# Neural Network Mapping based Control System in Hybrid Energy Storage System for Electric Vehicles

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***Abstract***: - In this paper, we use a neural network mapping function to fit in the range of reference and actual output, to improve efficiency by reducing the harmonics in the outputs. The system basically describes the hybrid energy storage system for lithium ion batteries and super capacitors. The application is for DC electric vehicle. So it is required to maintain a constant voltage without any flickers in the output of the DC voltage and currents. another hybrid energy storage system for electric vehicles is structured dependent on a Li-ions battery power dynamic constraint rule-based HESS energy the executives and another bi-directional DC/DC converter. The system is contrasted with conventional hybrid energy storage system, demonstrating it has huge preferred standpoint of diminished volume and weight. Besides, the swell of yield current is decreased and the life of battery is improved. a HESS dimensioning procedure that goes for getting a most good hybridization rate, thinking about the control methodology and the driving cycle for a picked HESS topology. So this approach for neural network mapping proves to beneficial for electric vehicle topology used as hybrid electric energy storage system.

***Index Terms***: **- HESS, super capacitor, ultra-capacitor, electric vehicle**

## Introduction: -

The main challenge for the pure electric vehicles (PEVs) with a hybrid energy storage system (HESS), consisting of a battery pack and an ultra-capacitor pack, is to develop a real-time controller that can achieve a significant adaptability to the real road. The consumption of fossil energy and the increasingly rigorous emission standards has led to a widespread concern for pure electric vehicles (PEVs) [1,2]. However, the short lifespan, the low energy, and power density of the energy sources in the PEVs restrict their further application. [3]The hybrid energy storage system (HESS) can deal with these problems by utilizing the large capacity of the battery and the high power of the ultra-capacitor, which contribute to HESS being a popular issue in the research and application area of PEVs [4]. Due to the shortcomings of short life and low power density of power battery, if power battery is used as the sole energy source of electric vehicle (EV), the power and economy of vehicles will be greatly limited [5,6]. The utilization of high-power density super capacitor (SC) into the EV power system and the establishment of a battery-super capacitor hybrid power system can achieve complementary advantages to make up for the lack of power battery [7,8]. The previous researchers simulated the important modules of the SC-battery hybrid power system in MATLAB/Simulink. The results show that the hybrid power system can exert its high energy density and high-power density characteristics, thus improving the vehicle's dynamic performance and energy utilization [9]. high-power SC with traditional batteries, and adopted parallel interleaving technology in DC/DC converter, which changed the topology of the hybrid power supply, greatly improving the overall performance of the composite power system. [10]. In this paper, we propose a new implementation to improve the efficiency of the electric vehicle and battery life.

## Implementation and Results:

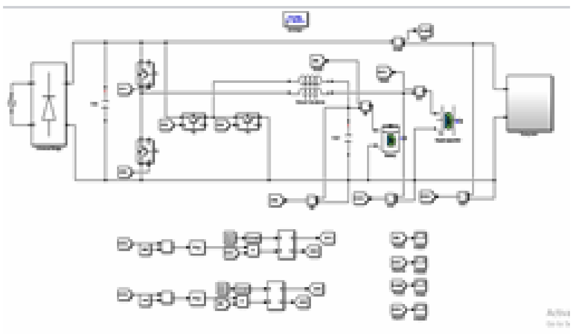

**Figure 3: Hybrid energy storage system applied to electric vehicles in PI model**

The above figure shows the Hybrid energy storage system applied to electric vehicles in PI model, it consisting of a bridge rectifier super capacitor battery and sub system, here we are adding the proportional integral controller

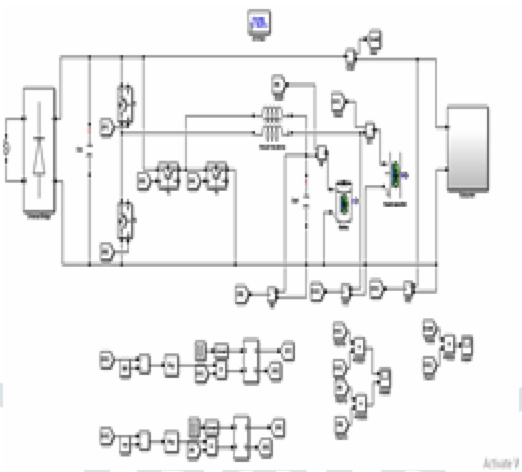

**Figure 4: Hybrid energy storage system applied to electric vehicles in PI model and power command**

The figure 4 shows the Hybrid energy storage system applied to electric vehicles in PI model and power command it consisting of bridge circuit super capacitor battery a sub system, here we are adding the power command also it will give the efficient output.

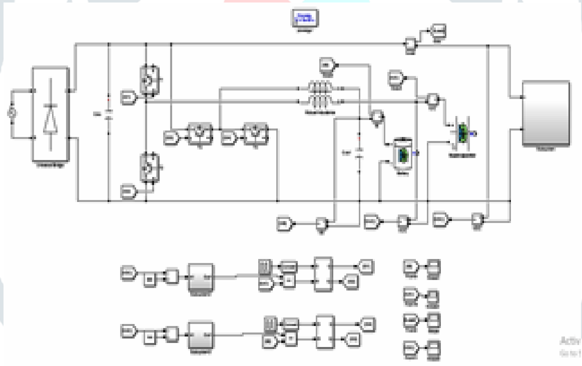

**Figure 5: Proposed Hybrid energy storage system applied to electric vehicles in Neural Network Mapping Function**

The above figure shows the Proposed Hybrid energy storage system applied to electric vehicles in Neural Network Mapping Function, here we are using the Neural Network Mapping Function having many advantages compared to PI.

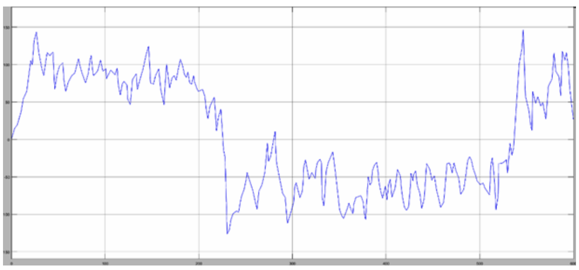

**Figure 6: Power command and actual power of HESS applied on electric vehicles**

The above figure shows the power command and actual power proposed hybrid energy storage system. Here the graph shows the power command and actual power of the system ,the power variation is started to zero and the high value 150 w the 0 to 100 t/s it become high level

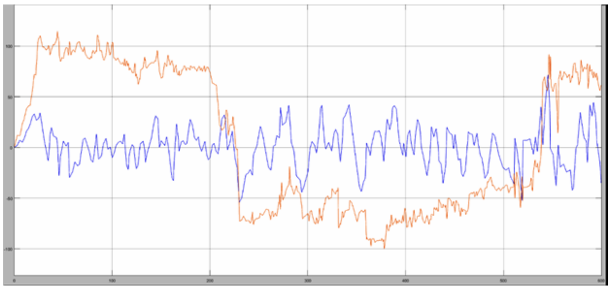

**Figure 7: Power of the super-capacitor and Li-ion battery HESS applied on electric vehicles**

The above figure is the waveform of Power of the super-capacitor and Li-ion battery HESS applied on electric vehicles here comparing the power of super capacitor and li-ion battery, the li-ion battery having high power variation in power compared to super capacitor.

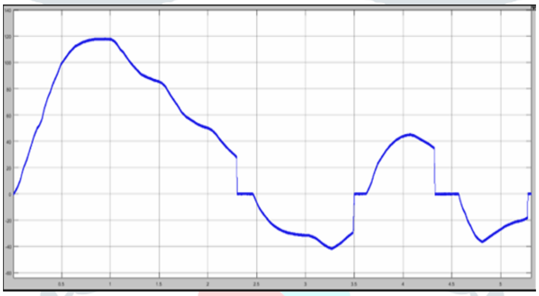

**Figure 8: Battery current proposed system**

The above figure shows the battery current of proposed system The battery current changes are smoother with no instantaneous perturbations. We can see in this graph the output current of the battery pack is smooth and has minimal ripple content

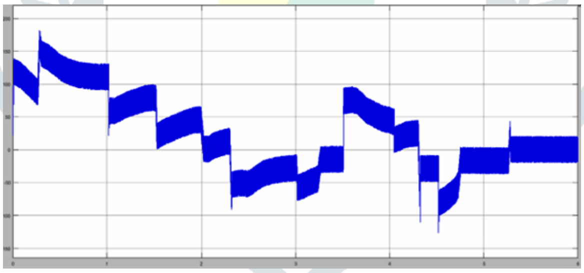

**Figure 9: Super-capacitor current of HESS applied on electric vehicles**

Figure shows the super capacitor current of proposed system. Compared to battery current the super capacitor current is having high ripple content.

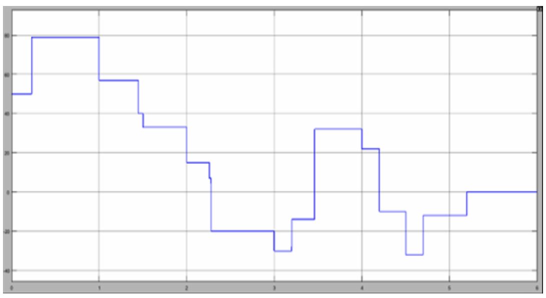

**Figure 10: Load current of HESS applied on electric vehicles**

The above figure shows the load current of HESS applied on electric vehicles in proposed system, here we can see the small amount of fluctuation in load current

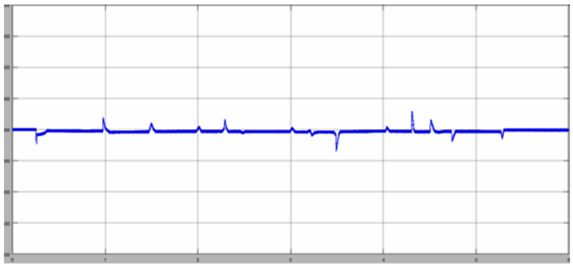

**Figure 11: Load voltage of HESS applied on electric vehicles**

The figure shows the load voltage of proposed system, the load voltage having small amount fluctuation

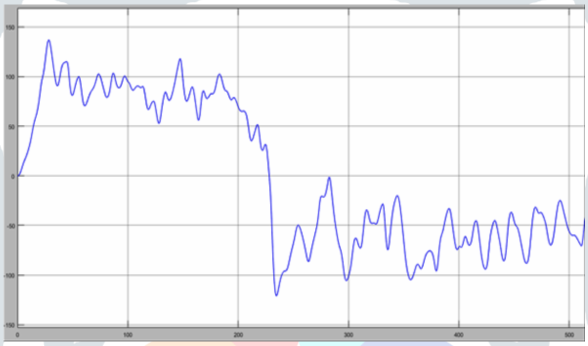

**Figure 12: Power command and actual power of proposed system**

The figure 12 shows the Power command and actual power of proposed system, figure shows variation of power command

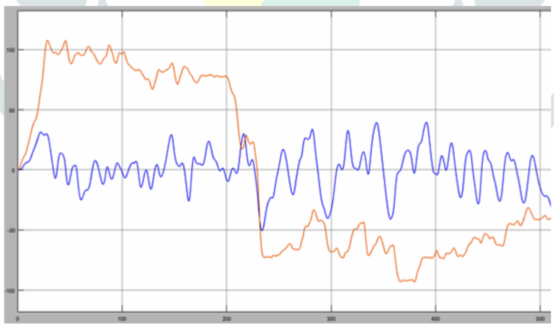

**Figure 13: Power of the super-capacitor and Li-ion battery of proposed system**

The figure 13 shows the Power of the super-capacitor and Li-ion battery proposed system here shows the Power of the super-capacitor and Li-ion battery. The THD of load current votage is improved by the use of neural network mapping function.

## Conclusion:

To conclude the work, as seen in results the neural network mapping function proves out to be of great benefit in terms of the output stability as distortion is significantly reduced. So therefore its efficiency is improved. The productivity attributes of battery, super capacitor (SC), direct current (DC)- DC converter and electric engine in a hybrid power system of an electric vehicle (EV) are broke down. Also, the ideal proficiency model of the hybrid power system is proposed dependent on the hybrid power system segment's models. System productivity changes fundamentally under various conditions because of various battery and SC states. Contingent upon the working conditions of battery and SC, the hybrid power system is arranged into four conditions in this work, and the exchanging guideline of single driving mode and double driving mode under four distinct conditions are picked up.

**References: -**

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