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A Review on Hybrid Electric Vehicle

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ABSTRACT: With growing oil prices and escalating environment worries, cleaner and supportable energy solutions are demanded. Present transportation contributes large amount of energy consumption and emission of pollutants. In this paper, hybrid vehicle technology has been analyzed, with Power split configuration having internal combustion engine and battery as the power source. Initially the analysis of hybrid electric vehicle performance is done with battery of higher amp-hr capacity .In advanced state the converter circuit is implemented to reduce the battery rating. Different cases have been observed with different charging and discharging circuitry of battery. Hybrid electric vehicles are admired because of their ability to achieve related performance to a standard automobile while prominently improving fuel efficiency and tailpipe emissions. Having a great control of ANFIS controller in power system and machine rather than other controller, motivate us to interface this controller in hybrid electric vehicle. An improving effect can be visualized from the simulation results.

KEYWORDS: Hybrid Electric Vehicle, Battery, converter, System efficiency.

I.INTRODUCTION

An emphasis on green technology is greatly demanded of modern cities. The significant growth of today's cities has led to an increased use of transportation, resulting in increased pollution and other serious environment a problems. Gases produced by vehicle should be controlled and pro active measures should be taken to minimize these emissions. The automotive industry has introduced hybrid cars, such as the Honda Insight and the Toyota Prius that minimize the use of combustion engines by integrating them with electric motors [1]. Such technology has a positive effect on the environment by reducing gas emission. The greatest challenge in research activities today is developing near zero- emission powered vehicles.

Hybrid vehicles rely on two or more energy converters for generating propulsion. Each energy converter is fed by an appropriate on-board energy reservoir. A hybrid electric vehicle (HEV) is comprised of an internal combustion engine together with one or more electric machines. The engine converts fossil fuel from the fuel tank into mechanical power while the electric machine(s) convert(s) electric energy from an electric energy storage system, such as a battery, into mechanical power [2]. Unlike the combustion engine, an electric machine is usually able to reverse the process by operating as a generator thereby converting mechanical power into electric energy. Augmenting the conventional drive train with an electric path is primarily motivated by the potential of better fuel economy [3].

In this paper, it proposes a number of hybrid electric drive train topologies exist, such as the series, the parallel, and the combined (or series-parallel) topology. Within each topology, a number of variants exist. This HEV power train is of the series-parallel type, such as the one found in the Toyota Prius car [4]. This HEV has two kinds of motive power sources: an electric motor and an internal combustion engine (ICE), in order to increase the drive train efficiency and reduce air pollution. It combines the advantages of the electric motor drive (no pollution and high available power at low speed) and the advantages of an internal combustion engine (high dynamic performance and low pollution at high speeds).

II.LITERATURE SURVEY

Conventional vehicles offer many advantages like long drive range, good performance and easy refueling. Hence they are dominating the vehicle market. However conventional vehicles have limitations such as air pollution

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and inefficient usages of fossil fuel. Necessity of the hour is fuel efficient and low emission vehicle without sacrificing the performance, reliability and safety of the vehicle. Pollution problem can be minimized by using zero emission electrical vehicles (EV) at the cost of limited drive range [1, 2].

Reduction in Green House Gas (GHG) emissions, increase in oil prices, and dependency on foreign oil are major incentives to the development and deployment of Hybrid Electric Vehicles (HEV) and Plug-in Hybrid Electric Vehicles (PHEV). Compared with conventional vehicles, HEV and PHEV generate considerably low noise, green house gas and ozone-precursor emissions. However, unlike HEV, PHEV offers the vehicle owner the flexibility of charging the onboard battery. Therefore, it allows the combustion engine to operate within its optimal efficiency range for longer periods which in return would increase fuel savings [3-7]. A battery is capable of storing large amounts of energy (in order of 100Wh/kg), but is not suitable for supplying a large amount of power in a very short time. This is due to a low power output density. HEVs can significantly improve fuel economy and reduce emissions with the satisfaction of vehicle performance [9-12]. Typical HEVs consist of an internal combustion engine (ICE), electric motor (EM), single or multiple energy storage systems (ESS), power electronic converters, and controllers. The behaviour of robust controller in the field of electric machine and the result which augurs us to adopt the fuzzy controller in the system. Over the past few decades, the use of fuzzy set theory, or fuzzy logic, in control systems has gained widespread popularity, all over the world [16]. It is therefore easier to be designed and more suitable to the control of the drives. The work also presents the first experimental results to support theoretical derivations and simulations [17].

III. NEED OF HYBRID ELECTRIC VEHICLE

Since petroleum is limited and will someday run out of supply. In the arbitrary year 2037, an estimated one billion petroleum-fueled vehicles will be on the world's roads, gasoline will become prohibitively expensive. The world need to have solutions for the *400 million otherwise useless cars* . So year 2037 gasoline runs out year means, petroleum will no longer be used for personal mobility.

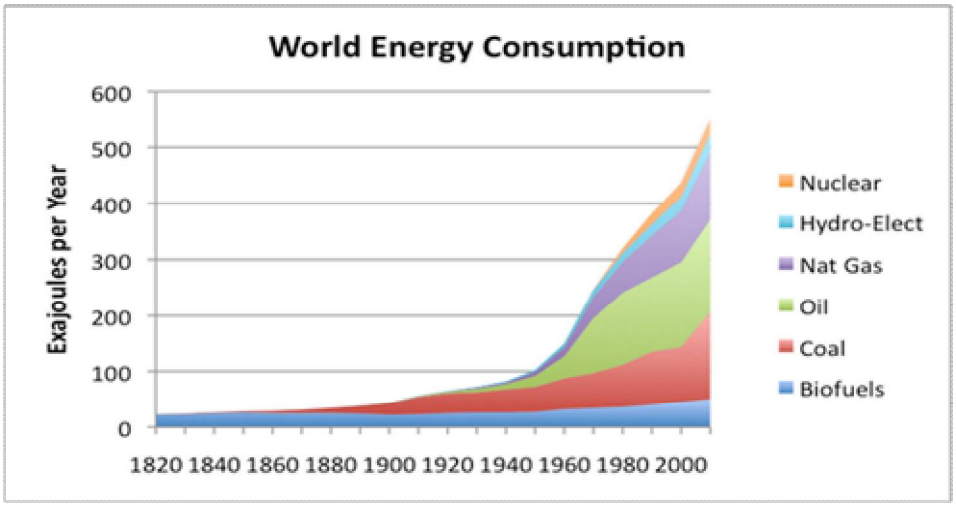

Figure 1 Shows the world energy consumption

A market may develop for EVs of the size of a scooter or golf cart. Since hybrid technology applies to heavy vehicles, hybrid buses and hybrid trains will be more significant. One of the biggest advantage of hybrid car over gasoline powered car is that it runs cleaner and has better gas mileage which makes it environmentally friendly. A hybrid vehicle runs on twin powered engine (gasoline engine and electric motor) that cuts fuel consumption and conserves energy. A forecasted idea of using hydro electric vehicle impact the energy consumption which is shown in figure 2.

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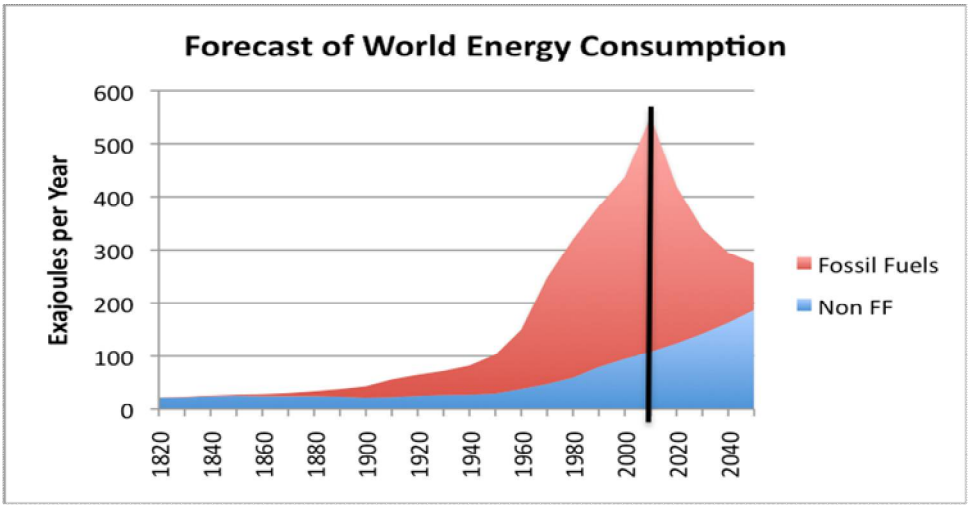

Figure 2 Forecasted energy scenario by using hybrid electric vehicle

IV. TYPES OF MODEL

Hybrid vehicle drivetrains transmit power for hybrid vehicles. A hybrid vehicle has multiple forms of motive power. A diesel-electric powertrain fails the definition of hybrid because the electrical drive transmission directly replaces the mechanical transmission rather than being a supplementary source of motive power. One of the earliest forms of hybrid land vehicle is the 'trackless' trolleybus of the 1930s, which normally used traction current delivered by wire. The trolleybus was commonly fitted with an internal combustion engine (ICE) either to directly power the bus or to independently generate electricity. This enabled the vehicle to manoeuvre around obstacles and broken overhead transmission wires. The powertrain includes all of the components used to transform stored potential energy. Powertrains may either use chemical, solar, nuclear or kinetic or make them useful for propulsion. Hybrid powertrains come in many configurations.

First one is Parallel hybrid systems have both an internal combustion engine and an electric motor that can both individually drive the car or both coupled up jointly giving drive. This is the most common hybrid system as of 2016.If they are joined at an axis (in parallel), the speeds at this axis must be identical and the supplied torques add together. (Most electric bicycles are of this type.) When only one of the two sources is in use, the other must either also rotate, be connected by a one way clutch or freewheel.

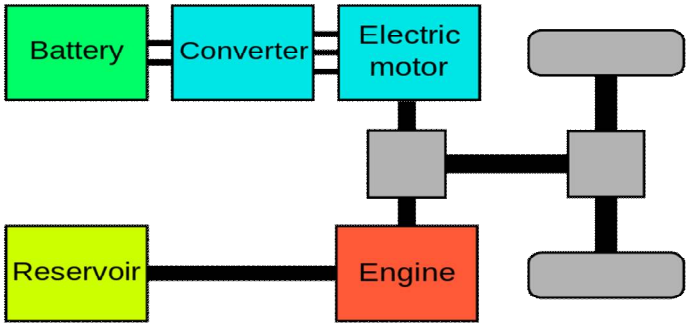

Figure 1 Parallel hybrid vehicle system

Second is series hybrid electric vehicle consisting of series arrange of sources as shown in figure. In effect the entire mechanical transmission between the ICE and the wheels is removed and replaced by an electric generator, some

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cable and controls, and electric traction motors, with the benefit that the ICE is no longer directly connected to the demand.

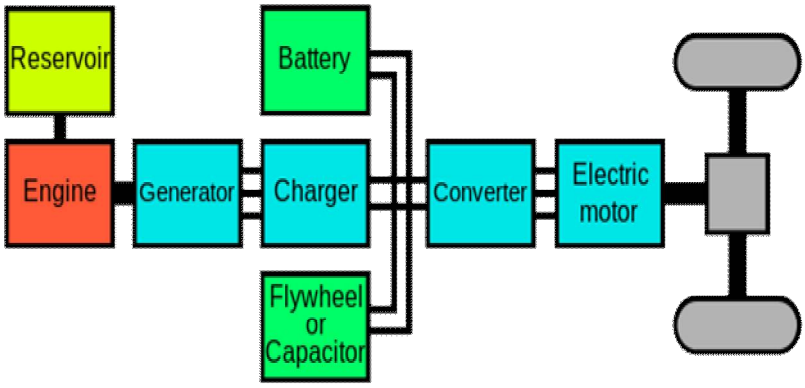

Figure 2 Series hybrid vehicle system

The last is series parallel hybrid electric vehicle that incorporate power-split devices, allowing for power paths from the ICE to the wheels that can be either mechanical or electrical. The main principle is to decouple the power supplied by the primary source from the power demanded by the driver.

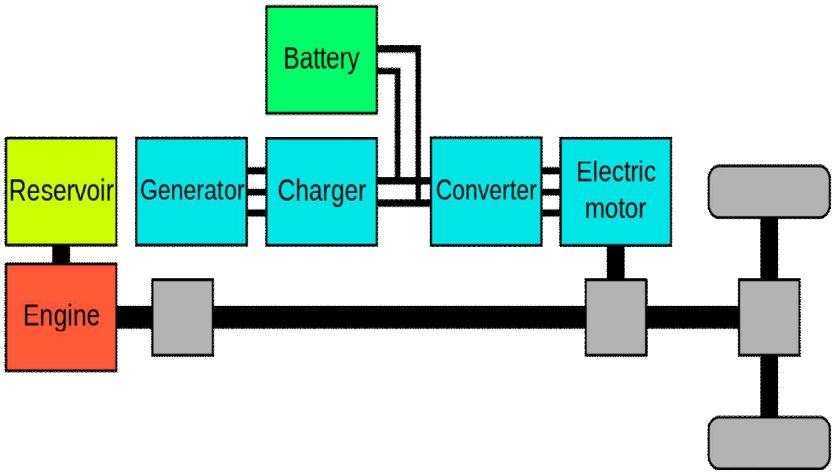

Figure 3 Series Parallel Hybrid electric vehicle

ICE torque output is minimal at lower RPMs and conventional vehicles increase engine size to meet market requirements for acceptable initial acceleration. The larger engine has more power than needed for cruising. Electric motors produce full torque at standstill and are well-suited to complement ICE torque deficiency at low RPMs. In a power-split hybrid, a smaller, less flexible, and more efficient engine can be used.

Artificial intelligence, ANN, Fuzzy Logic, hybrid networks, etc. have been recognized as main tools to improve the performance of power electronics-based drives in the industrial sectors. Currently, the combination of this intelligent control with adaptiveness appears as the most promising research area in the practical implementation and control of electrical drives. A review of the research carried out by various researchers regarding the ANFIS control of electrical machines was discussed briefly in literature review. The responses (speed) had taken a long time to reach the set value. In the research work presented in this chapter, an attempt is made to reduce the settling time of the responses (speed) and make the response very fast by designing an efficient controller using a hybrid type of ANFIS-based control strategy taking into account. Here, we have formulated this complex control strategy for the speed control of

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motor used in hybrid electric vehicle, which yielded excellent result compared to the other methods mentioned in the literature survey.

V. BENEFITS OF HYBRID ELECTRIC VEHICLE

Environmentally Friendly: One of the biggest advantage of hybrid car over gasoline powered car is that it runs cleaner and has better gas mileage which makes it environmentally friendly. A hybrid vehicle runs on twin powered engine (gasoline engine and electric motor) that cuts fuel consumption and conserves energy.
Financial Benefits: Hybrid cars are supported by many credits and incentives that help to make them affordable. Lower annual tax bills and exemption from congestion charges comes in the form of less amount of money spent on the fuel.
Less dependence on Fossil Fuels: A Hybrid car is much cleaner and requires less fuel to run which means less emissions and less dependence on fossil fuels. This in turn also helps to reduce the price of gasoline in domestic market.
Regenerative Braking System: Each time you apply brake while driving a hybrid vehicle helps you to recharge your battery a little. An internal mechanism kicks in that captures the energy released and uses it to charge the battery which in turn eliminates the amount of time and need for stopping to recharge the battery periodically.
Built From Light Materials: Hybrid vehicles are made up of lighter materials which mean less energy is required to run. The engine is also smaller and lighter which also saves much energy.
Higher Resale Value: With continuous increase in price of gasoline, more and more people are turning towards hybrid cars. The result is that these green vehicles have started commanding higher than average resale values. So, in case you are not satisfied with your vehicle, you can always sell it at a premium price to buyers looking for it.

VI CONCLUSION

Thus it allows each node with message to decide whether to copy the message to a path node by optimizing its transmission effort in order to provide a sufficient level of message delay. Using a channel selection scheme provides spectrum utilization while it minimizes the interference level to primary system. Using trustworthy algorithm, it improves the trustworthiness of the Spectrum sensing in CR-Networks. It enables network nodes to adaptively regulate their communication strategies according to dynamically changing network environment.

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