A new concept of intelligent hybrid inverter for battery charging

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ABSTRACT **: This is a new configuration of a single- phase hybrid inverter with an integrated battery energy storage, this paper proposes suitable for residential households to maximize local consumption of solar energy and thus reduce dependency on support. The hybrid inverter is called Direct Storage Hybrid (DSH) Inverter. A transformer-less topology such as HERIC, operating at low frequency to generate a three-level rectangular output voltage, is adopted to connect a photovoltaic (PV) panel to the load and/or the grid. A series active filter is employed to compensate the high harmonic components from the rectangular voltage and provide a sinusoidal voltage. A bidirectional dc/dc converter connects the battery to the PV panel to control the battery state of charge (SoC) and optimize the PV panel operation during both off-grid and grid-connected modes. The DSH inverter can let the battery bypass the dc/dc converter and connect directly to the inverter stage, leading to a significant improvement in throughput efficiency in battery utilization. This paper discusses the operation and loss analysis of the DSH inverter in off-grid mode.**

KEY WORDS : Arduino , Inverter , Solar Panel , Wind Turbine , LCD , Relay , Current Sensor.

INTRODUCTION

Renewable energies, like PV and wind, hold great promise as future solutions for our energy needs. However, their fluctuating nature harms electricity grids, and options that make grids smarter or improve their stability have long been research trends such as integrating battery storage solutions into existing grids to maximize the capacity, efficiency and use of renewable energies An example of this is stand-alone PV inverter or intelligent hybrid inverter with energy storage capability. An intelligent hybrid inverter stores energy only when necessary and maximizes self-consumption of PV energy. Such storage capability becomes more and more important when the price of solar energy sold to grid keeps getting cheaper Intelligent hybrid inverter is therefore predicted to be the future of PV installation, according to the French Electric Network. There are two common configurations for the intelligent hybrid inverter. The first system consists of a PV inverter and a separated battery inverter operating in parallel. They are connected to an ac bus via a multi-winding transformer or transformer-less topologies The battery inverter stores the energy via the ac bus The second system uses a common dc bus to link the solar panel, battery through a bi-directional dc/dc power converter and then adds a dc/ac inverter to interface with the ac grid Alternatively, uncommon configurations such as Z-source inverter , multi- port ac link inverter or switched-battery inverter were also proposed. However, it is difficult to achieve a high overall efficiency with these methodologies because there are many conversion paths and/or devices needed which would introduce more losses to the whole system. More importantly, none of the existing methods is capable of providing an optimized efficient path for PV–battery–load energy flow to maximize the battery usage and achieve the best throughput efficiency. This throughput efficiency is particularly important because the battery is the most expensive component in the system.

This paper proposes a new concept of high-efficient single phase intelligent hybrid inverter called Direct Storage Hybrid (DSH) inverter with an optimal throughput path for battery energy storage. The DSH inverter is applicable to residential households to maximize the local consumption of solar energy and thus reduce the stress on grid. The DHS inverter is equipped with an integrated power management system, which optimizes the battery performance in terms of operating cost, and can operate in both off-grid and grid-connected modes. This paper presents the operation of the DSH inverter in off-grid mode and analyses its power losses to prove its superior throughput efficiency via circuit

simulation. The DSH inverter has an independent battery charging path which can be optimized separately. It also has an excellent performance when discharging the battery to support the load at night. As a result, the DSH inverter can cover a wide range of operation with an expected throughput efficiency of more than 96%.

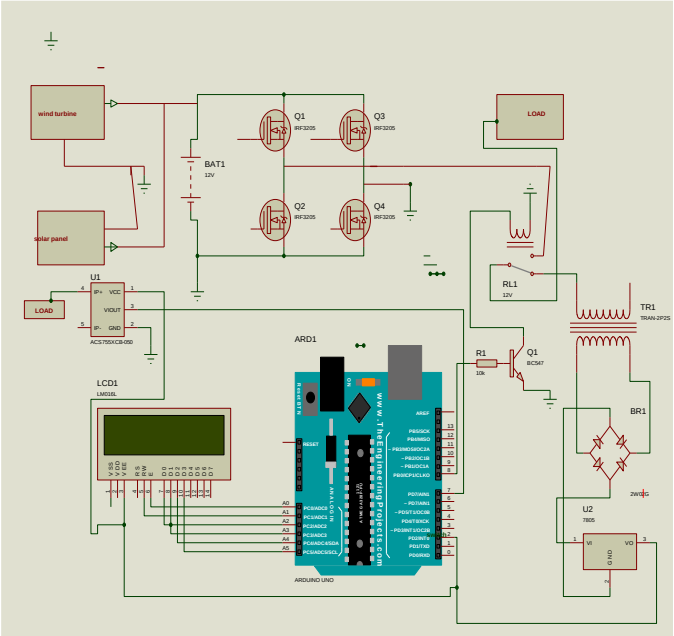
EXISTING SYSTEM

The conventional sources of energy are generally non-renewable sources of energy, which are being used since a long time, sources of energy are being used extensively in such a way thattheir known reserves have been depleted to a great extent, For example, petroleum in our country will get exhausted by the few decades and coal reserves are expected to last for another hundred years.

PROPOSED SYSTEM

Hybrid Inverter with Solar and wind Battery Charging System consists of aninverter powered by a 12V Battery, This inverter generates up to 110V AC with the help of driver circuitry and aheavy load transformer, This battery gets charged from two sources, i.e., wind and solar energy, If the mains power supply is available, the relay switches to the connection using mains power supply to supply to the load.

CIRCUIT DIAGRAM OF PROPOSED SYSTEM



WORKING PRINCIPLE

Current Sensor detects the current in a wire or conductor and generates a signal proportional to the detected current either in the form of analog voltage or digital output. Current Sensing is done in two ways i.e., Direct sensing and Indirect Sensing. In Direct sensing to detect current Ohm's law is used to measure the voltage drop occurred in a wire when current flows through it. A current-carrying conductor also gives rise to a magnetic field in its surrounding. In Indirect Sensing, the current is measured by calculating this magnetic field by applying either Faraday's law or Ampere law. Here either a Transformer or Hall effect sensor or fiber optic current sensor are used to sense the magnetic field.

ACS712 Current Sensor uses Indirect Sensing method to calculate the current. To sense current a liner, low-offset Hall sensor circuit is used in this IC. This sensor is located at the surface of the IC on a copper conduction path. When current flows through this copper conduction path it generates a magnetic field which is sensed by the Hall effect sensor. A voltage proportional to the sensed magnetic field is generated by the Hall sensor, which is used to measure current.

The proximity of the magnetic signal to the Hall sensor decides the accuracy of the device. Nearer the magnetic signal higher the accuracy. ACS712 Current Sensor is available as a small, surface mount SOIC8 package. In this IC current flows from Pin-1 and Pin-2 to Pin-3 and Pin-4. This forms the conduction path where the current is sensed. Implementation of this IC is very easy.

ACS712 can be used in applications requiring electrical isolation as the terminals of the conduction path are electrically isolated from the IC leads. Thus, this IC doesn't require any other isolation techniques. This IC requires a supply voltage of 5V. Its output voltage is proportional to AC or DC current. ACS712 has a nearly zero magnetic hysteresis.

Where Pin-1 to Pin-4 forms the conduction path, Pin-5 is the signal ground pin. Pin-6 is the FILTER pin that is used by an external capacitor to set the bandwidth. Pin-7 is the analog output pin. Pin-8 is the power supply pin.

HARDWARE REQUIREMENTS

- Arduino Uno
- Inverter
- Relay
- LCD
- Power Supply
- Solar Panel
- Wind Turbine Current Sensor

ARDUINO

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.ACS712 Current Sensor is a fully integrated, Hall-effect based linear sensor IC. This IC has a 2.1kV RMS voltage isolation along with a low resistance current conductor.

SOFTWARE

- Arduino IDE
- Embedded 'c' language

ADVANTAGES

Producing much more efficiency as two or more renewable energy generation system working together in the terms of electrical energy generation.

If the system gets damaged in case, no need of changing entire system or subsystem. Just, changing a damage component will work out.

RESULT AND DISSCUSION

This paper provides a summary of available approaches and those currently under research for optimal design of hybrid renewable energy systems.

Depending on the environmental conditions, required energy for the system can be supplied either separately from the wind or solar systems or using these two resources at the same time

POWER DESCRIPTION:

POWER SOURCE	INPUT OF THE POWER SOURCE(V)	SWITCH STATUS	LCD DISPLAY	LOAD STATUS
MAINS	230 V	ON	MAINS	BULB LIGHTS
MAINS	230 V	OFF	NO POWER	NO LIGHT
SOLAR	230 V	ON	SOLAR	BULB LIGHTS
SOLAR	230 V	OFF	NO POWER	NO LIGHT
WIND	230 V	ON	WIND	BULB LIGHTS
WIND	230 V	OFF	NO POWER	NO LIGHT

CONCLUSION

This paper proposed a new concept of single-phase intelligent hybrid inverter called Direct Storage Hybrid (DSH) inverter which can optimize the throughput path of a battery storage. Simulation results demonstrated the feasibility of the DSH inverter, showing stable operations under various PV conditions. It was proven that the DSH inverter has the potential to achieve a very good throughput efficiency of 96% or more. This superior performance is particular important to maximize the local consumption, reduce grid dependency, and increase benefits for PV–battery system at residential households.

FUTURE SCOPE

The proposed hybrid system model can also be erected in the path of rail road where high pressure of wind is developed by motion of the train. When manufactured on a large scale, power generation cost of this system will reduce. Excitonic solar cells can be used which has Tatiana nanotube arrays that shows considerable promise to harness a larger fraction of the solar spectrum. This will ultimately make this system more reliable and efficient. India recently proposed to augment cooking, lighting, and motive power with renewable in 600,000 villages by 2032, starting with 10,000 remote UN-electrified villages by 2012. India's new feed-in tariff was capped at 50 MW through 2009, although a second policy phase may increase the program cap to 1,000 MW. The tariff provides up to 12 Rupees per kWh for Solar PV projects promising a 10-year commitment with a cap of 50 MW. The proposed system can provide power to remote places where government is unable to reach. This will reduce the transmission losses and cost. By interconnecting these systems load sharing can be done. The power to the loads can be equally shared. Thus the power can be regularized.

REFERENCES

[1] M. A. A. Pedrasa, T. D. Spooner and I. F. MacGill, "Coordinated Scheduling of Residential Distributed Energy Resources to Optimize Smart Home Energy Services," *IEEE Trans. Smart Grid*, vol. 1, no. 2, pp. 134–143, Sept. 2010.

[2] J. Tant, F. Geth, D. Six, P. Tant and J. Driesen, "Multiobjective Battery Storage to Improve PV Integration in Residential Distribution Grids," *IEEE Trans. Sustain. Energy*, vol. 4, no. 1, pp. 182–191, Jan. 2013.

[3] D. Velasco de la Fuente, C. L. Trujillo Rodrguez, G. Garcer, E. Figueres and R. Ortega Gonzalez, "Photovoltaic Power System With Battery Backup With Grid-Connection and Islanded Operation Capabilities," *IEEE Trans. Ind. Electron.*, vol. 60, no. 4, pp. 1571–1581, April 2013.

[4] K. S. Tam and S. Rahman, "System performance improvement provided by a power conditioning subsystem for central station photovoltaic-fuel cell power plant," *IEEE Trans. Energy Conversion*, vol. 3, no. 1, pp. 64–70, Mar 1988.

[5] S. Daher, J. Schmid and F. L. M. Antunes, "Multilevel Inverter Topologies for Stand-Alone PV Systems," *IEEE Trans. Ind. Electron.*, vol. 55, no. 7, pp. 2703–2712, July 2008.