Development and implementation of Solar Panel based power management system

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Abstract: *Due to increase demand of electrical energy, solar energy is used to generate electrical energy which is natural source. Although solar energy is available throughout the day its isolation varies from morning to evening and with changing climatic conditions. As the efficiency of solar PV panel is low it becomes mandatory to extract maximum power from the PV panel at any given period of time. Several maximum power point tracking (MPPT) techniques are proposed for the purpose. Incremental conductance MPPT technique has higher steady-state accuracy and environmental adaptability. High frequency DC-DC Buck Boost converter is used to interface PV panel with load and MSP430 controller is used to control the system.*

Keywords: **Solar Panel, DC-DC buck-boost converter, Battery, MPPT Algorithm, MSP430 Controller**

INTRODUCTION

Solar energy is a simple energy which is provided from the Sun. This energy in the form of radiation which make the production of solar electricity possible. Now a day's Solar energy is very important part of every once life and rapidly most of the person is trying to learn that how to use this important natural resource and how to use this natural source to replace traditional energy sources. It can be control like other type of energy source and can used to generate electricity to run different field. Best and important part of this energy is free energy source.

Where power supplies are not available like space and remote places, to make electricity solar energy is used. To generate electricity by using solar power it becoming less costly and many conditions it is better and competitive with energy from oil and coal. Now Solar energy use in satellite system. With use of PV panels most of the satellites are engineered. Because of PV panel they can capture sunlight and can convert these arrays into electrical energy. This electricity power the satellites..Solar power is also useful in areas where standard electricity is not available. For example, research facilities in Antarctica depend on sustainable energy sources, such as the sun and wind turbines, to generate power.

In recent year because of electricity problem occurs solar power got lot of attentions. It is important to proper distribution of solar power into different devices to reduce wastage of solar energy that is called power management. In this project proper energy distribution will be done. This technique brings out the more efficient different area energy management system to reduce power consumption in different area. Objectives of this system are study about MPPT, Buck Boost converter designing as per requirement and specifications of solar panel and proper power management of solar energy.

RELATED WORKS

Yuncong Jiang al. have proposed a system in which, they presented the requirement of photovoltaic system which is MPPT. In which importance and basic principle of MPPT are discussed. Also discuss the conventional method and proposed method, which is perturb and observe algorithm. This method shows efficiency of PV module and compare with other method [1].

Shin Idenoue et al. have presented, MPPT algorithm is used for PV generator that can be used for tracking accurately by comparing with incremental conductance and instantaneous conductance of PV array. The result shows that developed incremental conductance has tracked successfully using microcontroller even if rapidly changing atmospheric condition and get higher efficiency that others [2].

Hassan abouobaidaet al. have presented, the dc/dc converter is used for measurement of output power for PV array. POP algorithm which gives PV output power by changing voltage and current values. PV output power change is detected by comparing voltage level of present and previous. MPPT is used for accurate power generation [3].

M.Kaliamoorthy et al. have presented a low power MPPT which is used to maximize the energy. Energy generation of solar cell is maximizing from small, low power cell. The entire design of system is used for low power operation. Also that system check the weather condition that shadow and cloudy type, when control system is able to generate an energy transfer rate. That system produces solar energy using wireless sensor network node[4].

FebusReidj G et al.have presented, to design and analyze dc/dc converter for different types in solar energy system and it is used to determine the performance of dc/dc converter. In this uses simple method, this combines PI converter and discrete time control for tracking maximum power point of solar array. The implementation has based on digital signal processor. In this experimental MPPT algorithm carried out buck, boost and buck-boost converter. Compare efficiency with different system. The system uses step down converter for high efficiency[5].
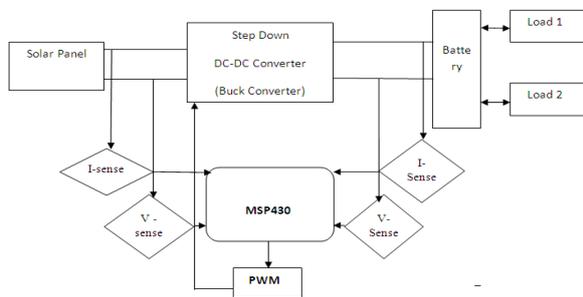
I. SYSTEM DESCRIPTION

Fig. 1 Proposed Block Diagram

A buck converter is inserted between the panel and the battery where it is used to interface PV panel with load. A buck converter is a DC - DC converter in which the output voltage is always increase or decrease than the input voltage, and pulse width modulation circuit is used to control the voltage of the buck converter. The duty cycle of the PWM output is controlled by MSP430.MSP430 is 16bit processor with von Neumann architecture and it is designed for low power applications. In this system MSP430 used for control the duty cycle of the PWM output. Here also use current and voltage sensing circuit. Current and voltage sensing at input and output is done to measure power at input and output respectively. Where output power should nearly equal to the input power. Hence to observe this, voltage and current sensing is to be done.

This project is based on priority and available power. The priority information is sent by several devices then controller checks the received priority and available power. If 100% power is available, power is equally dist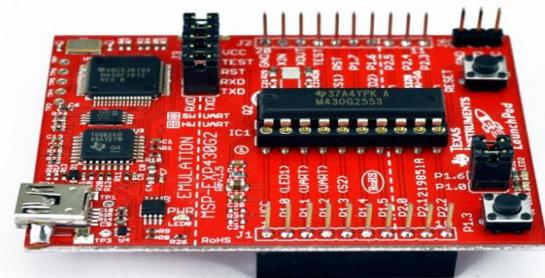ributed to all the devices. If less power is available the priority is checked and power will first supply to device with high priority and vice versa.

II. CALCULATION OF SLOPE

MSP430 Controller:-

A MSP430 based microcontroller from Texas Instruments.MSP430 is developed by Texas Instruments as an extremely low power 16 bit architecture for use in low power, low cost, energy constrained embedded applications The Hardware used is the MSP430 Launch pad from TI which contains a programmer/Debugger + two microcontrollers making it an ideal platform to start learning about MSP430G2xxx controller.
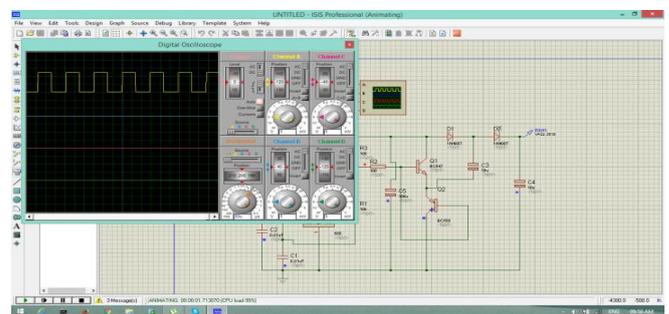

Fig. 2 MSP430G2 Launch Pad

III.RESULT

Fig. 3 Simulation output of Buck Boost Converter

Fig.3 shows the simulation output of Buck Boost converter. In this overall system used 60Watt,12Volt Solar Panel which have 40A/hr capacity of store the energy and selected 18Watt-20Watt power 2 LED load.

IV. CONCLUSION

A buck-boost converter for solar panel is designed which output voltage is increase or decrease than input voltage. A 60 Watt, 12 Volt solar panel is used. The output voltage of buck- boost converter is 21 to24 Volts. This voltage is given to battery which is of 12 Volts.

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