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Solar Powered DC Home Lighting System

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ABSTRACT: The aim is to eliminate load shedding and problematic blackout conditions, further offering cheap and continuous supply of electricity for both large and small consumers. In past few years, growing demand for sustainable energy increases the consumption of solar PV. Since generation from solar PV is in DC and most of the appliances at home could be operated on DC. In the proposed system, the solar panel is fixed and the roof top of house. The dc LED bulbs are fixed by wiring the circuit. The panel is tilted according to the suns position and the energy is saved in the battery. Producing maximum output for solar powered applications producing maximum output for solar powered applications. A high step up dc-dc converter which has series connected forward fly back converter using transformer technology to increase the performance with an advantage of high power conversion efficiency and high system reliability.

KEYWORDS: Photovoltaic panel, charge controller, Battery, Microcontroller.

I. INTRODUCTION

Renewable energy resources such as solar photovoltaic (PV) became more popular over the last decade due to increasing environmental awareness and tax exemption policies on the solar PV systems. Integration of solar PV using various smart load management techniques will boost the efficiency of the overall system by reducing the massive cost of electricity bills. The continuing fear about limited resources of fossil fuels and abrupt change in environmental conditions has pinched the consideration of power generation using renewable energies. World leading countries are also giving incentives to encourage the integration of these renewable energy sources (RES) with our existing systems. Therefore, increasing demand for these RES further enhances its credibility and unlocks different ways for individuals to utilize this cheap energy in this expensive world. But still, there is a need to find efficient and expert ways to enjoy these RES exclusively.

Recent developments in RES such as solar PV provide magnificent opportunities for concrete implementation of smart grid at individual level with further advancement of integration of battery storage and self-switching or controlling of smart appliances automatically. Hence, foremost achievement is the utilization and absorption of smart grid technologies using smart load management schemes in residential region, which in result gears to lessen energy price plus demand management more smartly.

For large number of purposes energy is required. Some traditional energy used from coal, oil, natural gas, nuclear energy is exhaustible and polluting. So an alternating source that is renewable solar energy is used as it is a good option and the electricity produced is clean, reduced cost and long lasting. The growth of solar in the past years have been expanded the importance of photo voltaic panels. the power conversion fundamental is represented by a PV panel unit of a PV generator system. The solar isolation of a PV module is responsible for the output characteristics since it has some linear characteristics. It is necessary to design and model for the applications which require it. To obtain the maximum power from the solar panel an algorithm used is maximum power point tracking technique. The voltage output from the solar panel is regulated from a boost converter.

II. RESEARCH METHOD

A) Photovoltaic Model:

A photo voltaic cell is a device which generates electric power using solar cells to convert energy from the sun into a flow of electrons. A PV Module refers to a number of cells connected in series in a photo voltaic array; modules are

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connected both in series and parallel. Environmental problems such as green house and polluting emissions to the atmosphere are reduced by large use of photovoltaic (PV) cells. voltage-current(V-I) curves, voltage-power (V-P) curves, maximum power point values, current in short-circuit and voltage in open-circuit across a area of irradiation levels and cell temperatures are accurately predicted. The linear curve depending on irradiation and temperature. Both V-I and V-P curves have a maximum mount which is often called as Maximum Power Point (MPP).
The output voltage of a PV Cell is basically a function of the photon current which is determined by load current mainly depending on solar irradiation level during the operation.

III DC HOME LIGHTING SYSTEM

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–n junction diode that emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the colour of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. LEDs are typically small (less than 1 mm2) and integrated optical components may be used to shape the radiation pattern.
LEDs have many advantages over incandescent light sources, including lower energy consumption, longer lifetime, improved physical robustness, smaller size, and faster switching. Light-emitting diodes are used in applications as diverse as aviation lighting, automotive headlamps, advertising, general lighting, traffic signals, camera flashes, lighted wallpaper and medical devices. They are also significantly more energy efficient and, arguably, have fewer environmental concerns linked to their disposal

IV.HARDWARE IMPLEMENTATION

A.SOLAR PANEL

Solar panels or more technically photovoltaic (PV) panels are a solar home electric system's enabling component. There can be various types of solar panel but mainly there are only three types of solar panel i.e., monocrystalline, polycrystalline and amorphous thin film type solar panel. Monocrystalline cells are being sliced out from ingot of pure crystalline. They are black in colour and they can absorb maximum sunlight falling on the surface if set at correct angle. The efficiency of monocrystalline cell is around 19- 20%. Polycrystalline cells are being made of pure silicon cut offs, unlike monocrystalline their cells are not perfectly aligned in one direction and thus interconnection losses may occur which reduces its efficiency to 13-15%. Amorphous thin film efficiency is around 6-10%. The Panels are made of wafers or cells of semiconductor material that use sunlight (photons) and the photovoltaic effect to generate direct current (DC) electricity.

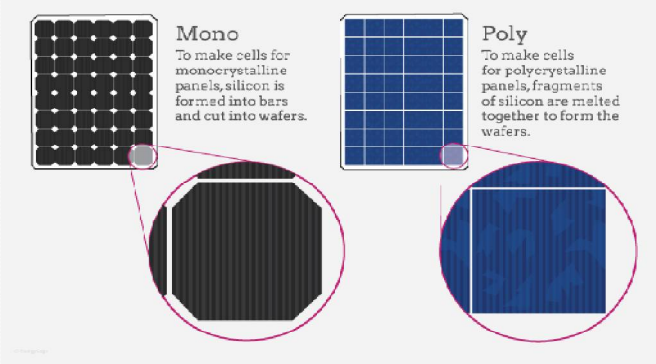

Fig 1: solar cell

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The different cell technologies are used to represent different energy conversion efficiencies and manufacturing techniques which are used in trying to reduce the cost of photovoltaic generated electricity. The photovoltaic technology is constantly evolving day by day in the direction of better conversion efficiency and lower cost. Each solar cell can generate a predetermined voltage and current under certain manufacturing and physical constraints. A solar panel is a series and parallel combinations of identical cells to generate the desired power output (current and voltage). Panels are assigned a power rating in watts which depends on the maximum power they can produce under ideal sun and temperature conditions. By knowing the rated power output we can determine how many panels are required to meet the electrical load demands. Multiple panels combined together are called solar arrays. There is a directly proportionality between solar panel cost and output power. The solar panel is approximately 50% of the total initial equipment cost of a SHS.

B. SOLAR CHARGE CONTROLLER

A solar charge controller manages the power going into the battery bank from the solar array. It ensures that the deep cycle batteries are not overcharged during the day, and that the power doesn't run backwards to the solar panels overnight and drain the batteries. Some charge controllers are available with additional capabilities, like lighting and load control, but managing the power is its primary job.

A solar charge controller is available in two different technologies, PWM and MPPT. How they perform in a system is very different from each other. An MPPT charge controller is more expensive than a PWM charge controller, and it is often worth it to pay the extra money.

C. BATTERY

Almost all solar electrical applications uses a lead-acid type of battery chemistry to store energy. This is because of the battery's storage capacity to cost ratio, their wide availability, technical simplicity, and support infrastructure.

With advanced design and power packed performance, the Luminous ILT 6000 60 AH Battery is a perfect power backup solution for your home. This 12 volt battery has a tubular plate construction. The inverter battery features extra flexible and strong oxidation reduction gauntlet which ensures higher performance and extremely long life of this rechargeable battery.

Battery Capacity:

The capacity of this Luminous ILT 6000 tubular battery is 60 Ah. The UPS battery has 12V voltage. This maintenance-free battery is ideal for longer duration and frequent power cut areas. You can install the luminous inverter battery in your home as well as small office.

Battery Design:

The small and portable luminous battery measures 41 × 17.6 × 23.3 (L × W × H) cm and weighs 22.8 kg. It is a short tubular battery. This lead acid battery has long and tubular plates which ensure more back up and longer life. The plates have been especially designed for improved charge acceptance. The inverter battery is easy to maintain. The UPS battery is covered with a sleek polypropylene cover. The sealed battery is rust resistant and shock proof.

D. Load:

LED bulbs of 10w is connected to the system.1.5 sq mm pvc insulated copper wire is used for the wiring section and the bulb takes place less power consumption. The bulbs can be withstand up to 55hrs for a single bulb and the all bulbs can withstand up to 8 hrs.

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V.RESULT& DISSCUSSION

The figure shows the output from the solar panel. By using this system the lighting system can be operated independently and the system is more suitable for houses. The battery charging time is taken up to 6hrs. The bulbs can be withstood up to 55hrs for a single bulb and the all bulbs can withstand up to 8 hrs. In the rainy seasons the battery charging time take more than 6 hrs.

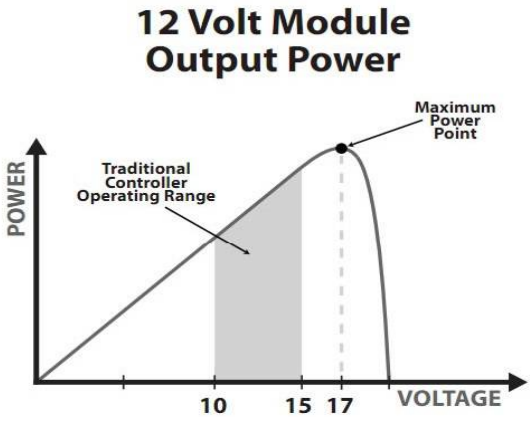

Fig 2: graphical representation of output

VI.CONCLUSION

By introducing solar lighting system the electricity bill can be minimized .The new system is going to make a change to the home. It's a low cost power system.

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