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A Literature Review on Hybrid Electric Vehicles

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Abstract
The diffusion of hybrid electric technology in automobiles is covered in the paper that is being presented. Vehicles with hybrid engines have the potential to use fewer fossil fuels, produce less pollution, and enable the transportation of renewable energy sources. Internal combustion engines in conventional automobiles are powered by gasoline or diesel. In addition to having an internal combustion engine and the ability to be fueled like regular automobiles, hybrid vehicles also feature an electric motor, a battery, and can run either partially or entirely on electricity. Hybrid cars can be set up to achieve a variety of goals, including better fuel efficiency, more power, or extra auxiliary power for electronics and power tools. Hybrid cars use a variety of technologies to match the performance of conventional vehicles, including regenerative braking, electric motor drive, and autonomous start or shutoff.

Keywords*: Hybrid Electric Vehicles*

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I. INTRODUCTION

Today, low-emission mobility is being significantly developed and promoted worldwide, especially in the automotive segment [1,2]. in this regard The transport sector is one of the leading causes of air pollution in particular [3]. Contributes to carbon monoxide, non-smoking hydrocarbons, and nitrogen oxides (NOx) [4,5]. Much effort has been made as environmental considerations are becoming more and more important. Recently implemented to develop various techniques and approaches for gas minimization -Emissions caused by the mobility sector [6,7]. The automotive industry is undergoing major changes to electric vehicles [8,9]. This tendency stimulates Align major brands with this new sector by developing a wealth of new cars Model [10]. The Toyota Prius was introduced to the market in December 1997 in this context. [11] The first milestone, followed by the semi-hybrid Honda Insight in 1999 Manually replace or reduce the size and weight of the CVT, reduce fuel consumption, Optimized aerodynamics [11,12]. At the same time, environmental protection laws are against pollution Evolve to address future environmental issues to protect ecosystems And people's health [13]. This is the case with the euro standard that regulates keys. Aspects such as emission restrictions since 1988 [14].

As a result, unlike the Japanese, American car market aiming to produce gasoline hybrids Hybrid solutions using diesel engines have been intensively researched in Europe Market-leading brands such as Citroen, Opel and Peugeot [12]. According to the Association of Automotive Engineers, you can define a hybrid car B. Vehicles with two or more energy storage systems that need to be powered Propellant systems, together or independently [15]. Similarly heavy load The Hybrid Vehicle Group shows that hybrid vehicles require at least two energy storage systems. System and energy converter. In reality, it is combined with a hybrid electric vehicle (HEV). Superior autonomy of conventional vehicles equipped with gasoline engine, compression ignition engine, fuel cell, solar cell, and consideration for speed, output, and environment Benefits of electric vehicles to get a car that consumes less fossil fuels Reduces the emission of pollutants into the atmosphere [16–18].

In general, pure electric vehicles have limited autonomy for the following reasons [19] Low energy density of batteries compared to conventional liquids [20] Fuel for internal combustion engine vehicles (ICE). Autonomy depends on capacity Batteries and driving methods, but now with advances in cars Technology and autonomy can be achieved from 800 to 1000km [21,22] at zero. Emission autonomy (purely electrical) ranges from 60 to 75 km. Most commercial vehicles It has a large battery capacity and is easy to charge, so it is ready to be plugged in. Procedures compared to traditional hybrids [23,24]. Onboard electrical storage is usually available It consists of a lithium-ion battery with a capacity of 13-18 kWh. The other On the other hand, electric vehicles often have a long charging time. Still fast and super-fast Charging technologies have emerged that

allow for less than 30 minutes of charging time [25]. However, this type of infrastructure is still limited. In addition, many countries There is not yet a large enough network of charging stations [17, 18]. this Limitations envision a formidable barrier to the widespread use of pure electricity vehicle. However, this trend is expected to change in the near future [26]. In this context, HEVs are an impressive alternative to pure electric vehicles. Development is motivated by the introduction of more restrictive norms. To For example, many European countries impose additional taxes on fuel consumption. A country like Spain [27]. In addition, there is continuous development of batteries technology. New technologies for large electric vehicles are being developed for each generation Storage [28-31]. This research effort has a direct impact on large-scale transplants Electric car. For example, an important aspect of the automotive sector is totals. The weight of the storage system. This property is strongly determined by the energy density Battery technology defined as the total weight (kg) required to store 1Wh. Figure 1 shows the expected trends in the development of this trait in recent years. Over 20 years of perspective on various technologies. As you can see, the following emerging technologies Because lithium-ion batteries are expected to provide very attractive properties for automobiles Sector [20,32,33]. Other promising areas of research focus on states or specific designs HEV powertrain configuration [34–37].

II. BASICS OF HEVS

2.1. Hybridization

A hybrid car has multiple powertrains that can be used either alone or in concert to move the car forward. Over the years, a variety of hybridization configurations, including fuel cell, gas turbine, solar, hydraulic, pneumatic, ethanol, electric, and many others, have been proposed. One of these is the hybrid electric car, which combines two well-established and technically and commercially successful technologies—electric motors and internal combustion engines—and allows customers to take advantage of each one's unique advantages.

2.2. Hybrid Electric Vehicle (HEV)

This is the most commonly customized hybrid vehicle. It is a combination of an electric motor drive system and I.C. engine. The electric motor is powered by the on-board battery. In HEV, I.C. By combining the engine and the electric motor, the engine can be used optimally. In city driving, vehicles are frequently started and stopped. When idle, the engine uses more fuel without doing any useful work, helping to improve fuel economy, reduce efficiency, and eliminate unwanted emissions. The HEV solves the problem by switching to the engine transmission and turning off the engine. In this way, it does not consume fuel when idling without exhausting exhaust gas. Another major advantage of HEVs is that if the fuel tank runs out while the engine is running, the vehicle can run on maximum range of electricity.

III. TYPES OF HYBRID POWER TRAINS

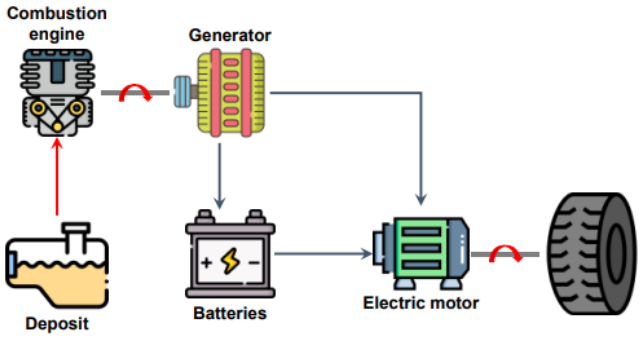
A vehicle's powertrain is a group of components that generate electricity and send it to the road surface. Hybrid vehicles can be divided into three basic categories of powertrain systems. These are briefly described below.

- Series hybrid
- Parallel hybrid
- Series parallel hybrid

3.1. Series Hybrid

It is an electric drive train using I.C. The engine acts as a generator to charge the battery and power the electrically driven motor. These vehicles usually have larger motors with larger battery packs and smaller I.C. engine. Series hybrids can be supported with an ultra cap to improve efficiency by minimizing in-battery losses. They can supply peak energy during acceleration and absorb regenerative energy during braking. Electric motors are efficient over a wide speed range, eliminating the need for a complex transmission between the motor and the wheels.

Some vehicle designs have a separate electric motor for each wheel. The disadvantage of integrating the motor into the wheel is that it increases unsprang mass and reduces driving performance. Benefits of single-wheel motors include simplified traction control (without traditional mechanical transmission elements such as gears, transmission shafts, differentials), four-wheel drive, and lower floor use.

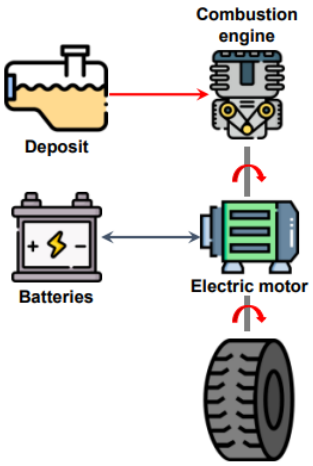


. Series configuration of an HEV.

3.2. Parallel hybrid

In a parallel hybrid system, both an internal combustion engine (ICE) and an electric motor are connected in parallel to the mechanical transmission. Most designs combine a large generator and motor into one unit, often located between the combustion engine and gearbox, replacing both traditional starter motors and alternators. The battery can be charged during regenerative braking and during cruising (when the ICE output is higher than the output required for propulsion).

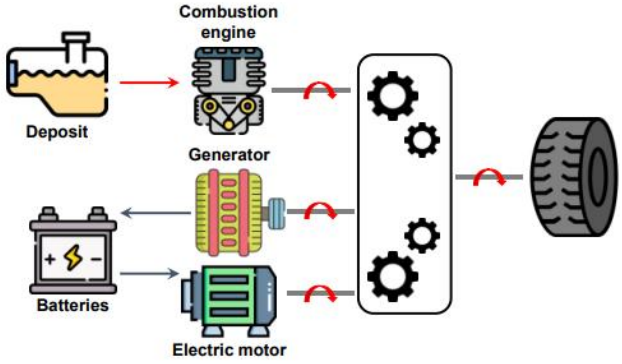
Parallel powertrains are more mechanically complex than series hybrids and are dual power, so both are possible. Combustion engine and electric motor to power the car. The figure shown is I.C. The engine and the engine work together. Internal combustion engines typically serve as the primary means of propulsion, and electric motors serve as backups or torque / power multipliers. The advantages of this are a smaller battery (lighter weight) and, in general, a more efficient regenerative brake to slow down the car and save energy in the process. Another advantage is that it can be easily integrated into existing vehicle models.



Parallel configuration of an HEV.

3.3. Series-Parallel Hybrid (mixed configuration)

This type of powertrain is a combination of two powertrain types, the vehicle can be a pure electric vehicle (as a series hybrid vehicle), a pure internal combustion engine vehicle, or a combination of both (parallel hybrid vehicle). increase. This is the most complex and most inefficient powertrain for most applications. Composite hybrid systems exhibit the characteristics of both series hybrids and parallel hybrids. There are two connections between the engine and the drive axle, a mechanical connection and an electrical connection. This shared power path allows you to interconnect mechanical and power power, but at the cost of complexity. The power split device is built into the drivetrain. The power to the wheels can be mechanical, electric, or both. This is also true for parallel hybrids. However, the main principle behind the combined system is the separation of the power supplied by the engine from the power requested by the driver. In a composite hybrid, this system operates slower than an inline HEV, but at high speeds as an inline HEV. The powertrain is less efficient and the engine will take over. This system is more expensive than a pure parallel system because it requires more computing power to drive additional generators, split power mechanical systems, and dual systems.



Mixed configuration of an HEV.

IV. CONCLUSION

Hybrid-electric vehicles (HEVs) combine the benefits of both IC engines and eletric motors and can be configured to obtain different objectives, such as improved fuel economy, increased power, or additional auxiliary power for electronic devices and power tools. The transmission of power using freewheels and chain wheels are very cheap and reliable. One disadvantage is that driving on electric power is not a good option for a long distance travel. Though this combined power train system can become much useful in more stop and go traffic situations. With the

use of this powertrain system, the overall fuel consumption and fuel economy is improved. Such vehicle would run on fuel but would use its electric motor to boost the power when needed. The costs of HEVs are a little more than the conventional cars but they more efficient and the exhaust emissions are less **V.**

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