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Design Of Two-wheeler Hybrid Electric Vehicle Using Matlab-simulink.

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Abstract: - **With the rising gap between the supply and demand of oil and the market monopoly of the countries with oil reserves, the world has turned its back on traditional fuels. Not to mention the everyday rising pollution. The work and advancement in electric vehicles are reaching their peak every day and new inventions are being made in this sector, just like the mega-market players and industries. A lot of research is concentrated on the four-wheelers nevertheless, two- wheelers are a major part of transportation in the world and as compared to the four-wheelers two-wheelers don't find the same spotlight. Our project highlighted this problem and created the simulation model of a two-wheeler hybrid electric vehicle which is a series-parallel hybrid. This simulation is constructed using MATLAB-Simulink software. This is a simulation model of a two-wheeler hybrid electric vehicle which uses a DC source (Battery) as a power source accompanied by the IC Engine. This system can shift load between the battery and IC engine so that power output can be constant, and the system can run smoothly. A DC-DC bidirectional chopper is used to convert power between battery and generator which increases the efficiency of the system. In a proposed system a two-wheeler is taken into consideration with an IC engine of rpm of 2000 (for reference) is taken into consideration for simulation.**

I. INTRODUCTION

Recently the world has been attracted toward the non- traditional power sources which have resulted in the increment of research on producing clean and sustainable energy sources for propelling machines and generating electricity. The reason is the decrease in the number of resources and visible changes in the environment. One of the things that constitute the most in both these factors is the mode of transportation. In India, the vehicle population is growing at the rate of over 5% per annum and today the vehicle population is approximately 40 million. The vehicle mix is also unique to India in that there is a very high proportion of two-wheelers 76% (SIAM, 2011). The growth rate of vehicles is the backbone of economic development and the Indian automotive industry (the second-fastest growing in the world). Today, in the country of about 7-8 million vehicles are produced annually. In 2011, the country reported 141.8 million registered motor vehicles The overall transport sector in India is estimated to emit about 15 percent of the CO2 emissions. But consider this – the total consumption of oil is responsible for 57 percent of the CO2 in the country today. And among all oil-consuming sectors, CO2 emissions from transport are increasing at the fastest rate at more than 6 percent per annum. This is daunting for any national combat plan for climate and public health. Even globally, curbing warming gases from the transport sector has proven to be the most difficult. How can we avoid an increase in GHG gases if cars drive the trend? To answer this question electric vehicles came to the market and started booming as they were offering a clean, efficient, and reliable source to drive the vehicle.

But with electric vehicles into the market, the large spotlight was captured by the four-wheelers as the market leaders such as Tesla, BYD, and Volkswagen Renault–Nissan–Mitsubishi Alliance flooded the market with an exotic range of EVs. But in doing this the manufacturers overlooked the population that drives two-wheelers which is mostly rural and constitutes as many as four- wheelers in India which constitute around 30 % of the total pollution which demands the attention of the mass. Recently in the market, the key players that are in the two-wheeler industry are Hero Electric. Hero Electric is the largest player in the Electric Two-Wheeler are TVS, Bajaj, Ather, Ampere, Okinawa Auto-tech, and Hero Electric which is a mostly pure or plug-in hybrid but none of them have provided the hybrid with IC engine which could indeed be one of the best solutions presently having faced the battery efficiency. The project has taken this approach of creating a simulation of such type of two-wheeler hybrid vehicle which uses an IC engine along with the Battery which can provide a new perspective for the research in this sector. We have used a DC-DC bidirectional chopper for the conversion of power between generator and battery which also charges the battery while the system is running. It integrates computation, visualization, and programming in an easy-to-use environment. In the construction of this system while working on this we could confirm that this holds the potential to transform into a new way of transporting and could perform as good as if not better than the EV that is on the market right now. The project also highlights the future scope for research in this sector by providing valid research data to map the efficiency and holes in the simulation.

II. METHODOLOGY

Two areas of industry and governments in the United States, Europe, and Japan have formed strategic initiatives to cooperate with new significant importance in automotive engineering are improvement in fuel economy and reduction of emissions. The automobile technologies. Over the years several 'non-traditional' solutions have been presented: Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), and Fuel Cell Vehicles (FCV). AEV seems the only promising technology able to satisfy the market requests since they match good performances in terms of both consumption and reliability. In a conventional vehicle, knowing loaded mass, desired maximum acceleration, and maximum climb, it is possible to find the power required by the engine. Consequently, while running under different conditions (speed, climb, etc.) maximum speed, estimated fuel consumption, and emissions can be calculated. Only at the end, the vehicle's performance is verified in carrying out a predetermined mission. In an Electric Vehicle (EV), the design process for the accumulation system and the electric mover - the only power source onboard is similar.

Electric generator power will correspond to the necessary power at the wheel while it's Methodology Procedure. In the case of a Hybrid Electric Vehicle (HEV) propulsion system design, the approach is different because it

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involves different choices for preliminary design data. In fact, in the design of a hybrid vehicle, there are more degrees of freedom than the conventional or electric vehicle design, thus it is possible to specialize the propulsion system and architecture for the common usage of the vehicle is asked to. For example, in the ―parallel‖ architecture the total power requirement can be distributed between the Internal Combustion Engine (ICE) and the Electric Motor (EM). Whilst in the ―series‖ one the choice is between the power to be supplied by the ICE and by the storage system to the electric motor. Moreover, to obtain the maximum performance in terms of fuel economy and emissions reduction, there are also configurations including some characteristics of ―series‖ and power.

―parallel‖ layouts. Usually, in-vehicle system designs some parameters are chosen in advance considering specifications, corresponding to the car required performances, and the others are used for the performance verification, but just even one wrong choice among these parameters, can avoid achieving possible efficiency. Hence, these must be considered as non-stationary complex energy systems, involving the most appropriate control strategy to manage the powertrain components, to achieve the best performances.

Many different approaches have been proposed: static optimization methods, intelligent control techniques (rules/fuzzy/neural network), game theory, and route control strategies. The principal approach's drawback is related to focusing on a particular issue of the HEVs, which is to consider the drive train devices and the control strategies independently of each other. To fix a power train profile and optimize the control strategy parameters or vice versa leaves open the question of whether the selection of better control law or different drive train components could result in better performances. An alternative approach is to use dynamic optimization algorithms, which allow finding out the minimum fuel consumption independently of any particular control law. This way is non-causal in that it finds the minimum fuel consumption using knowledge of past and future The demands, thus representing a limit of performance of causal control law. Nevertheless, being this approach is time and, implicitly, specific driving cycle-dependent, it cannot be implemented on a real vehicle control system for a real-time control strategy. Therefore, being all the decisions on hybrid propulsion system design (powertrain layout, control strategy, etc.) strictly connected to the mission profile it is worth furnishing a comprehensive methodology to assist the designer during the HEV propulsion system design process. This methodology consists of two distinct phases like,

1. Solving an optimization problem to detect the best powertrain components characteristics and choose the best rules-based control strategy.
2. Application and calibration of the control strategy parameters and adjustment of the whole drivetrain, and of the powertrain components characteristics. In this paper, the first phase will be presented, which is composed of three main steps:

a) First component sizing, in which components characteristics are determined based on vehicle mission.

b) Pre-optimization, in which a generic scheme of a hybrid powertrain is considered, and all the possible control strategies are imposed to rule the energy flows between energy devices to calculate all possible vehicle architectures.

c) Design optimization: using an optimization algorithm borrowed from the Graph Theory, the Dijkstra algorithm, the method allows the identification of the optimal powertrain rchitecture.

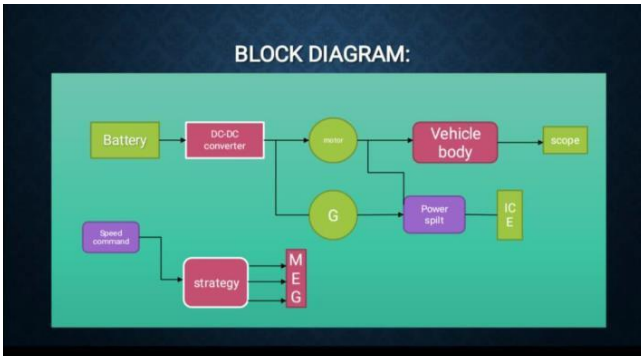

Figure 1: Power flow diagram

III. SYSTEM DEVELOPMENT Hybrid Electric Vehicle (HEV):

What is a hybrid? A hybrid vehicle combines any two power (energy) sources. Possible combinations include diesel/electric, gasoline/flywheel, and fuel cell (FC)/battery. Typically, one energy source is storage, and the other is the conversion of fuel to energy. The combination of two power sources may support two separate propulsion systems. Thus, to be a True hybrid, the vehicle must have at least two modes of propulsion. For example, a truck that uses diesel to drive a generator, which in turn drives several electrical motors for all- wheel drive, is not a hybrid. But if the truck has electrical energy storage to provide a second mode, which is electrical assists, then it is a Hybrid Vehicle. These two power sources may be paired in series, meaning that the gas engine charges the batteries of an electric motor that powers the car, or in parallel, with the car directly.

A HEAN is formed by merging components from a pure electric vehicle and a pure gasoline vehicle. The Electric Vehicle (EV) has an M/G which allows regenerative braking for an EV; the M/G installed in the HEV enables regenerative braking. For the HEV, the M/G is tucked directly behind the engine. The M/G is connected directly to the engine in Honda hybrids. The transmission appears next in line. This arrangement has two torque producers: the M/G in motor mode, M-mode, and the gasoline engine. The battery and M/G are connected electrically

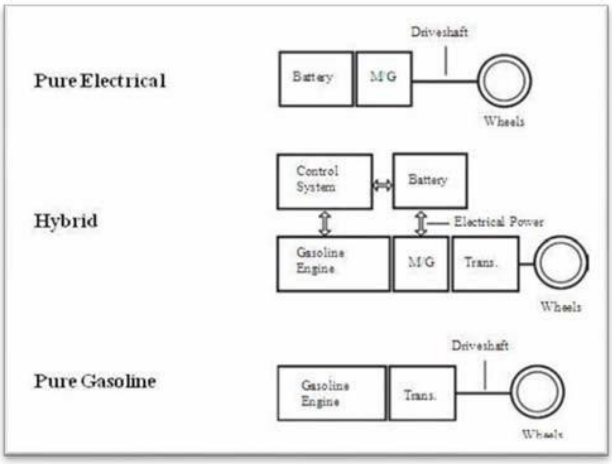

Figure 1: Power flow diagram

IV. RE SU LT

The following simulation is of a two-wheeler hybrid electrical. Which uses a series-parallel hybrid powertrain which charges the battery as well as runs the vehicle. Which can be used to drive a two-wheeler as it needs a smaller IC engine. The same mechanism can be added to any transport medium with slight changes which can help in decreasing the pollution created by pure IC engine vehicles. The system can be used to advance the existing system without making it outdated. This can solve a lot of our problems that may arise due to the complete scrapping of ongoing vehicles to replace them with electric vehicles.

V. CONCLUSION

By this, we conclude that we successfully designed a hybrid electrical vehicle model in MATLAB/Simulink which is useful to reduce emissions and maximize fuel economy. A petrol-electric hybrid vehicle system is designed successfully which is both economic and environmentally friendly in terms because half of the distance can be travelled with help of an electric system. This project provides an alternative to conventional vehicles without disturbing the existing framework of the system. It also satisfies the need for hybridization of vehicles to make them less dependent on conventional fuels. It is a self-sufficient system as the need for battery charging is fulfilled by the IC engine and the size of the IC engine is less as compared to a conventional vehicle. The performance of simulation of two-wheeler hybrid has been investigated thoroughly investigated and results were also proposed.

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