Development of An Energy Storage System For Hybrid Electric Vehicles Using Super Capacitor

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Abstract- *This paper aims in developing an effective and efficient energy storage system for hybrid electrical vehicle (EHV). For the effective storage here batteries along with super capacitors is been used. The installation of super capacitors is done by considering two major prospective. First experimental setup using super capacitors proves to be fine for data acquisition with fast charge/discharge property. The second approach is that simulating photovoltaic energy storage by super capacitors is covenant and accessible model along with equivalent circuits for photovoltaic conversion makes its superior. Also super capacitors provide rapid energy recovery along with regenerative braking.*

Thus with this power system loss of energy and stress of the main batteries gets minimizes during acceleration and deceleration mode. This system also reduces the high power demands of batteries. Due to which batteries average life expectancy and efficiency is increased.

In this paper the equivalent model for super capacitor is included which is used for simulating for automotive power systems. It includes soft switching bidirectional DC-DC converters which are used to connect the super capacitor with the battery for controlling instantaneous power flow. A prototype hybrid design is made for experimental calculations

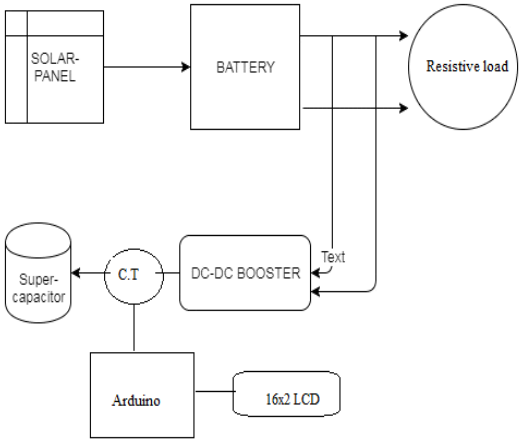
Keywords- DC-DC, Super Capacitors, EHV, Regenerative.

I. INTRODUCTION

The super capacitor is different from ordinary capacitor as they can be charged and discharge for many times also they can store energy with a higher rate than conventional electrolytic capacitors.

There are several of options like various batteries are available in market but super capacitors proves to be advantageous due to several reasons like longer life, rapid charge and discharge of energy.

BLOCK DIAGRAM:

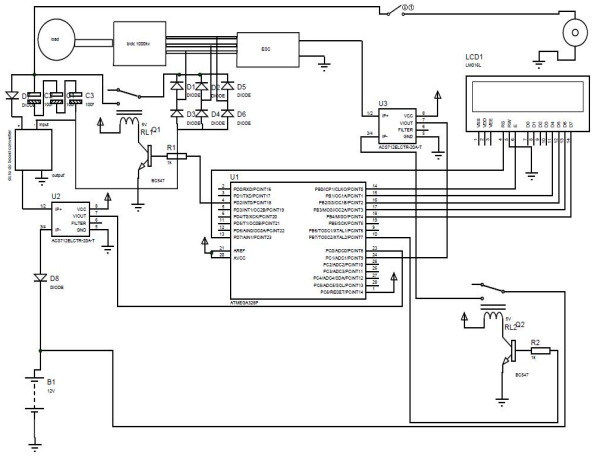


Though they currently are not able to compete with lithium based batteries in terms of energy density super capacitors are able to accept large sustained currents reliably and thus have improved power densities. These higher currents allow for potentially more energy to be stored during regenerative braking. Ultra capacitor based regenerative braking applications are currently, for the most part, restricted to hybrid buses and railway cars, where stops are predictable, and space is not too much of an issue. For this experiment these applications were outside of the author's budget, so a smaller scale electric bicycle was used instead, in order to measure ultra capacitors' ability not recoup braking energy.

II. METHODOLOGY

The braking system for a conventional vehicle is based on hydraulic braking technology. However, this traditional braking methodology causes a lot of energy wastage since it produces unwanted heat during braking. Thus, the invention of regenerative braking in electric vehicle has overcome these disadvantages moreover it helps in save energy and provides higher efficiency for a vehicle. In this system solar panel is used to store renewable energy from sunlight to run electric vehicle. And through charging circuit, energy stores in battery. Using battery power vehicle accelerate. In regenerative mode, the BLDC MOTOR act as a generator, it transfers the kinetic to electrical energy to restore the batteries or capacitors. Meanwhile, the brake controller

monitors the speed of the wheels and calculates the torque required plus the excessive energy from the rotational force that can be converted into electricity and fed back into the batteries during regenerative mode.



Despite this important advance in energy storage, they are still far from being compared with electrochemical batteries. Even Lead-acid batteries can store at least ten times more energy than Super capacitors. However, they present a lot better performance in specific power than any battery, and can be charged and discharged thousands of times without performance deterioration.

In a regenerative braking system, the trick to getting the motor to run backwards is to use the vehicle's momentum as the mechanical energy that puts the motor into reverse. Momentum is the property that keeps the vehicle moving forward once it's been brought up to speed.

III.CONCLUSION

In regenerative braking the efficiencies ranging from 8-15% are an improvement on the 10% efficiency target of most commercial systems. However, looking at the price tag, it's clear that installing this system on an electric vehicle is not economical based on the increase range it provides. With the lead acid battery pack used a range of about 10 miles was achieved, depending on how hard the user pushes the motor. With frequent regenerative braking one could hope to extend this range to about 11-12 miles. An interest in a particular activity may want to build their own capacitor based system for testing purposes, but investing in a lighter lithium ion pack and controller assist functionality would be the more costly choice at the moment. The cost of ultra capacitors may decrease in the near future making small scale systems like this possible.

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