*International Journal of Research in Engineering and Science (IJRES)*
*ISSN (Online): 2320-9364, ISSN (Print): 2320-9356*
*www.ijres.org Volume 5 Issue 8 ‖ Aug. 2017 ‖ PP.61-65*

# A Low Power Wireless Sensor MPPT Circuit Network Work

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***ABSTRACT:*** *This project presents a new system configuration for a photovoltaic energy system. The proposed design is for a boost converter. This configuration allows the sources to supply the load separately depending on the availability of the energy sources. Maximum power point t r a c k e r ( MPPT) c i r c u i t s p e c i f i c a l l y designed for wireless sensor nodes (hence effective, flexible, and power- aware), i.e., a power transferring circuit for optimally conveying solar energy into rechargeable batteries. High efficiency is granted by an ad hoc adaptive algorithm which, by keeping the PV cell in its optimal working point, maximizes energy transfer from the solar cell to the batteries. The suggested implementation is particularly effective in critical weather conditions where traditional solutions do not work and is characterized by a flexible enough design for immediately hosting, in a plug in fashion, different solar panels and battery topologies. The model of the proposed scheme has been built using MATLAB/SIMULINK. The complete model of the system has been presented in detail. Also, simulation results are presented and described.*
***Keywords:*** *Photovoltaic, Solar Energy, Boost Converter*

## I. INTRODUCTION

Environmental friendly solutions are becoming more prominent than ever as a result of concern regarding the state of our deteriorating planet. With increasing concern of global warming and the depletion of fossil fuel reserves, we are looking for sustainable energy solutions to preserve the earth for the future generations. Other than hydro power, photovoltaic energy holds the most potential to meet our energy demands. Similarly, solar energy is present throughout the day but the solar irradiation levels vary due to sun intensity and unpredictable shadows cast by clouds, birds, trees, etc. The common inherent drawback of photovoltaic systems is their intermittent natures that make them unreliable. Several PV power systems have been proposed and discussed in works eg.see[2]. Most of the systems in literature use a separate DC/DC boost converter connected in parallel for each of the renewable energy power sources. Solar cells are long lasting sources of energy which can be used almost anywhere. They are particularly useful where there is no national grid and also where there are no people such as remote site water pumping or in space. All energy sources should be exploited to extract the available energy; among the others the solar one is most effective in outdoor applications. The success of wireless sensor networks and their pervasive use is somehow constrained by energy supply which, generally provided by batteries, is a finite resource. Energy harvesting mechanisms must hence be taken into account to grant a long time operational life, with solar energy being the most interesting one in outdoor deployments due to its relatively high power density. In this paper we propose a low-power maximum power point tracker (MPPT) circuit specifically designed for wireless sensor nodes (hence effective, flexible, and power- aware),in fig 1 i.e., a power transferring circuit for optimally conveying solar energy into rechargeable batteries even in not optimal weather conditions. High efficiency is granted by an ad hoc adaptive algorithm which, by keeping the MPPT electronics in its optimal working point, maximizes energy transfer from the solar cell to the batteries. The suggested implementation is particularly effective in critical weather conditions where traditional solutions do not work and is characterized by a flexible enough design for immediately hosting, in a plug in fashion, different solar panels and battery typologies.

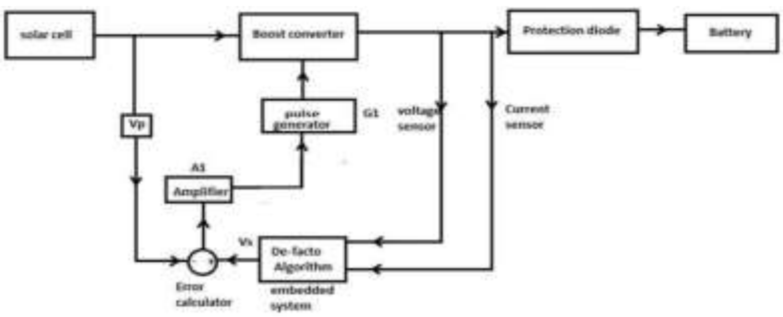


**Fig 1.** Block diagram of MPPT system

## II. DESIGNING A LOW-POWER, ADAPTIVE TRACKING POWER CONVERTER SYSTEM

The design of MPPT composed of two parts i) voltage controllable power converter (ii) a control system. Initially the power is taken from the renewable energy source i.e solar energy which would give p-v curve and V-I curve as in fig 2 &3. If the line impedance matches with the load -load impedance then there is no need for the MPPT system whereas if the changes appear there comes the requirement of the MPPT system. In order to boost the voltage according to the requirement, the voltage and current is sensed and fed into the embedded system which acts as a carrier for the algorithm which is to increase or decrease the voltage accordingly. From this de-facto algorithm one reference voltage is taken and compared with the providing voltage $V_p$ where error is detected and amplified in A1, which grants that $V_p$ input is kept at the optimal reference point of voltage Vs, A1 is an extremely low power unit (50-A supply current) with a reasonable large bandwidth (200-kHz gain– bandwidth product) and provides an amplified control error $V_s$-$V_p$. To stabilize the output voltage by operating its power switch at fixed duty cycle while the entire integrated power stage is turned on and off to control the power flow is accomplished by the hysteretic comparator C1 and the square wave generator G1. According to the error developed, the switching of the boost converter increases and correspondingly it is sent to the battery for storage, here we make use of nickel metal hydride rechargeable battery which is easily chargeable, low discharge rate, low size and weight, and also it gives longer life than Alkali. Again the process of MPPT continues till we get the required voltage.eg .see [6].

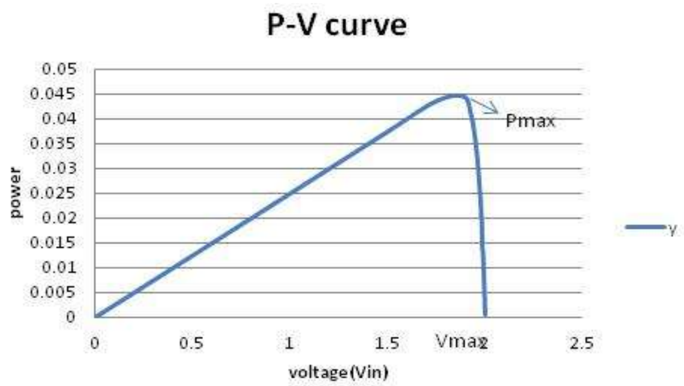


**Fig 2.** P-V curve of solar cell

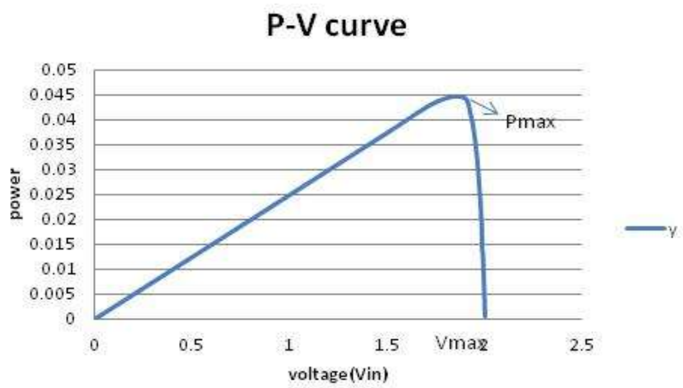


**Fig 3.** V-I curve of solar cell

## III. ADAPTIVE CONTROL ALGORITHM

Existing solar energy harvesting solutions for solutions for wireless sensor nodes envisage a simple on/off-threshold charge mechanism relying on a diode connecting the cell with the rechargeable battery, but it have certain drawbacks which can be addressed by adding MPPT to it with required algorithm. Here we use de-facto algorithm fig 4 which is mainly used for low power wireless sensors.

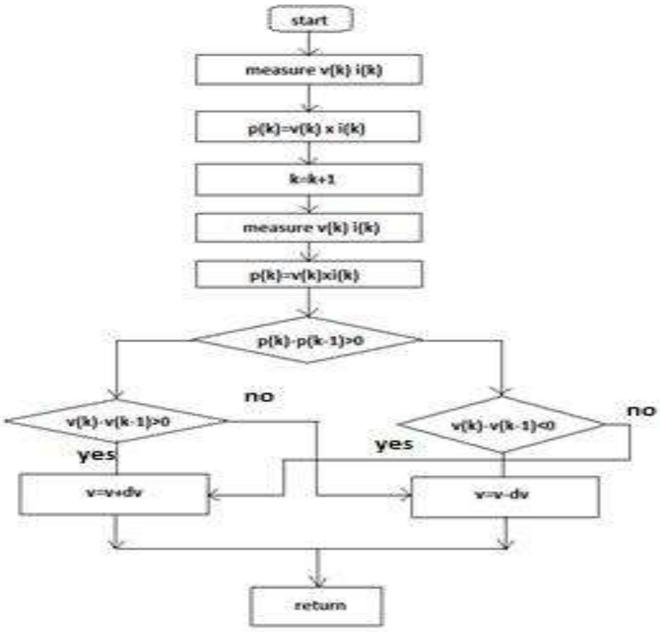


**Fig 4.** Control algorithm for identifying optimal Vs

The above mentioned algorithm is the modified P&O in which the power less than is not considered. Initially the system waits for turn on of the converter, amplitude exploration takes place where the maximum power point is been found and waits for threshold value. Again it see whether power is coming from the cell, according to the gradient value the increment and decrement value of voltage is done. From this the tracking of maximum power point is continuously done for the required voltage eg .see[3].

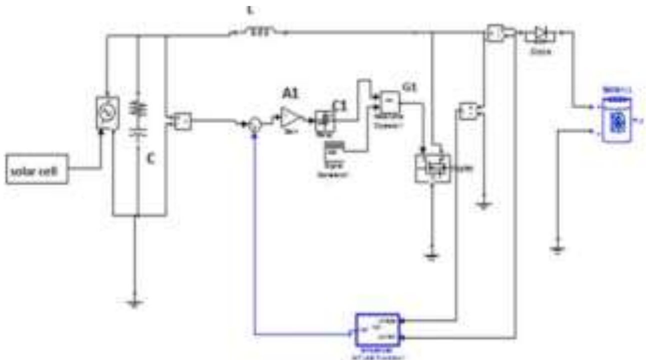


**Fig 5.**Simulation of MPPT system

During operational activity the controller also monitors the battery voltage and disables the converter whenever the voltage is above a safety voltage threshold. Moreover, the controller performs a digital zero compensation of the current channel readings, sampling the channel before the converter is turned on. This digital zero compensation is necessary since the low current/low power analog current reader has an intrinsic bias which needs to be removed to grant an accurate detection of the zero power condition.

## IV. EXPERIMENTAL RESULTS

The experimental results fig 7 are simulated in MATLAB and shown for both solar cell and MPPT for the input voltage 2V with the constant duty cycle of 0.6 the switching frequency of the system is 1kHz

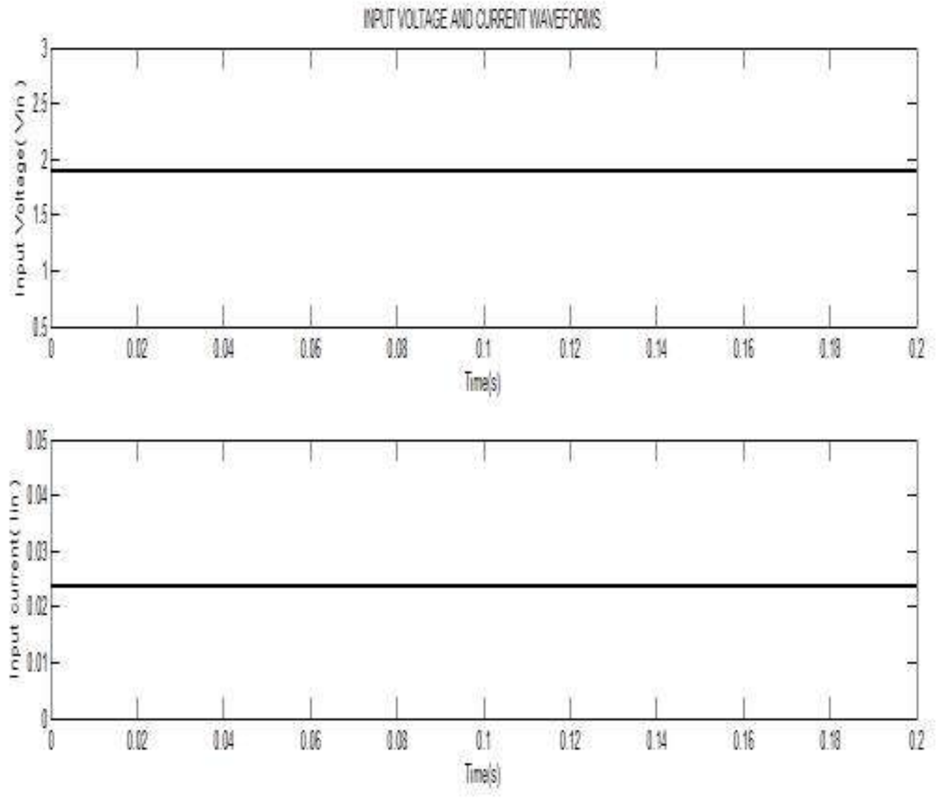


**Fig 6**. Input voltage & current waveform of cell

The experimental set up fig 5 is to adopt for changing weather condition but in order to check the operation of our new MPPT The above is provided with input voltage and current from the single constant irradiance. The aim of our system is to obtain the 4v as the output. Since we need a small incremental voltage for sensors. Initially the manual reading are taken by changing the load to obtain p-v & i-v curve to find which is the maximum power point of the that particular cell.

## V. CONCLUSION

The conventional energy resources are not enough to fulfill the needs of society, that's the reason for going alternative energy sources like renewable energy sources. Renewable energy is the energy generated from natural resources like solar, wind and tidal etc. Solar energy is the radiant light and heat from the sun, which can be converted directly into electrical energy by using photovoltaic effect. Solar energy has been recognized as important natural energy resources because it is clean, abundant and pollution free. The success of wireless sensor networks and their pervasive use is somehow constrained by energy supply which, generally provided by batteries, is a finite resource. Energy harvesting mechanisms must be taken into account to grant a long time operational life, with solar energy being the most interesting one in outdoor deployments due to its relatively high power density. a maximum power point tracker (MPPT) circuit specifically designed for wireless sensor nodes (hence effective, flexible, low cost and power-aware), i.e., a power transferring circuit for optimally conveying solar energy into rechargeable batteries. Existing MPPT circuits, such as those used for traditional outdoor applications, a r e not suitable for wireless sensor network nodes; there it is assumed that the generated power is high enough to make negligible the power consumption units, the size of the solar panel must be as small as possible and a traditional MPPT circuit would consume, in the best case, all the generated power of the MPPT electronics. A MPPT has been suggested in the project to maximize the power generation from a small, low power solar cell. The entire design of the system, from the power converter to the digital control system has been expressly designed for low power, independently from the specific nature of the solar panel and the battery type show that the suggested control system is able to generate an energy transfer rate particularly high also when the cell is in shadow or the weather is cloudy, differently from existing solutions for WSN nodes that do not produce energy in these situations.

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