MPPT SOLAR CHARGE CONTROLLER WITH THREE STAGES BATTERY CHARGING

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ABSTRACT

Energy is one of the issues that is causing the most controversy as fossil fuels are the greatest pollutants and the greatest contributors to the house hold equipment's or lighting. The global warming revolution of environmental concern, fuel savings and unavailability of power has led to the renewal of interest in natural source of energies. This is for interest in developing countries whose energy consumption rate is increasing at a very fast rate should be investigating new energy systems based on renewable energies that do not pollute and which are inexhaustible such as the Solar system. In this thesis research a simple, reliable and effective solar panel charging system has been introduced consisting of a solar panel of desired size and shape. This developed solar panel charger is consisted with an embedded system, which contains three modules one is dc to ac converter, second is micro-controller/compiler module and third is charging output and a battery system. This whole system regulates the electricity produced, after being converted to ac from dc between the storage battery and charging output with the help of MPPT system which is programmed to combat the situations in presence and in absence of input supply and able to supply stored energy at night or in unavailability of solar source.

Keywords: Renewable Energy, Solar Energy, Embedded System, Battery, MPPT system

I. INTRODUCTION

Present PV chargers use MPPT charging algorithm of optimizing cell voltage according to battery requirement to increase throughput of solar cells this scenario presents a fault, which occurs when cells are providing voltage above or below the battery requirement in order to match the current requirement of batteries this design can be improved by load variation across PV module.

The rapid depletion of conventional fossil fuels and environmental concern have resulted in extensive use of renew- able energy sources for electrical power generation. Energy is the convertible currency of technology. Without energy the whole fabric of society as we know it would crumble; the effect of a 24 hour cut in electricity supplies to a city shows how totally dependent we are on that particularly useful form of energy. Computers and lifts cease to function, hospitals sink to a care and maintenance level and the lights go out. As populations grow, many faster than the average 2%, the need for more and more energy is exacerbated. Enhanced lifestyle and energy demand rise together and the wealthy industrialized economies which contain 25% of the world's population consume 75% of the world's en ergy supply [1]. The use of new efficient photovoltaic solar cells (PVSCs) has emerged as an alternative measure of renewable green power, energy conservation and demand-side management [2]. Renewable energy is the only hope and it is the area of latest

research which needs a revolution to make an effective solar panel charging system for the regulation of the flow of current to the desired output and saving the battery from receiving extra voltage and increasing the life.

II. MODELLING OF VI MODULATOR

A **charge controller**, **charge regulator** or **battery regulator** limits the rate at which electric current is added to or drawn from electric batteries. It prevents overcharging and may protect against overvoltage, which can reduce battery performance or lifespan, and may pose a safety risk. It may also prevent completely draining ("deep discharging") a battery, or perform controlled discharges, depending on the battery technology, to protect battery life. The terms "charge controller" or "charge regulator" may refer to either a stand-alone device, or to control circuitry integrated within a battery pack, battery-powered device, or battery recharger.

III. MODELING OF MAXIMUM POWER POINT TRACKING (MPPT)

It is a technique that grid connected inverters, solar battery chargers and similar devices use to get the maximum possible power from one or more photovoltaic modules. Photovoltaic solar cells have a complex relationship between solar irradiance (W/square meter), temperature and total resistance that produces a non-linear output efficiency which can be analyzed based on the I-V curve. It is the purpose of the MPPT system to sample the output of the PV cells and apply the proper resistance (load) to obtain maximum power for any given environmental conditions.

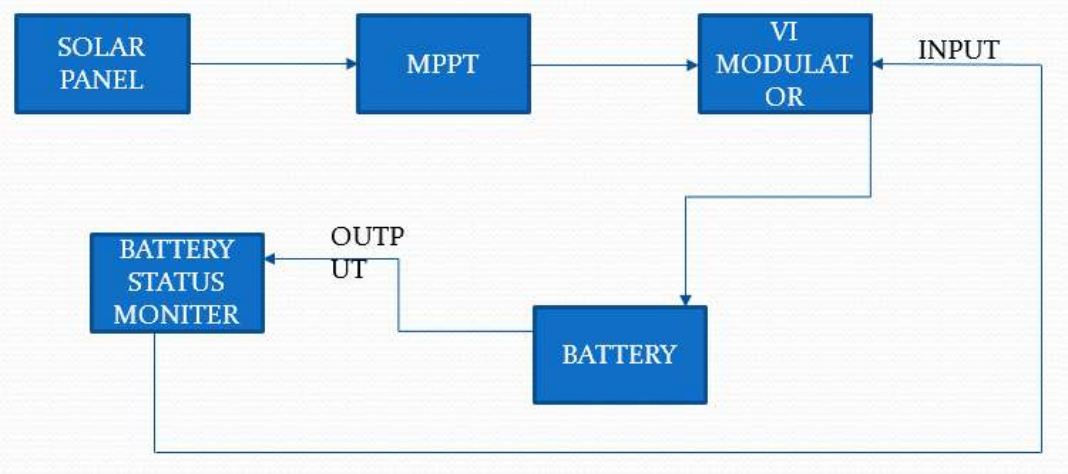


Figure.1. Block Diagram for the Proposed System

The model consists of a:

- SOLAR PANEL
- POWER MONITOR
- SOLAR PANEL AND CURRENT MONITOR
- SWITCHING BATTERY CHARGER
- BATTERY CHARGER MODELING
- CONTROLLER
- SPICE MODEL OF THE CONTROLLER

IV. PROBLEM STATEMENT

A small effective system comprising of four modules, first the stepping down the dc voltage from Xv to Yv(say) for the MPPT system process to take place, secondly inverting the dc to ac, followed by the relay action of switching and finally passing it to the MPPT system module where it is governed as per the situation of the battery of the module as well as of the system.

V. PROPOSED METHOD

The designed system will solve several of the situations where the solar panel is shown incapable and not worthy for the work. As the system switching the different modes of the battery in the system and in the applied area. Here is the general information describing the overall system, we get the supply from the solar panel system which is step down as per the requirement and inverted if needed which sends us to the next level of relay where the switching takes place as per the command of MPPT system. Considering the three situations in when solar panel is connected:

a) Firstly when the output is connected, in this case the current flows directly to the output, once the output requirements are fulfilled, it automatically switches to the next mode with the help of a MPPT system being regulated by MPPT system and commanded to relay, fixed to a certain level and glowing the led for the same.

b) Secondly the switched mode transferred to the charging of the battery placed inside the system for emergency usage, follows the same function of charging and when fully charged to the level of MPPT system given it switches the current to the initial stage.

c) Thirdly the initial stage current not entering the sys- tem when both the stages are fulfilled prevent the further depletion of batteries which can be caused if extra current runs through them and increasing the life of the system.

Here the design shows the various connections inside the system taking place.

Input from the solar panel

Stepping down the voltage

Inverting the voltage

Relay switching the different modes as per the

As soon as the battery of output is filled up the system cut-off the supply and glow the respective device.

And doing same for the system battery and glows the led after the system cut off.

And finally when both the tasks are performed it returns the supply to the input point.

VI. REQUIREMENTS

1. Solar panel: - any solar panel as per the need and requirement.
2. A normal storage battery: - as per the model required
3. A MPPT system: - preferably atmega16L
4. A relay: - 12V/5V or as per the requirement
5. Invertor: - to convert dc to ac voltage
6. MPPT system Programming.

VII. VI MODULATOR

7. LED/Electricity Consuming Device: - signifying the battery is full and VI Modulator system to cut off the supply.

VIII. CIRCUIT DIAGRAM

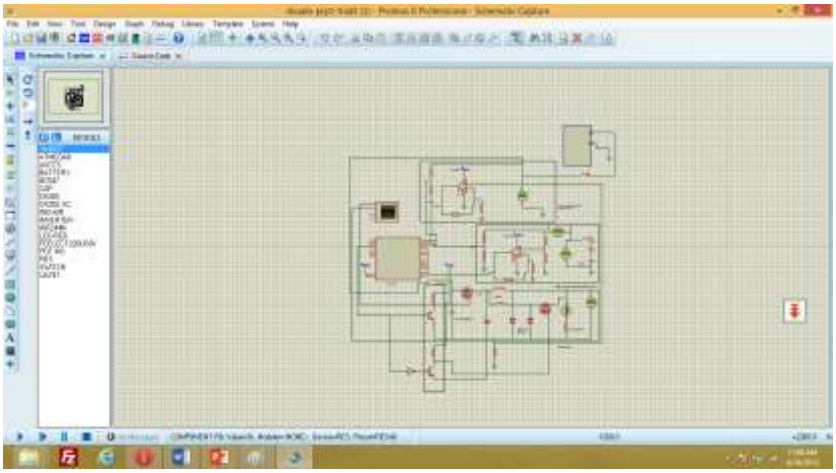
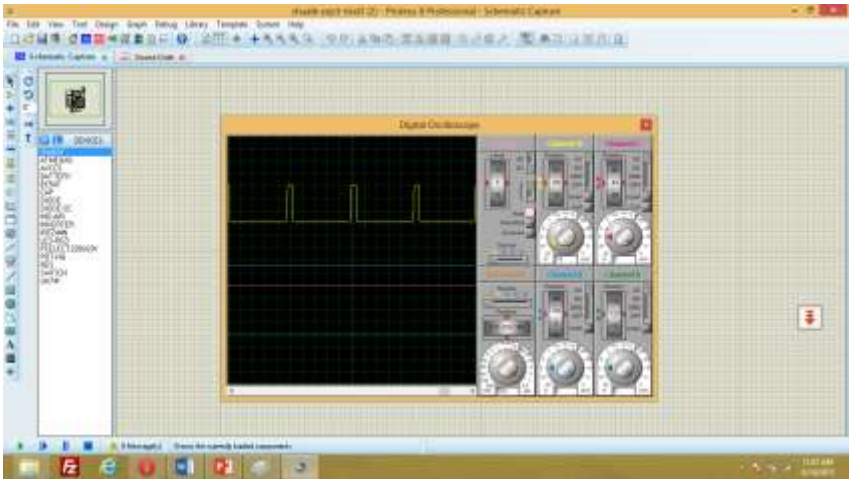


Figure 2: Designed Proposed Circuit

IX. OUTPUTS



X. CONCLUSION

As discussed in the paper the proposed system will be very effective for solving several situations where the solar panel is incapable and not worthy for the work. The proposed

Effective charging system can be extended to any level, any set-up, which only involves the small embedded kit with the three essential modules empowering the renewable energy.

- The overall aim of this project was to develop a small/large scale battery charging system, which include power management functions and a user interface.
- From the start, it was obvious that a DC-DC converter would be used as the source and the load are both DC. After it was found that a suitable DC-DC converter for the system could not be sourced it was decided

to design and build a converter specifically for this project. This would also provide a greater understanding of the DC-DC conversion process and the theory behind choosing the components. A buck converter was designed, as the output voltage to the load would always be lower than the voltage output by the solar panel.

- Power management functions came in the form of maximum power point tracking.

REFERENCES

[1] Fells I. The problem. In: Dunderdale J,(1990) editor. En- ergy and the environment. UK: Royal Society of Chemistry.

[2] Abu Tariq, M. Asim, Mohd Tariq (2011) "Simulink based modeling, simulation and Performance Evaluation of an MPPT for maximum power generation on resistive load", 2nd International Conference on Environmental Science and Technology,Singapore.

[3] Khan, B.H., (2006), Renewable energy re- sources,TataMcGraw-Hill Publishing Company Limited, New Delhi, India.

[4] Altas. I, A. M. Sharaf, 2007 "A photovoltaic array (PVA) simulation model to use in Matlab Simulink GUI environ- ment." IEEE I-4244- 0632 -03/07.

[5] PV Cells http://en.wikipedia.org/wiki/Photovoltaic_cells

[6] PV cell equivalent circuits and characteristics http://emsolar.ee.tu-berlin.de/lehre/english/pv1/index.html

[7] I-V and P-V charactersitics of a Solar Cell http://www.chuck-wright.com/SolarSprintPV/SolarSprintPV.html

[8] Shell ST10 solar panel http://www.solarelectricsupply.com/Solar_Panels/Shell/ST10.html

[9] WU Yu-rong, ZHANG Guo-qin. Design of single phase photovoltaic grid-connected inverse system based on DSP [J].RELAY.2008,36 （4）:51-53

[10] LI Dong-hui, WANG He-xiong, et al. Research on several critical problems of photovoltaic grid-connected generation system [J]. Power System Protection and Control. 2010,38（21）:208-214.

[11] ZHOU Nian-cheng, YAN Li-wei, et al. Research on dynamic characteristic and integration of photovoltaic generation in micro grids [J]. Power System Protection and Control.2010,38（14） : 119-127.

[12] ZHANG Chang- hua. Design and MPPT Control of Home Photovoltaic Generation System [J]. Journal of Hubei University for Nationalities (Natural Science Edition)..2011,29（2） : 194-196.

[13] HE Wei-wei, YANG Jin-ming. Research on Photovoltaic Maximum Power Point Tracking System [J]. Power System Protection and Control. 2008,42（8）:30-32

[14] Q. Zeng, L. Chang, P. Song. SVPWM-based Current Controller with Grid Harmonic.