Title: An Intelligent DC-DC/AC Converter

Description:
Commercially available converters are devices capable of converting energy, usually DC and AC, generated by photovoltaic panels and wind turbine into specific type, i.e. AC. There are three basic types of DC-AC converters: square wave, modified square wave, and pure sine wave. The square wave is the simplest and the least expensive type, and nowadays is not used commercially because of low quality power. The modified sine wave produce square waves with some dead spots between positive and negative half-cycles, and they are suitable for many loads. This type is the most popular low-cost inverters on the market today. Pure sine-wave inverters produce AC voltage with low total harmonic distortion. They are more expensive and used when there is a need for a clean sinusoidal output for some sensitive devices like medical equipment, stereos, etc.
In this project we want to design and develop an intelligent converter that will be able to convert energy from the photovoltaic panels(s) and wind turbine to DC and AC voltages, and be able to charge a bank of batteries. Figure 1 shows a level 1 diagram of the intelligent converter. It consists of five subsystems:

1. Smart battery charger: this unit should be able charge a bank of batteries.
2. DC/AC power supply: this subsystem will deliver DC and single-phase AC electric power. If no energy is being supplied by the photovoltaic panel, the wind turbine, or an energy harvesting device, the batteries will provide uninterruptible power supply to a load (to the point where damage to the batteries is prevented).
3. Measurement of Power Factor, current, voltage and frequency: this module will be able to compute/measure the PF, I, V, and F being applied to an AC load.
4. Monitor/data logger: this unit should be able to record online voltages from, instantaneous power factor being applied to the load, and battery charge/discharge history.
5. Interface to internet: this subsystem will display in real-time, and on the internet, the same electrical parameters being recorded by the monitor/data logger module.

Intelligent DC-AC/DC Converter

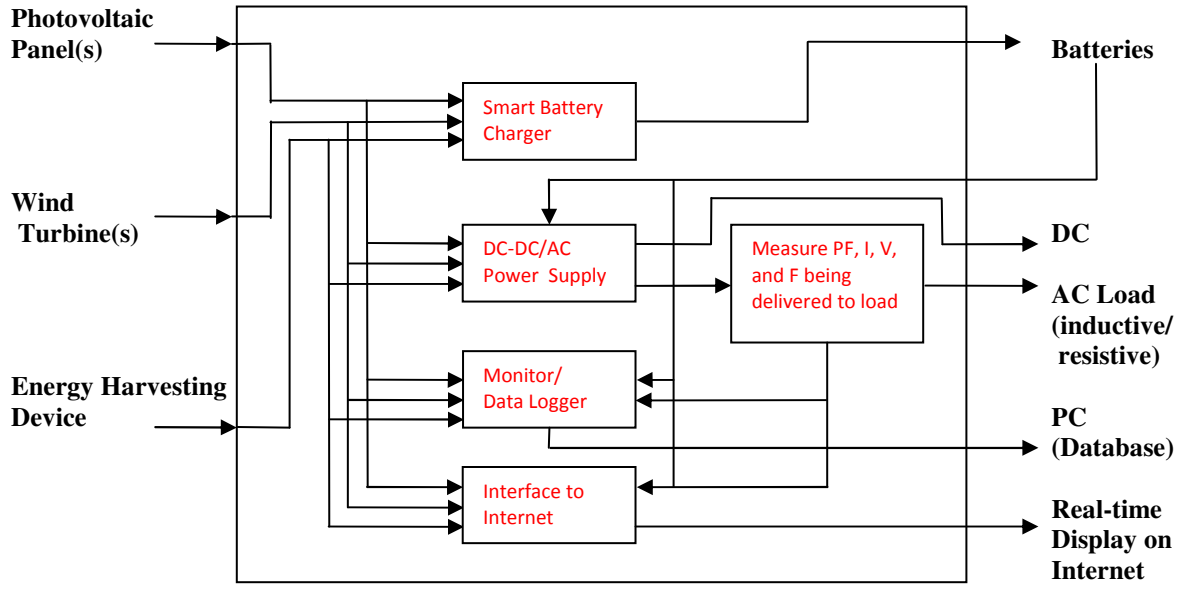

Figure 1. Level 1 design of an Intelligent DC-AC/DC Converter.

Specifications:
Each team will be tasked with designing and implementing the system described above. The specifications for each module are described below.

1. Smart Battery Charger: a) Use the float charge method to charge a bank of batteries. This method is used to prevent from overcharging the batteries. It senses when the bank of batteries is at the maximum level and temporarily shuts off the charge (floats voltage at zero or minimum charge until it senses that the battery output voltage has fallen), b) able to charge a 12 VDC battery (or battery bank). This unit produces medium-high voltage and must include a safety mechanism to protect the battery and system.
2. DC/AC Power supply: a) Regulate the online power supply off the photovoltaic panel, wind turbine, and energy harvesting device to 12 VDC and 12VAC @ 60 Hz. This unit produces medium-high voltage and it must include a safety mechanism to protect the system.
3. Measurement of Power Factor, current, voltage and frequency: a) Sample AC voltage, current, and frequency being supplied to the load at a frequency of at least twice the highest frequency being provided, b) and be able to compute the power factor. This unit produces medium-high voltage and it must include a safety mechanism to protect the system.
4. Monitor/Data logger: a) Record, at a frequency at least twice the highest frequency, online voltages and currents, battery voltages, and power factor values, b) tag and store data on a SD card or PC.
5. Interface to internet: a) Display electrical parameters, in real-time, on the EE web server.