Advanced Solar Charger

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Abstract- *Solar charger is a well-established technology in this era .We are going to design a easily portable and efficient solar charger .The main purpose of the solar chargers these days is to charge mobile and other devices. The design is an embedded application , which can continuously charge devices using solar panels and also the devices can be charged with storage batteries in absence of solar power .The monocrystalline solar module transform sunlight to energy when exposed sun through photovoltaic process. This generated energy is transferred through circuit to the lithium ion battery and stored in it. This Li-ion battery is interfaced with voltage regulators to charge the loads. The circuit is consisted of a trigger, ADC (analog to digital converter, MCU(microcontroller unit) and LED for display. The ADC generates a clock pulse and MCU controls and displays the battery status on the LED. Further this stored power in the battery is used to charge devices from the provided outputs like Type-c, Type-B, and USB etc. The findings of this research indicate a positive response that solar powered charger is as efficient as a traditional wall charger.*

Keywords- Mobile charger, Folding solar panel, Rotating solar panel, E 26 bulb output , C- type input and output , charging time indicator and function display, Camera battery charger, Lithium Ion battery, EDC(analog to digital converter, MCU(microcontroller unit) and LED display.

I. INTRODUCTION

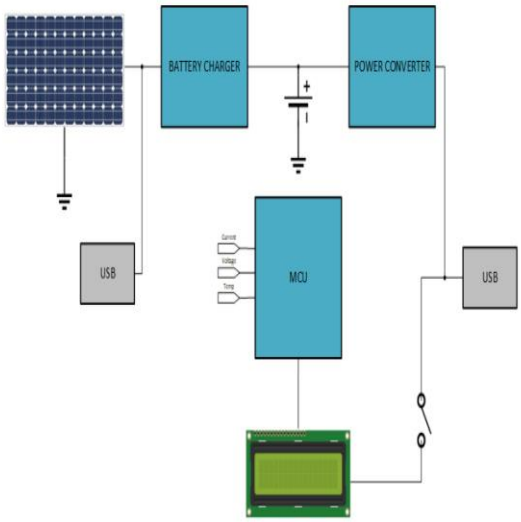
In today's world lot of inventions are being carried out for replacing non-renewable sources of energy. As Solar energy is a renewable source of energy and which is available in enormous amount so everyone is trying to use their electronic devices by solar energy. About 80% energy used these days is generated from fossil fuels present in the depth of the ocean. As we know fossil fuels are non-renewable sources of energy so these energy resources will last up to coming 40 to 50 years so to preserve these non-renewable sources of energy we should maximize the use of renewable sources of energy. There are many advantages of solar energy over the fossil fuels. Solar energy is present in enormous amount so it is an eternal source.

Effect of solar energy on environment doesn't lead to global warming;acid rain and environmental degradation as solar energy never emit pollutants in the atmosphere. The Solar cells directly converts solar energy to electrical energy. By using the lithium ion batteries we can easily store the generated solar energy in the form of batteries so we can use the generated energy for further charging devices. This battery helps us to charge electronic devices in the absence of solar power. Using this device various devices of low voltage and medium voltage can be charged easily. TheLED Display provided is used to display the charging status and it is controlled through a microcontroller.

This project can lead us to increase in usage of renewable sources of energy for our day to day life.

II. BLOCK DIAGRAM

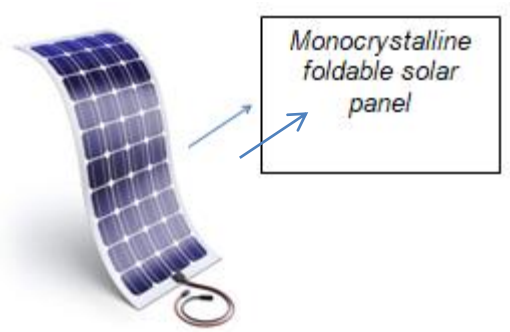
The block diagram of the solar charger shows how the device works. The energy generated from solar panel is stored in lithium batteries through the circuit. The 'MCU' that is Microcontroller units which are used for controlling functions of the products and devices automatically and remotely. The MCU controls the functionality of this device. The power generated from this device is stored in battery or can be directly provided to charge devices through various given
outputs.



III. HARDWARE DISCRIPTION

1. Solar panel-

The surface of solar panel used is monocrystalline type. Monocrystalline solar panel provides efficiency about 17.5% - 19%, having output about 10 -12 watt.So monocrystalline foldable solar panel is used in this product for higher efficiency.



There are two types of solar panels:

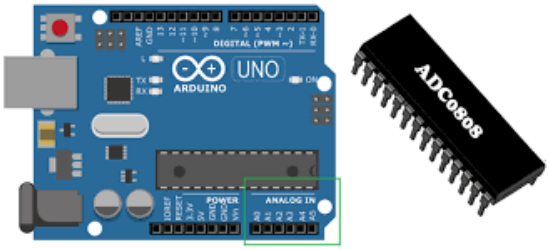
1) Rotating solar panel- Which can rotate its surface according to our need.
2) Folding solar panel - Which increases the surface area of solar panel for more consumption of sunlight in low intensity conditions. It makes the product very portable and efficient.

2. Analyzer circuit-

The analyzer circuit is consisting of three major components:

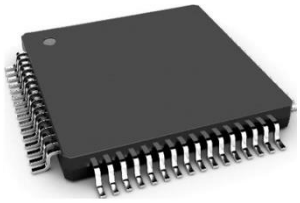
a. ADC (analog to digital converter)

ADC is used to analyze the Voltage across battery terminals and so to convert it to digital form.



b. MCU (microcontroller unit)

Microcontroller unit is used to control the functionalities of the device and also to display the charging status of battery on LED.



C. LED for display-

Led is used to display the percentage of battery. This also displays required time to charge the battery up to its capacity, number of output connected to the device etc.

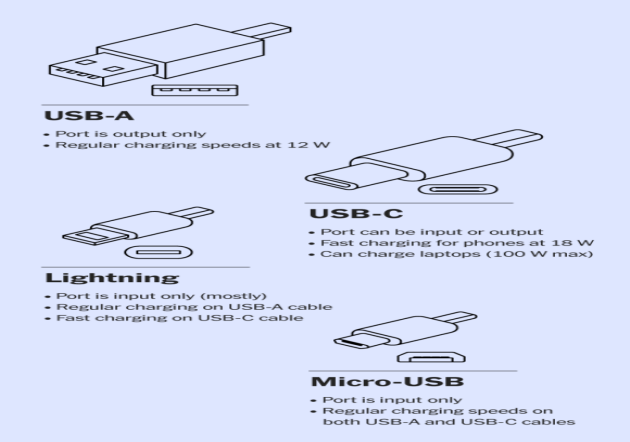
Functional display

3.Lithium Ion battery-

The Storage battery used in this device is lithium ion battery. The lithium ion batteries have greater lifespan and higher power storing capacity as compared to traditional lead acid batteries. They are also portable due to to small size and more efficient than traditional batteries.Storing capacity of the battery we have used is of 3500 mAh. Storage capacity can be varied according to the usage.

4. Different types of outputs–

We have used the different types of outputs in the product so we can charge different types of devices of different voltages. The outputs are USB Type- C, Type-B (for mobiles), Type-B mini (for iPods), E26 detachable outputs (for charging bulbs), standard USB output, Type A.

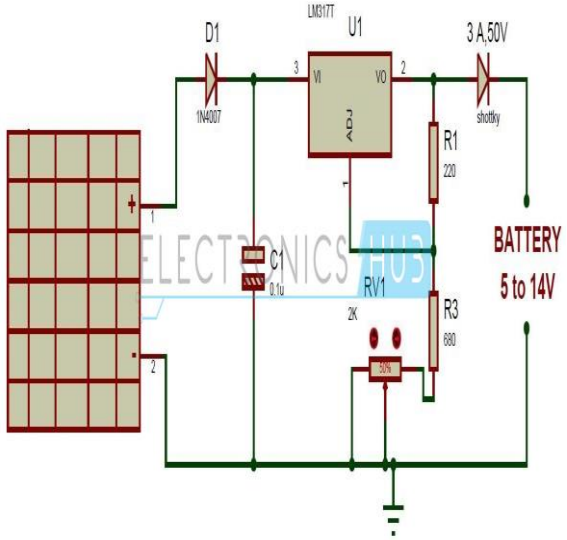


E26 detachable output-

IV. WORKING

The energy extracted from monocrystalline solar panel through the photovoltaic cells present on it used to charge the lithium ion battery. The power generated from solar panel is passed to the battery through the circuit. The battery is connected with two voltage regulators LM317T and LM7805 which controls flow of current in the circuit, and charge the voltage loads of 5 volt , 10 volt and 12 volt. The analyzer circuit requires 5 volt supply for working of MCU and LED.

In analyzer circuit Schmitt trigger is used as a timer for ADC. Schmitt triggers used in signal conditioning application. It generates a clock pulse, and then ADC analyzes the voltage across the battery terminals and converts it into digital form. The Microcontroller is used as a power tool for automation of the LED display. Then using this microcontroller charging percentage, number of outputs connected and time for charging the battery up to capacity. The digitized output generated from ADC is transfers the voltage across battery to the MCU. The voltage circuit decreases voltage up to 5 volt. According to this then few analyzes and displays the battery status on the LED panel. Is the working of solar charger.



Circuit Diagram

V. BENEFITS

- As all the relevant information is displayed on the screen it is very convenient for the user to monitor the charging status of the device.
- This device can simultaneously charge two or more devices.
- The power storing capacity of the battery can be increased according to the user's need.
- The device is very portable and very efficient.
- According to some research the efficiency of solar charger is approximately equal to traditional electric chargers.

VI. FUTURISTIC SCOPE

- This device can be very demanding in the future. To make this device future secure.
- We can opt wireless charging Technology in this device. The wireless charging can make the device more efficient and future secure.
- We also can make it permanent charger by designing small and more efficient solar panels on the rear side of the devices like mobiles, power banks.

VII. LIMITATIONS

- If the amount of sunlight incidenting on the surface of solar panel is inadequate then the amount of electricity

generated by the device will be less in amount. So this device should be kept in exposure of sunlight.

- If we have to increase the storage capacity of the battery then price of the product will be increased.

VIII. CONCLUSION

- According to researches efficiency of solar charger is about 69.80% and efficiency of traditional electric wall charger is 71%.
- So the efficiencies of both types of electric charges are approximately equal so traditional electric charges can be easily replaced by portable solar charger.

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