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Design and Development of Hybrid Charging Topology

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ABSTRACT

Implementation of this system is to ensure continuous output current to load utilizing both Photovoltaic (PV) energy and AC Grid. Utility interfacing PWM converter designed here to operate by both solar energy and storage batteries that highly satisfies the necessity in rural areas where National Grids are hardly available and power cut problem reduces the effectiveness of system. Solar energy gets priority here to charge storage battery rather than AC source that may save hundreds of megawatts power every day. To extend the battery lifetime and keep system components hazard-free, it includes exact battery-level sensing, charging-current controlling by microcontroller unit (MCU) charge to congregate maximum PV energy from AC Solar Modules. Investigation on improvement of power- interfacing control and optimization of overall system operation assent to intend usage recommendation in this exposition.

Keywords : Solar Energy, Hybrid Charging Topology, Battery, Electric Vehicle.

I. INTRODUCTION

Most of the recent commercial MPS system is the composition of PWM (Pulse Width Modulation) type converter, storage battery & converter-cum-charger transformer regardless of the concern for overload, overcharging or low battery cut problems. Exact voltage level sensing and battery-charge controlling are also unavailable. These phenomena result in degradation of battery lifetime and in the same time huge wastage of power and extends electricity bill. So, intelligent modification is needed in the existing MPS system. The proposed system utilizes a MCU (microcontroller unit) to successfully overcome these tribulations. Moreover, due to limited sunshine hours and non-ideal conditions, it is not only desired to accumulate maximum PV energy from panels but also to ensure maximum utilization. The designed system has been rigorously tested in extremely harsh environments to ensure reliable, trouble-free operation regardless of any change in climate. Hence, new research directions are explored for the utilization of solar energy, electrical engineering development and power electronics technology.

II. PROPOSED SYSTEM

The proposed system basically consists of three tiers:
a) Input power system,
b) Intelligent processing system and
c) Output power system.

The core part of this system is the intelligent switching circuit which is composed of PIC 18F25K22 based MCU unit which ensure uninterrupted output power based on the available input. This pre-programmed section intelligently not only maintains maximum AC output power with greater efficiency but also DC supply to small DC load that may reduce pressure of AC output. The following sub-sections give the details of entire system.

Input Power and Switching System

Input power section allows three different sources of energy like grid line, storages battery and Photovoltaic energy. To minimize the burden on the grid line, the system is designed as follows: when Grid supply is present, switching circuitry gets informed about its availability from AC main sensing section and passes AC main's signal to converter output socket. In absence of AC grid supply, switching circuitry takes DC input from storage battery and turns on converter circuit i.e. composition of oscillator, MOS driver, output amplifier and transformer section and AC low-pass filter. Oscillator section generates 50 Hz MOS driver signal that gets amplified, sent to converter transformer using MOSFET switching and transforms into AC and injects AC energy to the AC-side output connection. Such periodical switching ON/OFF of MOSFET starts an alternating current with 50Hz frequency at primary winding of step-up transformer that results in 220V AC supply at the secondary winding. All these functionalities are done here by implementing PIC 18F25K22 MCU unit that resembles the change-over section of commercial MPS section implementing by analog circuitry.

Intelligent Processing and Battery Charging System

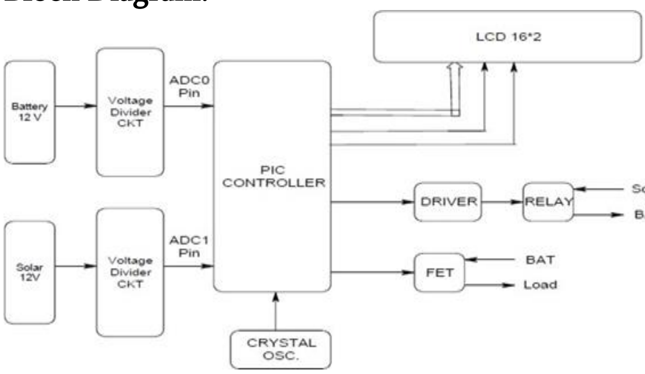
In absence of solar energy, it is mandatory to use AC mains to charge storage battery. But, in daytime, it prefers solar energy to AC grid in battery charging for power saving purposes. To ensure maximum possible PV energy, some intelligence is applied in this proposed system. With a regular charge controller, if the batteries are low at say 12 volts, then a 40 watt solar panel rated at 2.20 amps at 18.20 volts (2.20 amps times 18.20 volts = 40 watts) will only charge at 2.0 amps times 12.4 volts or just 25 watts, losing 35% of panel's capacity. In this case the system compensates for the lower battery voltage by delivering closer to 3 amps into the 12.4 volt battery maintaining the full power of the 40 watt solar panel. The intelligent charging section involves three level of charging like absorption level charging, bulk level charging and float charging. A bulk level charging is maintained for initializing charging process for a discharged battery. When Battery voltage exceeds a critical level, charge controller maintains adsorption level charging. A full charged battery gets only float level charging that maintains trickling current (i.e. one tenth of full charge current) causes available solar energy being unused.

Output Power system

Implementing such configuration described in previous section, maximum utilization of photovoltaic energy is not yet confirmed practically. In semi-urban areas, where load- shedding are not much frequent, almost 80% of available solar energy are being left unused. To utilize such power, this system contains an output pin that supplies additional DC power to small loads likes in mobile charging application, DC fan, DC light, DC iron, electric filters etc.

III. SYSTEM DEVELOPED

Block Diagram:



Block Diagram of solar charger Controller circuit

HARDWARE:

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig 1 shows complete hardware for the charging system Which LCD display is connected to show battery voltage as well as grid and panel voltage .In our system two inputs and one output we were provided. In which inputs are provided for grid and panel respectively, output is provided for the connection of load.

Fig 2 shows Lead-acid batteries are available in several different configurations like small sealed cells with capacity of 1 Ah to large cells with capacity of 12,000 Ah. Lower and higher cut-off voltages can be changed with the help of modes. In this project, we are using battery of 12V, 18 Ah capacity.

In Fig 3. Shows Solar cells produce energy by performing two basic tasks: (1) absorption of light energy to create free charge carriers within a material and (2) the separation of the negative and positive charge carriers in order to produce electric current that flows in one direction across terminals that have a voltage difference. In this project, we are using solar panel of 12V.

IV. RESULT

Charging by raw without load

Time (in minutes)	Raw Voltage (V)	Battery Voltage (V)
0 (Start)	11.9	11.3
20	12.4	11.7
32	12.2	11.8
40	12.4	11.9

Charging by PV without load

Time (in minutes)	Panel Voltage (V)	Battery Voltage (V)
0 (Start)	12.2	11.3
15	12.2	11.7
30	12.3	11.8
50	12.0	11.9

V. FUTURE WORK

Here we can also implement a fine adjuster of output DC voltage level to power large possible and even tiny loads. A voltmeter can also integrate for this purpose at the output section to make this as user-friendly as possible.

VI. CONCLUSION

This project presenting topology of hybrid charging system for sort of electric vehicle, which is generally used to reduce use of non-renewable source of energy, which is fairly significant. This study develops a system that provide a circuit by which we can charge EV's using solar as well as grid power, to mostly reduce pollutants emission from power generation and transportation sector in a suitable way.

VII. REFERENCES

[1]. Sheikh, Mohr Rizwan &Sheikh, Sirajuddin & Waghmare, Santosh & Labade, Suvarna & Tekale, Anil. (2017). A Review Paper on Electricity Generation from Solar Energy International Journal for research in applied science and engineering technology.

[2]. Kabir, Ehsanul & Kumar, Pawan & Kumar, Sandeep & Adelodun, Adedeji & Kim, Ki-Hyun. (2017). Solar energy: Potential and future prospects. Renewable and Sustainable Energy Reviews.

[3]. Falvo, Maria & Sbordone, Danilo & Bayram, I. Safak & Devetsikiotis, Michael. (2014). EV charging stations and modes: International standards. 2014 International Symposium on Power Electronics, Electrical Drives, Automation and Motion, SPEEDAM 2014.

[4]. M, Brandl & H, Gall & M, Wenger & Lorentz, Vincent & Giegerich, Martin & Baronti, Federico & G, Fantechi & Fanucci, Luca & Roncella, Roberto & Saletti, Roberto & Saponara, Sergio & A, Thaler & Cifrain, Martin & W, Prochazka. (2012). Batteries and battery management systems for electric vehicles.

[5]. Richard Corkish, Solar Cells (Encyclopedia of Energy, 2004)

[6]. PV Technology "Photovoltaic: Sustainable Power for the World." 08 Oct 2005.

[7]. Nation Center for Photovoltaics. "Turning Sunlight into Electricity." 20 Oct. 2002.

[8]. Rahmani, Fatemeh. (2018). Electric Vehicle Charger based on DC/DC Converter Topology.

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