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Solar Charge Controller Using MPPT

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***Abstract*— In the developing world various technology develop every day hence there is required more energy. The energy demand increase day by day we need to find innovative solutions as our available resource are going to short. The use of solar energy is comparatively less to other available energy sources at present. This paper presents detailed design, implementation of solar charge controller using Maximum Power Point Tracking (MPPT) technique. Solar controller charged the constant voltage battery under varying atmospheric condition. We used MPPT algorithms for getting maximum power from solar panel. This power from the solar panel is use to charge battery. Solar energy is stored in the battery. The solar charge controller is also designed to display the battery voltage by LCD for user friendliness. The solar charge controller designed using a DC/DC buck converter whose switch was controlled by a PWM signal generated by the pic 16f877a microcontroller to regulate its output. The microcontroller generates the PWM signal after its MPPT algorithms analyzes and decides the ON time PWM signal**

Keywords—MPPT, DC/DC buck converter, pic16f877a microcontroller, LCD.

I. INTRODUCTION

Renewable energy sources are fast becoming an alternative to traditional fossil fuels due to their advantages of being clean and inexhaustible mainly. Solar power is one of the renewable energy sources and although it has high potential its generation efficiency (conversion of solar energy to electricity) is low with most commercial solar panels having efficiency of less than 30%. With this already low power generation efficiency of solar panels to ensure high efficiency. Since the I-V characteristics of solar panels vary with atmospheric condition such as irradiance, more power can got out of solar panel by using Maximum power point tracking (MPPT) methods [1]. The main principle of MPPT is to extract the maximum power from photovoltaic solar panel to make the system more efficient. MPPT compare solar panel voltage with set reference voltage and then decide the generation of PWM pulses according to that pulses battery get charged. Using MPPT solar charge controller reduces the number of PV module that need to be installed to generate certain power by maximizing the power generated from critical number of PV modules needed to generate the power at high efficiency[2]. Also reduce power loss while moving solar panel. Our project objective is to charge the battery with constant voltage at any atmospheric condition.

II. LITERATURE SURVEY

With increasing global population, energy demand has grown exponentially leading to depletion of natural resources we have heavily been relying on e.g. coal, oil and natural gas. This has not only depreciated the longevity of these resources but has also detrimentally affected our global climate. The renewable energy sources are thus more desirable throughout the world to reduce greenhouse emissions. The main renewable sources are biomass, geothermal, tidal, hydro, solar and wind. The solar energy is not as efficient as other energy sources like coal, but develop in the electronics field is used to create very stable and efficient resource to overcome the problems associated by using solar panels [3]. The many of growing market of portable electronic devices, a large number of battery power has been required. Especially battery charge using green source that is using solar energy[4].

Recently as increase in environmental pollutions and fuel exhaustion the development of renewable energy systems has been required. Because of this the photovoltaic (PV) power generation system is become a solution. Photovoltaic system produce electric power without generating environmental pollution. It directly transforming solar radiations into electricity [5] .

This project uses MPPT to charge battery, to improving efficiency and reducing overall cost of the system.

III. MAXIMUM POWER POINT TRACKING

To charge constant voltage battery, we required to continuously track maximum power from the solar panel. Without using MPPT solar charge controller is like connecting the battery directly to the solar panel voltage. As earlier traditional solar charge controller may charge a battery with the less voltage hence battery not charge properly. The voltage and current (VI) characteristic of a solar panel is shown in fig.1[3].

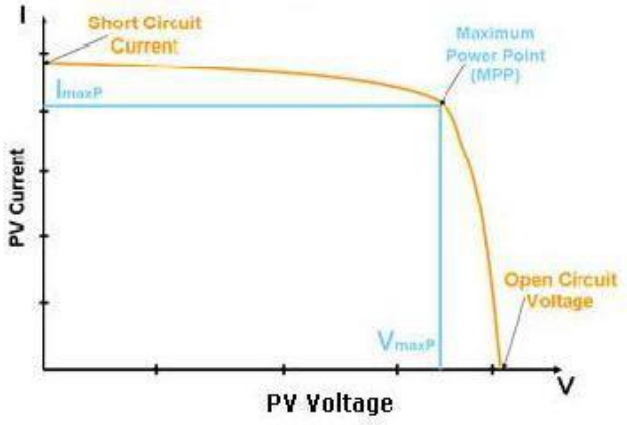

Fig.1. Solar panel voltage/current characteristic

Maximum power point tracking algorithms used to getting the maximum power point of solar panel. MPPT checks the output of solar panel, compare it to reference voltage then produce PWM signal to switch ON/OFF of buck converter. If solar panel voltage less than reference voltage then PWM pulse ON time is more and if it is more than reference voltage then PWM pulse ON time is less hence at any condition battery charge with constant voltage. This all process is controlled by pic 16f877a microcontroller.

IV. SPECIFICATIONS

A. Solar panel

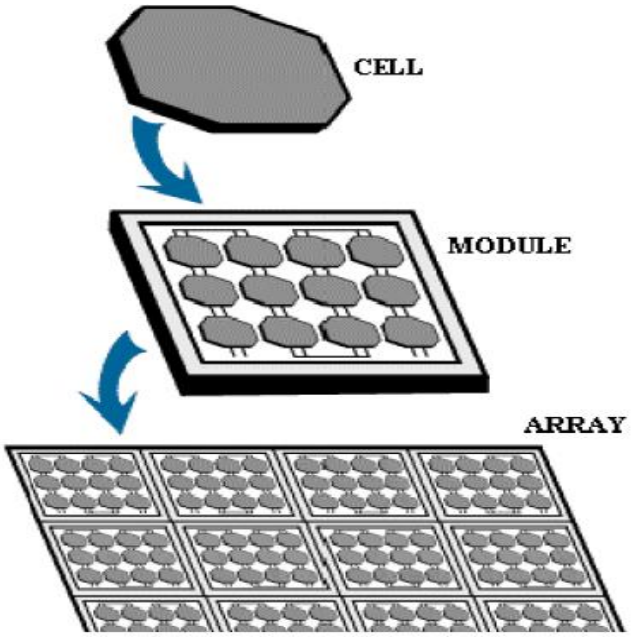

Fig.2. Solar panel

Above figure shows solar panel it consist of array of cell to form photovoltaic module. Solar panel is main component to get used of solar energy.

B. PIC16f877a

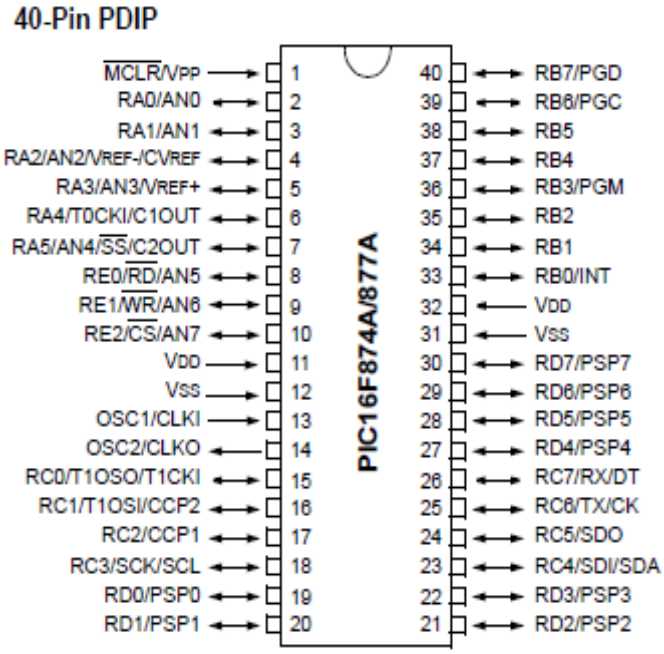

Fig.3. PIC16f8777a

It is 40 pin low power microcontroller. It has 10 bit 8 channel analog to digital converter, also has two capture compare PWM modules.

C. Buck converter

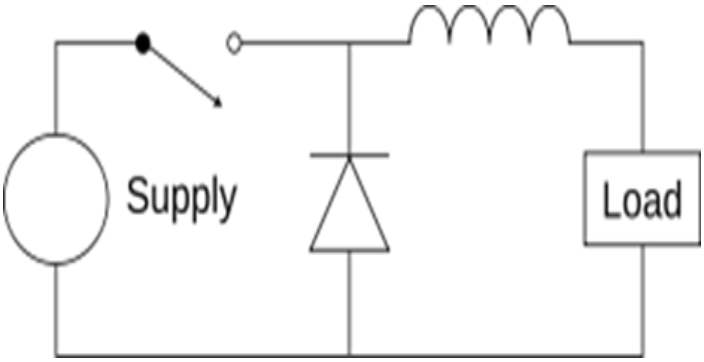

Fig.4. buck converter

A buck converter is DC to DC power converter which is steps down voltage from its input to output.

D. LCD

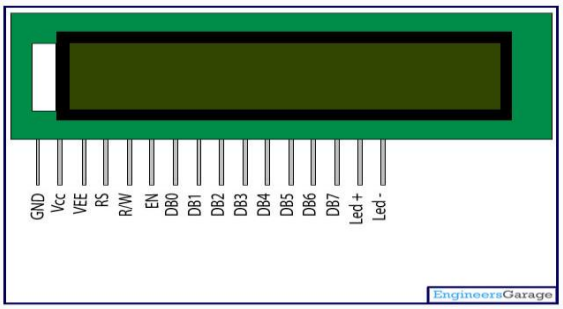

Fig.5. LCD display

LCD(Liquid crystal display) screen is an electronic display module and find wide range of applications. A 16x2 LCD display is very commonly used device. 16x2 LCD means 16 character and 2 line

V. BLOCK DIAGRAM

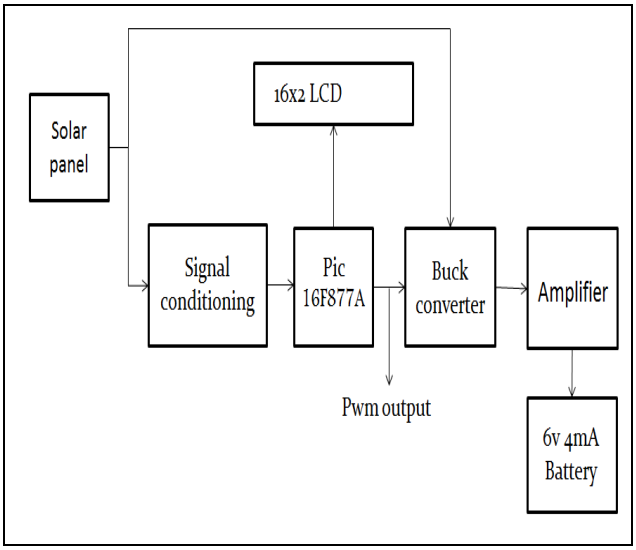

Fig.6. Block diagram

Solar panel extract energy from sun. the voltage of solar pane is given to signal conditioning and buck converter. Signal conditioning is mainly voltage divider circuit. this block output is given to ADC pin of pic 16f877a microcontroller. It compare input voltage with reference voltage and according to that PWM pulse is generated. microcontroller also control LCD is used to display battery voltage. The PWM pulse give to buck converter according to pulse switch ON/OFF. Output signal of buck converter is amplify and give to battery. The battery get charge to constant 6 volt.

VI. ANALYSIS AND RESULT

Maximum power tract from solar panel and battery get charge with constant voltage. Battery charge at constant voltage even there is minimum sun rays i.e morning an evening also.

ADVANTAGES

- Battery can charge continuously with minimum sun rays intensity.
- The Use of microcontroller ensures reliability of the system.
- The system is user friendly hence can be easily operate by users

.APPLICATIONS

- It is used in street lighting.
- It can be used for many industrial purposes.
- It can be used for battery charging and portable charging.
- It used in prone farming, in Aerospace.

CONCLUSION

The Solar charge controller charge constant voltage battery at any atmospheric condition .This system is user friendly as we used LCD to display battery voltage. The maximum power point tracking method make solar charge controller more efficient.

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