Strict CO2 emission laws and increased public awareness will propel HEVs to be the longer term of road transportation. Penetration of PHEVs within the market will change the operations of electrical grid substantially, and efforts are being made to supply a two-way communication between the user and therefore the grid. A

review of varied components of HEVs like architecture, bidirectional converter, ESS, motors and MPPT has been presented, and therefore the findings are summarized at the top of every topic in tabular form.

Based on the literature review, it's found that the complex hybrid architecture will provide greater efficiency, trading off on higher costs and more complex designs. Because the inverters are needed to interface the motor engine with ESS, their selection is of prime importance and q-ZSI is found to be a promising candidate. To extend the battery life, it's suggested to mix UC with battery which can further improve the fuel efficiency and performance during varying ambient conditions.

Based on the study administered, it's observed that there's a growing interest in developing advanced traction motors for hybrid vehicles and lots of traction motors are available within the market. However, considering the trade-off supported performance, robustness, reliability and price, the selection is usually between induction motor and static magnet AC motor. PVHEVs are still in infant stage and being explored to attenuate gasoline consumption and maximize the usage of renewable energy. Various MPPT algorithms tuned with AI techniques like FL, ANN and PSO also are being explored for PVHEV applications.

A comparison of varied existing hybrid vehicles is provided in Table 9 which can function a guide to settle on the simplest option. This paper provides all necessary information regarding the above-mentioned components and should be considered as a comprehensive document for the researchers and academicians who wish to hold out research within the field of hybrid vehicles.

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