INTELLIGENT POWER SAVER USING SUPERCAPACITOR

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Abstract

Electricity bill has become the highest house hold expense every month. Due to frequent power cuts we are forced to use Uninterrupted Power Supply which also increases the power consumption because of the bad efficiency of the batteries. Though we have good efficiency batteries of Lithium ion categories it won't be suitable for middle class houses due to the high cost of the battery. Our mind thinks about the utilization of free energy from the sun, but the cost of solar panels to utilize the energy is the question mark now. So our idea is to use supercapacitors to reduce solar panel rating and make a solar house possible even for middle class houses. A simple RC circuit in which C is a supercapacitor will be a solution for this problem. The parallel RC circuit is generally used because the output voltage is equal to the input voltage. The current rating is thus increased since the capacitor output has higher power density. Thus the panel required to charge a UPS battery can be reduced to 1/5th of the generally required size. It can be used in solar powered or electrically operated battery vehicles. Though solar or electrical vehicles have lot of advantages than the fuel ones, it is not being used in great extent because it cannot provide the initial torque as a normal vehicle does. Supercapacitors can be a solution for those kinds of problems so that the vehicle can match all the features such as speed, torque like a normal vehicle. This circuit consists of a 48V lithium ion battery, controller, high Farad supercapacitor, sensor and the brushless dc motor acts as the load. Thus the sensor senses the places where high power is required and sends to the controller. The controller uses the supercapacitor to deliver high power to the load. As the speed picks up the sensor again sends the information to the controller and the controller uses the battery to deliver power to the load. Thus supercapacitor is used in two major applications. They are: To reduce the panel rating so that the panel cost will not be a problem to charge ups batteries and thus the electricity bill is drastically reduced and also Solar or electrically operated vehicles is made functionally similar to that of a normal fuel operated vehicles.

Keywords: *Supercapacitor, Li-ion Battery, Solar Panel, Hybrid Vehicles*

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1. INTRODUCTION

Nowadays, electricity bill has become the highest house hold expense every month. Due to frequent power cuts we are forced to use Uninterrupted Power Supply which also increases the power consumption because of the bad efficiency of the batteries. Though we have good efficiency batteries of Lithium ion categories it won't be suitable for middle class houses due to the high cost of the battery. Our mind thinks about the utilization of free energy from the sun, but the cost of solar panels to utilize the energy is the question mark now. So our idea is to use supercapacitors to reduce solar panel rating and make a solar house possible even for middle class houses.

2. SOLAR HOUSE

Imagine a Solar powered House. For the basic appliances like fans, lights, T.V and 2 plug points we will be in need of 1kW solar panel which will cost around one lakh. Though it is an one time investment, it is not practically possible to invest such a huge amount initially. To go by both sides, i.e. best efficient method and as well as cost effective method we hereby come up with an idea to introduce super capacitors which can reduce the panel rating to a great extent.

3. SUPERCAPACITOR

We know that C is proportional to A/d .Thus supercapacitors have higher surface area and less distance of separation between the plates. It has double layer capacitance in them and thus results in very high farad ratings. Thus supercapacitor is the best solution for many numbers of applications.

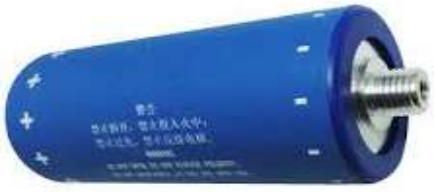

Fig -1: Supercapacitor-Model

3.1 Working

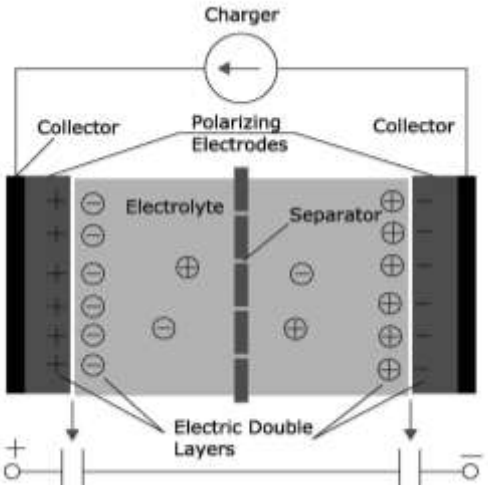

Fig -2: Supercapacitor-Working

3.2 Features

- Supercapacitors can be used for trillion and zillion number of times.
- It takes seconds to charge a supercapacitor.
- The energy density is almost 5 percent as much as a modern lithium-ion battery.
- The attractive feature of supercapacitor is its size. For such a high farad its size is very small..

4. HOW SOLAR PANELS RATING CAN BE REDUCED:

A simple RC circuit will be a solution for this problem. Supercapacitor is used in this RC circuit. The parallel RC circuit is generally used because the output voltage is equal to the input voltage. The super capacitor used will have great farads like 1000F. The current rating is thus increased since the capacitor output has higher power density. Thus the panel required to charge a UPS battery can be reduced to 1/5th of the generally required size.

4.1 Circuit Diagram

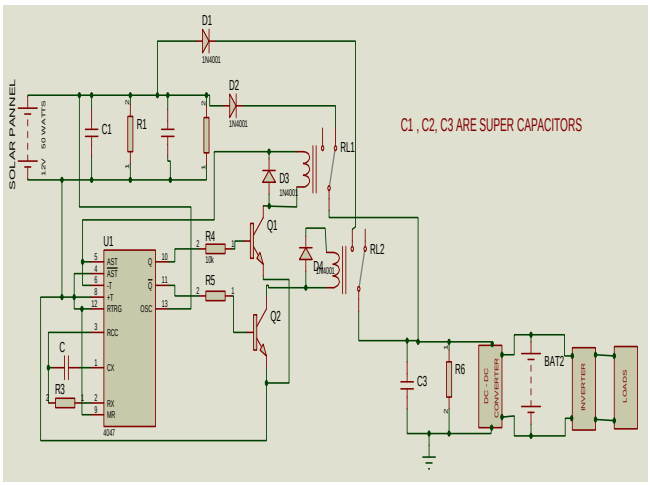

Fig -3: Circuit Diagram to reduce Solar Panel rating

4.2 Explanation

Using the above given circuit a 12V, 50W panel will be able to charge a battery of 12V, 150Ah. It is well known that 12V,50W panel without using supercapacitor cannot produce that current to charge a battery of this rating. Here 3 RC parallel networks are connected in parallel where the capacitors used are supecapacitors. IC4047 timer circuit has two possible output states. During the first state the transistor Q1 is ON. Relay1 moves from NO to NC. Hence the discharge takes place through Network 1. After a time constant of 2.2RC the transistor Q2 turns On. Relay2 moves from NO to NC. Hence the discharge takes place through Network 2. The overall output is fed to network 3 which again boosts the output. For the maintenance of constant output of 12v&15A, a D-D converter is used. This output is used to charge the battery. Discharge rate of the capacitor is made equal to the time constant of the timer IC. Thus just a 12V, 50W panel can charge a battery of 12V, 150Ah in 10 hours using this circuit.

5. APPLICATION II OF SUPERCAPACITOR

5.1 Battery-Supercapacitor

Hybrid Energy Storage System

Another application of supercapacitor is, it can be in solar powered or electrically operated battery vehicles. Though solar or electrical vehicles have lot of advantages than the fuel ones, it is not being used in great extent because it cannot provide the initial torque as a normal vehicle does. Supercapacitors can be a solution for those kinds of problems so that the vehicle can match all the features such as speed, torque like a normal vehicle.

5.2 Working

This circuit consists of a 48V lithium ion battery, controller, 1000F supercapacitor, sensor and the brushless dc motor acts as the load. As alreadyknown battery has high energy density and the supercapacitor has large power density. Thus the sensor senses the places where high power is required and sends to the controller. The controller uses the supercapacitor to deliver high power to the load. As the speed picks up the sensor again sends the information to the controller and the controller uses the battery to deliver power to the load.

5.3 Block Diagram:

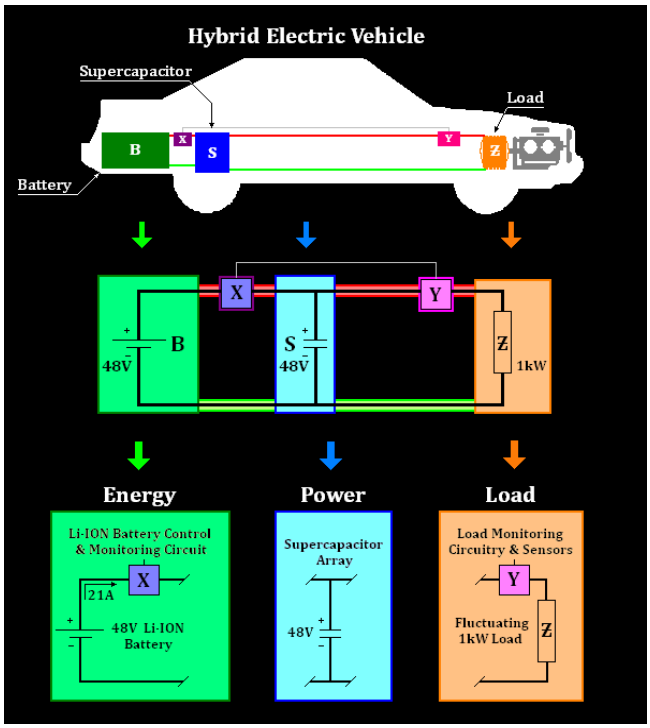

Fig -4: Block Diagram for Hybrid Vehicles

6. CONCLUSION

Thus supercapacitor is used in two major applications. They are:

1. To reduce the panel rating so that the panel cost will not be a problem to charge ups batteries and thus the electricity bill is drastically reduced.
2. Solar or electrically operated vehicles is made functionally similar to that of a normal fuel operated vehicles and thus paves a full stop to the pollution, noise and fuel crisis by a fuel operated vehicle.

REFERENCES

[1]. IEEE, DOI:10.1109/DATE.2011.5763295
[2].ULTRACAPCITORS: http://www.nrel.gov/transportation/energystorage/ultracapacitors.html

BIOGRAPHIES

My name is Sathish.P. I love reverse Engineering and also working with bread boards. My interest in Physics made me think about Supercapacitors. I am a team person, which made me go well with my partner and work on Supercapacitors.

My name is Ponmanisundar.S. I believe anything is possible with science and the clear example is our work on Supercapacitors. I generally read a lot of books.