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A REVIEW ON PARALLEL BATTERY SYSTEM USING SUPER-CAPACITOR

Sudhanshu*, Sombir
M.tech Student, School Of Engineering & Technology, Ganga Technical Campus, Soldha, Bahadurgarh
Department of Electrical Engineering, Ganga Technical Campus, Soldha, Bahadurgarh

ABSTRACT

This is a review paper on different improvements that has occurred in the field of electric vehicle, it is mainly concerned in the ways in which maximum utilization of battery energy occurred primarily in battery with help of joining super-capacitor i.e. making a combination of two of the technology i.e. batteries with high energy concentration and super-capacitor with high power density to deliver best solution to the drive span and battery life. This technology benefits in improving acceleration in electric vehicle as well as also develops regenerative braking of the vehicle. It also comprises the comparison of different test results; control tactics adopted for effective amount of stored energy and also state the benefits and drawbacks of the same

Keywords- *Electric Motor, Super-Capacitor, Battery System, Regenerative Braking,BLDC Motor, Convertor, Control Mechanism.*

INTRODUCTION

The interest taken by the govt. in the electrical vehicle mobility plan in India and also by many foreign countries with the rise in restriction in pollution regulating norms set by governments such as Euro6 in Europe and also Bharat stage 5 to be likely in April 2017 the automotive firms are working hard to fulfill the demands set underneath these norms and to make urban cities less polluted. Great improvement in the field of electric vehicles started taking place to increase the plea to the people by eradicating maximum possible complains by public by developing the technology to an extent where it could contend with typical inner combustion engine. An improvement that could turn out to be an milestone attainment or the one which can turn the fortune of electric vehicles is parallel battery technology using super-capacitor which not only raises the performance of the vehicle but also increases the travel distance, develops regenerative braking efficacy and also recalls the battery of its stresses during uphill and accelerating, also develops the top speed attained by the vehicle because of its high specific power capacity as compared to batteries.

The report stresses on the super-capacitor and its applications in electric drive vehicles instead of batteries or combining it with batteries. Superior attention is given to the super capacitor because of their high efficacy and charge acceptance in comparison with batteries.

The several methods applied to attain the aim of a more powerful electric bike and scooter that are described in detail below and also the deviations in technology took place and the improvement in result with respect to earlier method is being discussed.

PRINCIPAL OF WORKING

In a standard electrical vehicle the movement of energy is from its reservoir i.e. battery which is connected in the vehicle which is available in market to suit the necessity of the vehicle to the dc-dc convertor which permits the current to the motor which in order deliveries the power to the load. The image below shows the flow of power But in battery system which is of parallel type there are two power sources available so that the load will only be on a single battery and hence the life of battery increases and therefore the performance of the vehicle develops.

The primary of the system employs buck-booster converter with IGBT power static switches. The super capacitor bank is connected to the boost side and the battery pack is connected to the buck side.
The control system measures the battery and super capacitor bank voltages, the condition of battery's charge, speed of the bicycle and the instantaneous current on the super capacitor bank

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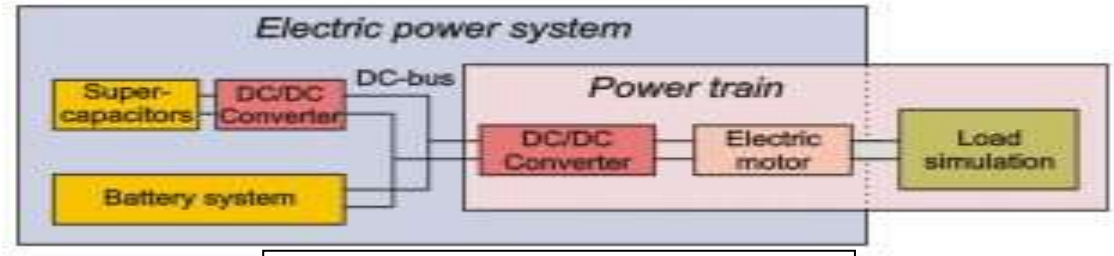

Fig2. Propulsion system with dc/dc convertor

Super capacitor

The below figure displays the graph of specific energy versus specific power. It can be clearly visible from the figure that the power density of the super capacitor is higher but the specific energy is very low therefore it cannot be used as the main power source as it will drain very fast but it can be used at times where load increases such as acceleration or uphill. In such cases this is very useful.

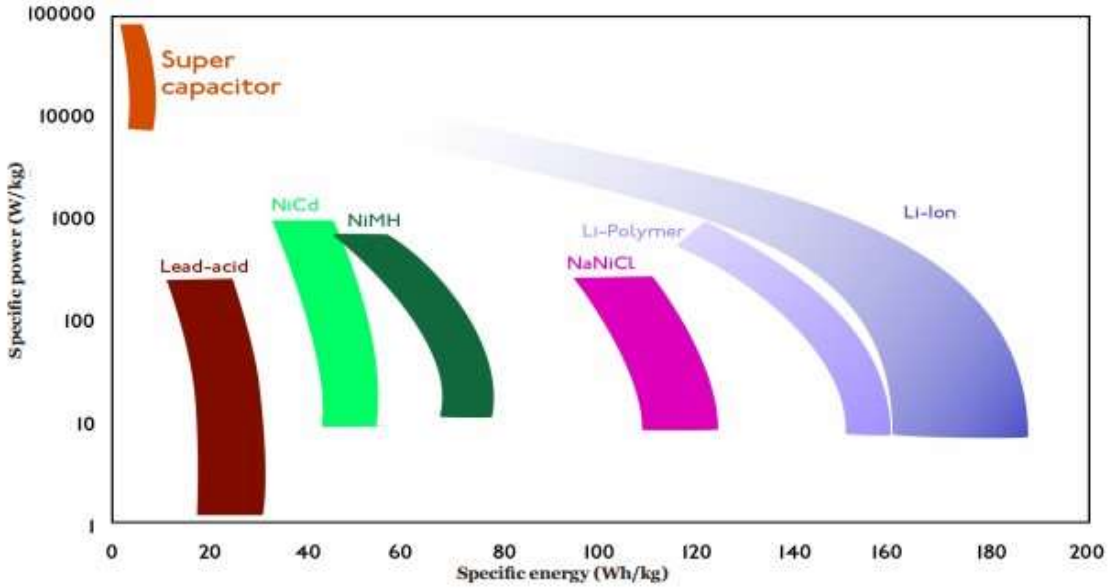

Fig3. Ragone graph comparing battery types and supercapacitor

Electric bicycle and its relevance can be employed as a means of transportation in different locations in the world. It was seen that for every case in time, only current in the battery is always higher than the current drawn from battery and supercapacitor. Efficacy analysis displays that only 23% of energy is employed from supercapacitor.

This work implements a smart boost converter which allows an electric bike to be driven by a battery/ supercapacitor hybrid combination. Experimental results display developments in hill climbing acceleration of the bicycle as a straight result of the boost converter. Battery life is improved by employing the super capacitors. However when regenerative braking is employed to recharge the supercapacitors is a difficult task because the boost converter was not certain to be bi-directional. The top speed was not enhanced but the range was increased.

Electric drives are designed for motorized bike by presenting the regenerative braking and new control method. Human-powered hybrid electric bikes are vital for private transportation and eco-friendly is explained in the paper. These vehicles are inexpensive and apt to all ages. It also benefits to relieve the traffic crowd. Equations which are employed for design of electrical drive is shown in below figure. Equation (1) shows the equilibrium and equation (2) maintains the skin friction drag and bluff body pressure drag into account.

1. T total = T friction + T slope + T air
2. C air = (V c + V w)^2 * b * Cr * A * þ */2

Study has been done on the control system of the electric bicycle and selection of the motor. Probability to recuperate the energy of braking is main focus while designing the electrical drive. It is of lower cost and easy solution. Control system is designed in which the capacitor bank gives the input to the boost and battery pack provides input to the buck and then lastly to load. On the basis of the economic and technical consideration the feasibility of bicycle is examined. A dynamic model is been specified to study the performance of the system in different situations. The technology of supercapacitors is being used to reduce the electromagnetic stress and life of battery increases.

Authors in this paper have defined the limitations of the electric bike like charging time of 7-8 hours and lifecycle of the battery pack. The authors in the paper have tried to indicate the new trends that enhanced the performance of the Trends like supercapacitors, controller, buck boost converter and regenerative braking is employed in electric bikes. Advantages of these trends are also addressed like battery life, increased speed, reduction in the charging time and range per charge. When features of the bike are designed such as air resistance and rolling are measured to match the power needed by the vehicle for propulsion. Control techniques are also used for the respective requirements. On other hand disadvantages of e-bike are also revealed like battery issues, long charging time which is improved by the trends and advancement.

Authors have projected several future opportunities and provide more improvement in the technology. Electric vehicles offer a prominent future in transportation. With modifications such as better motor, advanced controller and other improvements the speed of the vehicle can be upgraded. A small onboard solar panel could be an ancillary source.

BLDC motor is an electric with human-powered bicycle defined by the new control techniques employing 16 bit microcontroller. An electric bicycle operates on a BLDC motor and controlled from ECU. Some ECUs parts such as electric horn and remote key etc. are found in ECU. It comprises inverter circuit for motor, fault detection, SMPS, analog and digital IOs, temperature sensor and finally the controller itself. The usage of microcontroller such as XC866 to regulate the flow of electricity also there is a detailed discussion on control system design and motor choice. The paper has a results giving an improvement that occurs in the efficacy is in the range of 14%-19% giving high expectations for this technology.

CONCLUSIONS

In this paper comparison of electronic converter employing two power sources connected via two DC-DC converters is defined having potential application in electric bicycles or in other vehicles for personal use without inner combustion engines.

It gives the scope of improving parallel battery system that can be implemented on the e-bike using the performance of battery improves a great deal and also the efficacy of regenerative braking also increases.

FUTURE SCOPE

The improvement of economical and high energy density would benefit in increasing its approach to bring its production to manufacturing scale because as it is now this technology is expensive and its outcomes being positive does not comprehend the input cost.

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