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SOLAR MAXIMUM POWER POINT TRACKING SYSTEM AND ITS APPLICATION TO GREEN HOUSE

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ABSTRACT:

In this paper a low voltage, low cost & high efficiency based solar maximum power point tracking system for green house applications is presented. The main controlling element is the micro controller programmed in c language in order to extract maximum solar power point. In addition we use buck converter for MPPT. Further this maximum power is utilized to drive pumps and fans of green house. Sun is a very abundant source of power. Even so, only a fraction of the entire energy is harnessed and that too not efficiently. The main cause of this is the high cost of installation of solar cells. Also solar cells are mostly kept fixed, so they do not obtain the optimum amount of sunlight throughout the day. A new micro-controller based solar-tracking system is proposed implemented and tested. The scheme presented here can be operated as independent of the geographical location of the site of setting up. The system checks the position of the sun and controls the movement of a solar panel so that radiation of the sun comes normally to the surface of the solar panel. The developed-tracking system tracks the sun in the single plane. PC based system monitoring facility is also included in the design. In this paper we have proposed a single axis tracker for our discussions. This avoids the complexity of construction and usage.

Keywords: LDR, SOLAR PANEL, ARDUINO UNO.

1. INTRODUCTION:

The world constraints of fossil fuels reserves and the ever-rising environmental pollution have impelled strongly during last decades the development of renewable energy sources (RES). The need of having available sustainable energy systems for replacing gradually conventional ones demands the improvement of structures of energy supply based mostly on clean and renewable resources. At present, photovoltaic (PV) generation is assuming increased importance as a RES application because of distinctive advantages such as simplicity of allocation, high dependability, absence of fuel cost, low maintenance and lack of noise and wear due to the absence of moving parts. Furthermore, the solar energy characterizes a clean, pollution free and inexhaustible energy source. In addition to these factors are the declining cost and prices of solar modules, an increasing efficiency of solar cells, manufacturing-technology improvements and economies of scale. Photovoltaic modules are interconnected assemblies of photovoltaic cells (solar cells) packaged in a weather tight housing. Modules are rated and called out by their wattage as measured under factory controlled Standard Test Conditions (STC is equal to 1000 W/m2 at 25◦C and 1.5atm). In addition, every module has a maximum voltage (Voc) and current (Isc). These characteristics are used by solar designers to create an efficient PV system.

2. RELATED STUDY

PV cells are made of semiconductor materials, such as silicon. For solar cells, a thin semiconductor wafer is specially treated to form an electric field, positive on one side and negative on the other. When light energy strikes the solar cell, electrons are knocked loose from the atoms in the semiconductor material. If electrical conductors are attached to the positive and negative sides, forming an electrical circuit, the electrons can be captured in the form of an electric current and generate electric power. This electric power can then be used to power a load [1-3]. A PV cell can either be circular or square in construction. The power that one module can produce is not sufficient to meet the requirements of home or business. Most PV arrays use an inverter to convert the DC power into alternating current that can supply loads such as motors, lights etc. The modules in a PV array are usually first connected in series to obtain the desired voltages; the individual modules are then connected in parallel to allow the system to produce more current [4].

A simple and popular model of the PV cell is the one representing it with an equivalent circuit consisting of a single diode [1-2]. In such a model, the ohmic losses can be taken into consideration by including a series resistance and/or a shunt resistance. When both the series and shunt resistances are considered, the model of the PV cell, which is shown in Figure 2 (a), requires computation of five parameters in order to establish the current-voltage relationship that characterizes the cell [3]. The number of parameters becomes four when only the series resistance is taken into consideration [5, 4-7]. The four parameters model is shown in Figure 2 (b). An attractive feature of the aforementioned models is that most of the calculations only rely on the data provided by the manufacturer. Another important feature is the fact that these models can be used in representing a single cell, a module of connected cells, or even an array of modules. The single diode model is suitable for system-level designs. However, experiments requiring high accuracy at the expense of complication can use more complicated models such as the two diodes model [7, 8].

3. METHODOLOGY

The prototype model of a solar microcontroller based greenhouse working on basis of maximum power tracking will be made in the following steps:

• Complete layout of the whole set up will be drawn in form of a block diagram.

• Day and night sensor will first sense the condition and give its output to the microcontroller.

• The photovoltaic panel will be mounted at an optimum angle of 67 degree in the month of April for the latitude of Chandigarh as referred from

Solar Electricity handbook 2013 edition solar electricity from the vertical as on a d.c. motor driven by a driver I.C. such that the panel moves and the microcontroller checks the output voltage at various points.

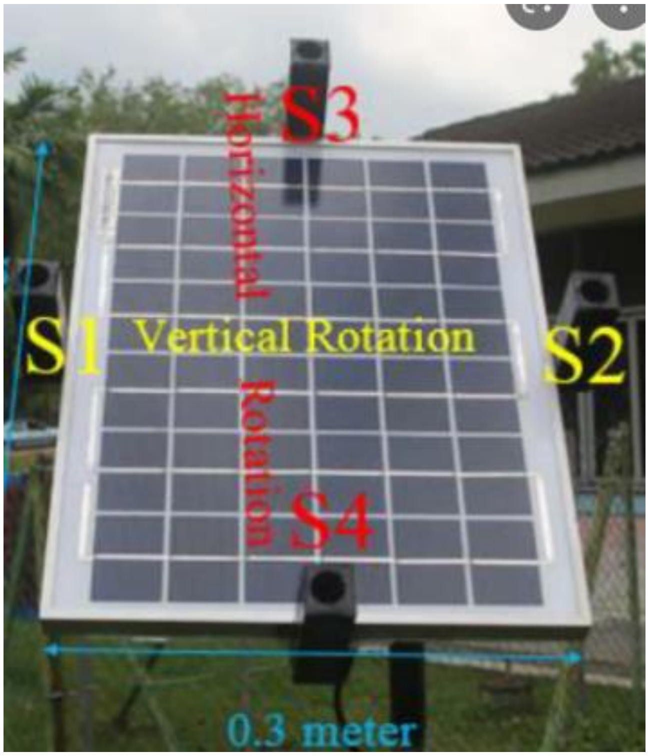
- Identification of points where maximum voltage and hence maximum power received by the solar panel.
- Maximum power will be detected by MPPT Algorithm developed, then fed to Analog to Digital converter and stored in microcontroller.
- The motor and hence the panel will be stopped when maximum power will be received by the solar panel and hence will start charging the battery.
- A check on soil, humidity and temperature can also be kept using sensors and solar energy stored can be used to run a water pump and water air pump so as to maintain different parameters at an optimum level [5].

OPERATION:

SOLAR TRACKERS: Solar tracker is a device which is used to collect the solar energy emitted by the sun. Solar tracking is Nothing but changing position of panel With respect to sun. Usually photo voltaic module assembled in solar tracker is more powerful than critical irradiance in the fixed system. Solar trackers are classified on basis of performance, coast respectively. by tracking system we can catch 40-50% more efficiency compared to fixed panel. Among them dual axis provides increased efficiency of 48% as compared with single axis tracker. Advantage of Dual axis trackers is catching the position of the sun anywhere in the sky due to seasonal variations. The following figures represent solar tracking systems. The main aim of this proposal is to implement high efficiency solar tracker.

Fig.1. Hardware system.

The principle of the solar tracking system is done by Light Dependant Resistor (LDR). Four LDR's are connected to Arduino analog pin AO to A4 that acts as the input for the system. The built-in Analog-to-Digital Converter will convert the analog value of LDR and convert it into digital. The inputs are from analog value of LDR, Arduino as the controller and the DC motor will be the output. LDR1 and LDR2, LDR3 and LDR4 are taken as pair .If one of the LDR in a pair gets more light intensity than the other, a difference will occur on node voltages sent to the respective Arduino channel to take necessary action. The DC motor will move the solar panel to the position of the high intensity LDR that was in the programming.



CONCLUSION

The use of both LDR and RTC sensor makes it easy to track the sun path. LDR sensor is used when there is no obstruction between sun and solar panels the intensity of light decides the position of the solar panels because LDR sensor reacts to intensity of the light. And when there is cloudy weather the RTC sensors comes into action ,programmed RTC sensor positions the solar panel as the path of sun is stored in the program and micro controller controls the sensors. Dual axis gives ease of rotation of solar panels.

FUTURE SCOPE: This type of solar panels is the future of humans. As in remote areas electricity is yet to be introduced Solar panels can be provided to the remote areas so that electricity can be used everywhere. As solar energy is a renewable form of energy power will be generated by any means.

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