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SOLAR POWER BATTERY CHARGER

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ABSTRACT:

A solar powered battery charger is presented, where a photovoltaic (PV) panel is used to convert solar power into electric current and Solar Power Battery Charger is charges the batteries by controlling the output power of the PV panel and current sensor monitors the charging current of the battery. In the software, an optimal control algorithm is applied to see output current of pv panels and voltage of battery. The simulation and experimental results are presented and compared. The applications of this technique can be light electrical vehicles such as golf carts, scooters, airport utility vehicles, as well as other renewable power stations where batteries are used for energy storage.

Keywords: ATMega328p Microcontroller**,** Solar panel, Charge controller, Arduino (NANO), Battery, Current and Voltagesensors.

INTRODUCTION:

Applications of solar energy have been a research topic for decades. In recent years, it has attracted even more interest due to the challenges on the environment, fuel source, and automotive industries. Using solar power to charge batteries is not a new idea. A simple way to accomplish this is to connect a photovoltaic (PV) panel directly to a battery. A charge controller limits the rate at which electric current is added to or drawn from electric batteries. It prevents overcharging and protect against overvoltage, which can reduce battery performance or lifespan and may pose a safety risk.

The advantages of such a system are the simplicity and low cost. This paper presents the design of a solar powered battery charger with optimal controller. The goals of the proposed system are: 1) to convert the solar power into electricity as much as possible under the varying weather condition; 2) To charge the battery as fast as possible in accordance to the battery lifecycle condition. The application of the proposed system can be light electrical vehicles such as golf carts, scooters, airport utility vehicles, as well as other renewable power stations using batteries as energy storage.

The different non- conventional methods of power generation may be such as solar cells, fuel cells, thermo-electric generator, solar power generation, wind power generation, geo- thermal energy, tidal power generation etc. This project give idea about non- conventional Energy sources and why we are going for that non-conventional energy sources. The proper uses of solar energy and its different application which are using at home, defense sector, marines, remote area etc. Photovoltaic (PV) system is one of the most reliable, efficient and economical renewable energy system used worldwide. This system has long life, low maintenance cost and is free of pollution. Photovoltaic generation system is widely used in stand-alone or grid-tied or hybrid system.

BASIC BATTERY CHARGING METHODS

In general there are so many battery charging control methods out of this constant voltage method is easy to understand and implement**.** We have used "**constant voltage method"** in our model to charge the battery. A constant voltage charger is basically a DC power supply which in its simplest form may consist of a step-down transformer from the mains with a rectifier to provide the DC voltage to charge the battery. Such simple designs are often found in battery chargers. The lead- acid cells used for cars and backup power systems typically use constant voltage chargers.In addition, lithium-ion cells often use constant voltage systems, although these usually aremore complex with added circuitry to protect both the batteries and the user safety.

PROPOSED SYSTEM:

The main motivation to use solar power by using solar power battery charger circuit independence on availability of electricity outlet. It will provide easier, and cost- effective management. Controllers work by slowly reducing the amount of power going into your battery as it approaches capacity .When your battery is full, PWM controllers maintain a state of "trickle", which means they supply a tiny amount of power constantly to keep the battery topped off.

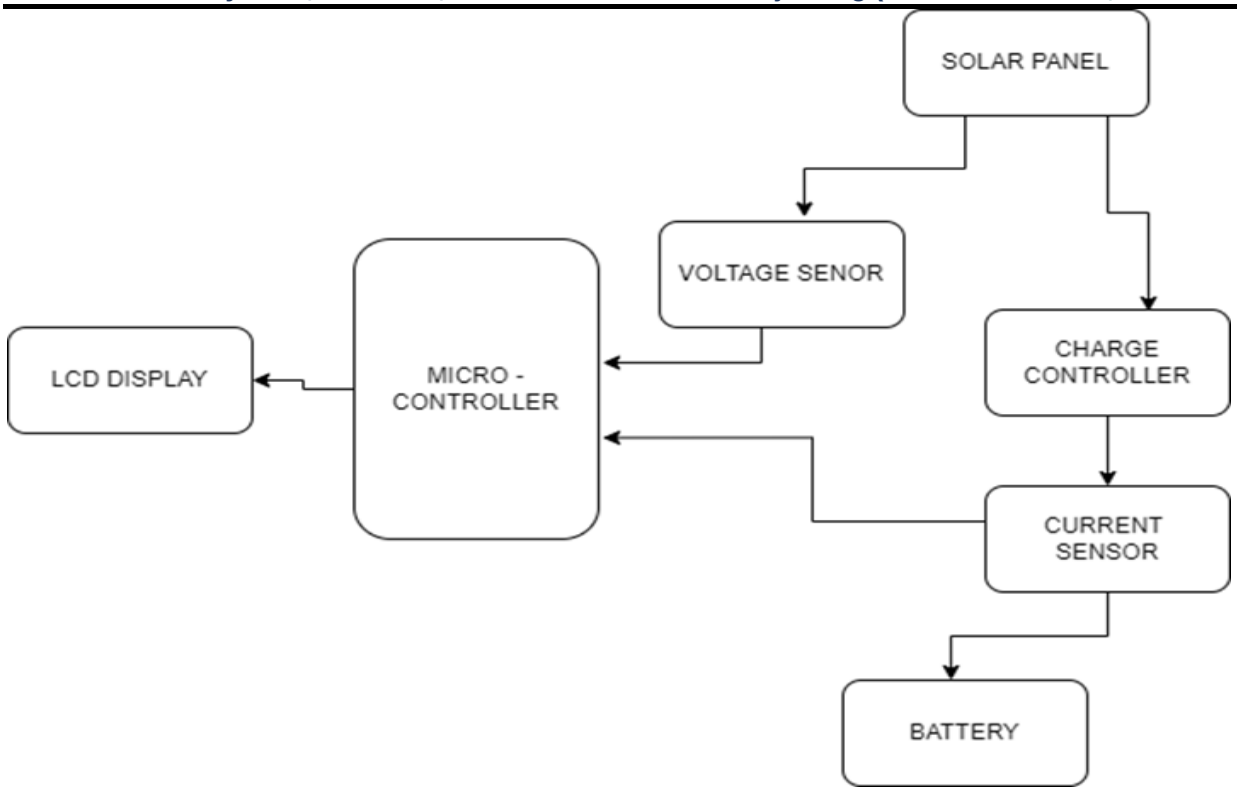

Fig.1: Block diagram of solar power battery charger assembly.

We have used lead acid battery because it has large current capability to store electric power. Another reason to choose lead-acid battery cause it is tolerant for overcharging. We used 2 batteries of 35 Amp hour whose voltages are 12 volts. A battery is a device that stores chemical energy within its active materials and converts it directly into electric energy with the help convertor circuit by means of an electrochemical oxidation-reduction (redox) reaction. When a battery is supplying power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free-energy difference is delivered to the external circuit as electrical energy.

Specifications of solar photovoltaic panel:

Maximum Power(Pmax):100+-2% W

Current at maximum power:5.2 Amp

Short circuit current : 5.73 Amp

Voltage at maximum power: 19.37 Volt

WORKING OF THE PROTOTYPE:

The current coming from solar panels goes to the battery via solar power battery charger circuit and battery stores that electric current in the form of chemical energy and converts it into electrical energy when it is needed. The incoming current from photovoltaic plates initially we have relay which acts as switch and when current exceeds its limit relay goes in off condition. Also to step downs the voltage for charger assembly at 5 volt cause our components work in 5 volt only. Used microcontroller Atmega 328p prevent batteries from being damaged by overcharging and over-discharging by controlling the current flow from panels.it regulates feeding current in batteries.

The ACS712 is a fully integrated, hall effect-based linear current sensor is used to measurement of

current flowing through circuit and feeding the batteries. And to measure the voltage of batteries Voltage Sensor is used. To show the measured data on screen we have used HD44780 LCD (16*2) LCD screen.it monitors the amount of current and voltage in an object and display on LCD screen. Arduino nano used for programming to show desired message and measured data on screen. Here we have done programming in Embedded C. We have used 2 lithium ion batteries which are 35 Amp hours which stores power.

EXPEREIMENTAL RESULTS:

Here are the hourly readings of current (feeding current) and voltages of battery

Sr. No	Time	Voltage (V)	Current(Amp)
1	8:00am	8.97	3.42
2	9:00am	9.17	3.59
3	10:00am	9.52	3.87
4	11:00am	10	4.1
5	12:00am	11.5	4.67
6	1:00pm	12.38	5.1
7	2:00pm	12.74	5.1
8	3:00pm	12.93	4.72
9	4:00pm	13.10	4.34
10	5:00pm	13.22	4.12
11	6:00pm	13.24	3.65

APPLICATION:

The applications of solar energy can be bifurcated into three types i.e. Power, domestic and agriculture. Few popular applications that can be listed under these are as follows:

1. Solar water heater
2. Tank collector
3. Portable solar still
4. Solar cooker
5. Solar steam cooker
6. Portable solar dryer
7. Solar pv street light

CONCLUSION:

This project provides a comprehensive design and implementation details of pv based battery charger system which is used to charge lead-acid battery in float charge mode as well as in bulk charge mode. Mathematical model of pv module, synchronous buck converter and battery has been provided. Experimental prototype of pv based battery charging module has been developed which is then tested in outdoor environment. It has been observed that the battery is charged in bulk mode and in the said charging mode. Experimental results demonstrate the charging of the battery.

In this project solar battery connect to the supply line parallel of the solar battery charge.it is controls the power supply by using atmega 328p microcontroller .this system provides portable, reliable power anywhere it is needed .From off-grid construction sites, to remote locations where power is not accessible or affordable without associated with traditional fuel-driven generators.

REFERENCES:

[1]H. Fathabadi, "Novel photovoltaic based battery charger including novel high efficiency step-up dc/dc converter and novel high accurate fast maximum power point tracking controller," Energy Conversion and Management, vol. 110, pp. 200–211, 2021.

[2] Y.-C. Chuang, "High-efficiency zcs buck converter for rechargeable batteries," IEEE Trans. Ind. Electron., vol. 57, no. 7, pp. 2463–2472, 2021.

[3] S. Ketsingsoi and Y. Kumsuwan, "An off-line battery charger based on buck-boost power factor correction converter for plug-in electric vehicles," Energy Procedia, vol. 56, pp. 659– 666, 2021.

[4] S. Chiang, H.-J. Shieh, and M.-C. Chen, "Modeling and control of pv charger system with sepic converter," IEEE Trans. Ind. Electron., vol. 56, no. 11, pp. 4344–4353, 2021.

[5] S. Padhee, U. C. Pati, and K. Mahapatra, "Design of photovoltaic mppt based charger for lead-acid batteries," in Proc. IEEE Int. Conf. Emerging Technologies and Innovative Business Practices for the Transformation of Societies (EmergiTech), 2021, pp. 351–356.

[6] B. Subudhi and R. Pradhan, "A comparative study on maximum power point tracking techniques for photovoltaic power systems," IEEE Trans. Sustain. Energy, vol. 4, no. 1, pp. 89–98, 2021.

[7] T. Palanisamy, S. Mendelson and D. Cipris, "A smart charger for lead acid batteries", *172nd Electrochem. Soc. Meeting*, no. 132, 1987.

[8] Commercial charger, Westinghouse Davenset Rectifiers, England.