



Fusion of Energy Harvesting with Hybrid Power Generation for Low Power Applications with Super Capacitors

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ABSTRACT

Seeing the ever-increasing graph of demand in the power & energy sector and ever-decreasing statistics of fossil fuels, the look towards the concept of mix generation i.e., optimum use of various resources of energy available at a particular location to fulfill the promise towards upcoming generation in order to provide the sustainable solution. The process of acquiring the energy from the surroundings and get it processed into the usable format of energy & power application is the theme of energy/power harvesting. In the last few years, there has been a surge of research in the area of power harvesting and hybrid power generation. This increase in research provides many mix power generation pair of sources at macro level. This paper provides an outline for hybrid power generation particularly for low power application, harvesting energy and gets it efficiently utilized by the use of super capacitors.

Keywords: energy harvesting, mix-generation, super capacitor.

INTRODUCTION:

Present scenario depicts the application of hybrid power generation so as to cover the graph for demand of power by mixing most favorable and adaptable resources of energy related to the site. This concept of hybrid power basically considers sources in bulk off course to drive huge energy cycle from one form to another. There is a related lower band of energy in the urban surrounding this can be traced through the harvester modules and get hybridized with natural sources like solar & wind at micro level and can make a bit of demand digested by optimizing the handling and utilization with super capacitors. A super capacitor is an electrochemical component that will lead electrical energy storage into a new dimension.

A LOOK INTO ENERGY HARVESTING AND HYBRID GENERATION:

Macro scale energy harvesting technology in the form of wind mill, watermill and passive solar power systems have been around the centuries. Now as designers seek to cut the cords, they turn to micro energy harvesting systems that can scavenge mill watts from solar, vibration, thermal & biological sources. However understanding ultra low power from the sourcing side brings challenges as harvested power derived from ambient sources tends to be unregulated, intermittent and small. Recent energy scavenging technology provide electricity from different natural resources, such as wind power, water flow, heat, sunlight, vibration, since there has been an interest due to mass increase of wireless sensors and low power electronics. Electronic devices such as mobile phones, laptops, PDAs (personal digital assistants), medical implant devices and different types of sensor nodes all require a power source to operate. Therefore, they are provided with either wires or disposable/rechargeable batteries to supply the power. The problem with batteries is that they have limited lifetimes or they are required to be recharged on a regular basis. This hurdle can be efficiently solved out with the application of super capacitor replacing batteries for low power applications. Therefore, it is possible to power electronic devices using energy sources already in the environment or even wasted from other systems. For example, a lower condition monitoring sensor which is able to alert the failure of a machine can be powered by the electromagnetic

field created by surrounding working equipment in the work place.

ABOUT SUPERCAPACITOR:

In response to the changing global landscape, energy has become a primary focus of the major world powers and scientific community. There has been great interest in developing and refining efficient energy storage devices. One such device, the super capacitor has matured significantly over the last decade and emerged with the potential to facilitate major advances in energy storage. Super capacitors also known as ultra capacitors or electrochemical capacitors, utilize high surface area electrode materials and thin electrolytic dielectrics to achieve capacitances several orders of magnitude larger than conventional capacitors. In doing so, super capacitors are able to attain greater energy densities while still maintaining the characteristic high power density of conventional capacitor.

PROPOSED MODEL:

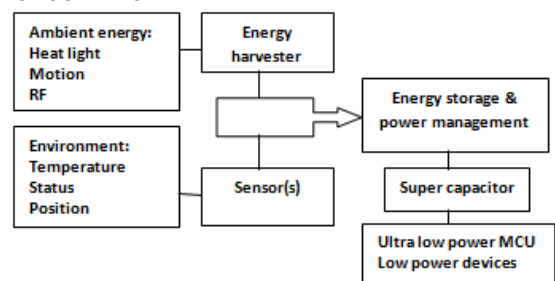


Fig. 1 Block diagram of harvesting unit

OPTIMIZATION OF ENERGY THROUGH HARVESTING IN PROPOSED CONCEPT:

As depicted in suggestive model harvested energy from harvester & sensors fed to the energy storage and management unit. As the energy has captured from the physical world it need to pass through transduction process, so as to cast it in usable form of energy as per requirement.

The revolutionary phase of proposal glows up with the storage unit in the form of super capacitor, which can provide efficient & massive sort of power required to several medium range applications.

QUANTUM OF ENERGY FROM SORROUNDING

Fig. 2 Energy harvesting estimates:

Energy source	Harvested power
Vibration / Motion	
Human	4μW/cm ²
Industry	100 μW/cm ²
Temperature difference	
Human	25μW/cm ²
Industry	1-10mW/cm ²
Light	
Indoor	10μW/cm ²
Outdoor	10mW/cm ²
RF	
GSM	0.1μW/cm ²
WIFI	0.001μW/cm ²

Fig. 3 Macro vs. Micro energy harvesting comparison:

Macro vs. micro	Energy source	Solution	Ultimate goal
Macro	Renewable energy (e.g., solar & wind)	Energy management solutions	Reduce oil dependency
Micro	Energy from the environment (e.g., vibration, body heat)	Ultra low power solutions	Perpetual devices

FUTURE OF POWER HARVESTING:

The idea of carrying electronic devices such as personal digital and analog assistants and never worrying about when their power source will need to replace or recharged, could be far closer than one would think. The major limitation is the lower bench mark for the quantum of power and need to be resolved by applying suitable amplifier unit in conjunction, so that desire for self-powered electronic s grows quickly.

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