Design and Development of Portable Power Charger: A Green Energy Initiative

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Abstract
Owing to fast growth in the world population and aspiration of people for higher standards of living, the world will need greatly increased energy supply in the coming years, especially cleanly-generated electricity. A cleaner energy future depends on the development of alternative energy technologies to meet the world's growing energy needs. The transition to sustainable energy resources and systems provides an opportunity to address multiple environmental, economic, and development needs. The significant advances in renewable energy technologies and associated long-term cost reductions, have paved the way for sustainable energy alternative.In this paper, we have proposed the design and development of portable power charger based on renewable energy sources for generating green energy.

Keywords
Green Power, Environmental Sustainability, Energy, Renewable Energy Resources.

I. Introduction

Energy consumption has always a noticeable impact on the environment. Fast growing world population, increasing prosperity and the hunger for fuel that has developed a consequence, have led to a rapid rise in the need for energy, so to fulfill that need we require renewable resources. We must make the transition toward renewable energy as soon as is humanly possible in order to achieve the energy efficiency and environmental sustainability. Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. When it comes to sustainability issues, development means advancement in every domain viz. Economy, Social equity and Environment.Moving towards energy sustainability will require changes not only in the way energy is supplied, but in the way it is used, and reducing the amount of energy required to deliver various goods or services is essential. In this paper, we have proposed the design and development of portable green power charger to promote environmental sustainability.

II. Scope

Due to increasing concern of energy consumption in wireless communication networks, researchers around the globe need to shift their focus towards the green communication [9]. The technological growth and innovation can contribute to this vital aspect to achieve environmental sustainability. There are many compelling reasons for choosing these approaches as the environmentally friendly methods of powering the future wireless networks. PV chargers are complex devices, which can also be constructed in a simple way with reduced efficiency and performance. Various factors, in particular the degree of efficiency, are depending on the design of the PV chargers themselves, but also on the role and function of mobile phones within the power chain. After standards were introduced such as micro-USB and the 3.5 mm audio jack, the question is, which type of new standards are thought for mobile phones in future. Due to the tendency towards open source platforms, there are more opportunities for the design and implementation of PV chargers. However, user requirements and expectations can be fulfilled if design specifications for PV chargers are made. Beside a suitable size of photovoltaic, the PV charger needs to provide a high degree of efficiency. Hereby, each component of the system structure will have its individual degree of efficiency and has an influence on the output performance. It is a non-trivial task to establish a reasonable tradeoff between charging times, battery capacity, costs and size of the PV charger, since many factors come into play and have to be considered.

III. Proposed Research Work

To solve battery charging problem in an easy and cheap way, renewable energy source of solar power is used to provide sufficient energy for the portable device battery. For this reason photovoltaic (PV) solar cell is used as an energy source. The energy provided from PV cell is applied to the boost dc-dc converter to step up the input PV cell voltage to the sufficient USB output voltage. Then USB port can be used for any kind of portable devices to charge their batteries.

Although PV cell voltage can be stepped up to the USB voltage level which is DC 5 V, because of small power and voltage levels system efficiency is limited. On the other hand, acquired energy from the PV cell is limited for small portable size of solar battery charger. So, small size li-ion battery is added to the system to feed output power for fast response.

In here, PV cells energy feed dc-dc boost converter with li-ion battery to provide sufficient voltage and power to the USB port. Thus, required energy is ready for the portable device to charge its battery.

IV. Brief Literature Survey

M. Fareqet al. (2014)

The project offers to study and fabricate solar WPT using inductive coupling and studies that WPT is not much influenced by the presence of hands, books and types of plastics [1].

Christian Schusset al. (2014)

It examines the current conventional solar chargers with an aim to highlight evident weaknesses in existing system structures and proposes design specifications that make solar chargers competitive in terms of expenses as compared to USB chargers [2].

M Sitbon et al. (2014)

Describes design process and functionality of a portable two-way solar charger prototype using a lightweight custom solar panel to demonstrate the device functionality and energy yield capabilities [3].

Christian Schuss and Timo Rahkonen (2013)

Describes the various design structures, in which mobile phones

act as active or passive devices depending upon available communication between the phone and charger so as to harvest solar energy for mobile phones [4].

Burak Akin (2012)
Efficient and fast charge system is developed in POWERSIM simulation program with DC-DC boost converter [5].

Ian Y.W. Chung and Yung C. Liang(2011)
It presents an efficient solar energy harvesting circuit that is capable of making maximum power point tracking achieved by using constant voltage tracking principle implemented using discrete analog components [6].

Marc Pastre et al.(2009)
The solar battery charger has been designedusing ASIC which can be used for charging NiCd/NiMH batteries with a photovoltaic panel. It operates at low power supply voltage in the range of 0.6V to 1.5V [7].

Ke Liu and Makaran, J.(2009)
The optimal power control algorithm has been used so as to track the sunshine to get maximum output power [8].

V. Problem formulation

A. Need of Proposed Research Work
Portable electronic devices have crucial importance in today's smart world and with the fast developing technology era, battery requirements are increasing to manifold, by virtue of which there is strong need to fulfill the current power requirement appetite and it could be better option if we make transition towards renewable energy sources to promote environmental sustainability. To solve battery charge problem in an easy and cheap way, renewable energy source of solar power is used to provide sufficient energy for the portable device battery. As energy saving and environmental protection become a global demand and inevitable trend, there is an urgent need to shift our focus to energy-efficiency oriented design for the wireless mobile communication networks [10-11]. Optimizing energy efficiency through alternative energy resources will not only reduce environmental impact, it will also cut costs and help to make wireless mobile technology more affordable for everyone.

B. Significance of Proposed Research Work
Cell phones and other portable electronic video and music players are irresistible devices in our lives. Bigger screens and complex processes of these devices require high power demand which can cause battery charge problem in over use. Nowadays, smart phones and other portable electronic devices are more widely adjustable to charge via USB port. Portable device charge system is proposed by solar energy and wind energy with DC-DC boost converter. Efficient and fast charge system will be developed in POWERSIM simulation program which will eliminate the requirement of power banks or spare batteries to power the portable electronic devices.

VI. Objectives
The main objective of the proposed research work is to design and develop the Portable Green Power Charger so as to promote environmental sustainability. Other objectives are as follows:

- To design and develop the green power charger so as to accomplish the insatiable appetite of power for irresistible gadgets (like mobile phones) with renewable energy resources.
- To develop portable device in order to eliminatethe requirement of power banks (spare batteries) specifically in remote areas with Solar and Wind Energy with the aim of encouraging environmental sustainability.
- To implement the phenomena of Capture, Store and Charge for making the device more efficient and reliable.
- To step up the input PV cell voltage to sufficient USB output voltage so that USB port can be used for any kind of portable devices to charge their batteries.

VII. Methodology
Fig. 1 shows the flow chart to achieve our main objective i.e Environmental Sustainabilityusing Renewable Energy Sources (RES) viz. Solar and Wind.

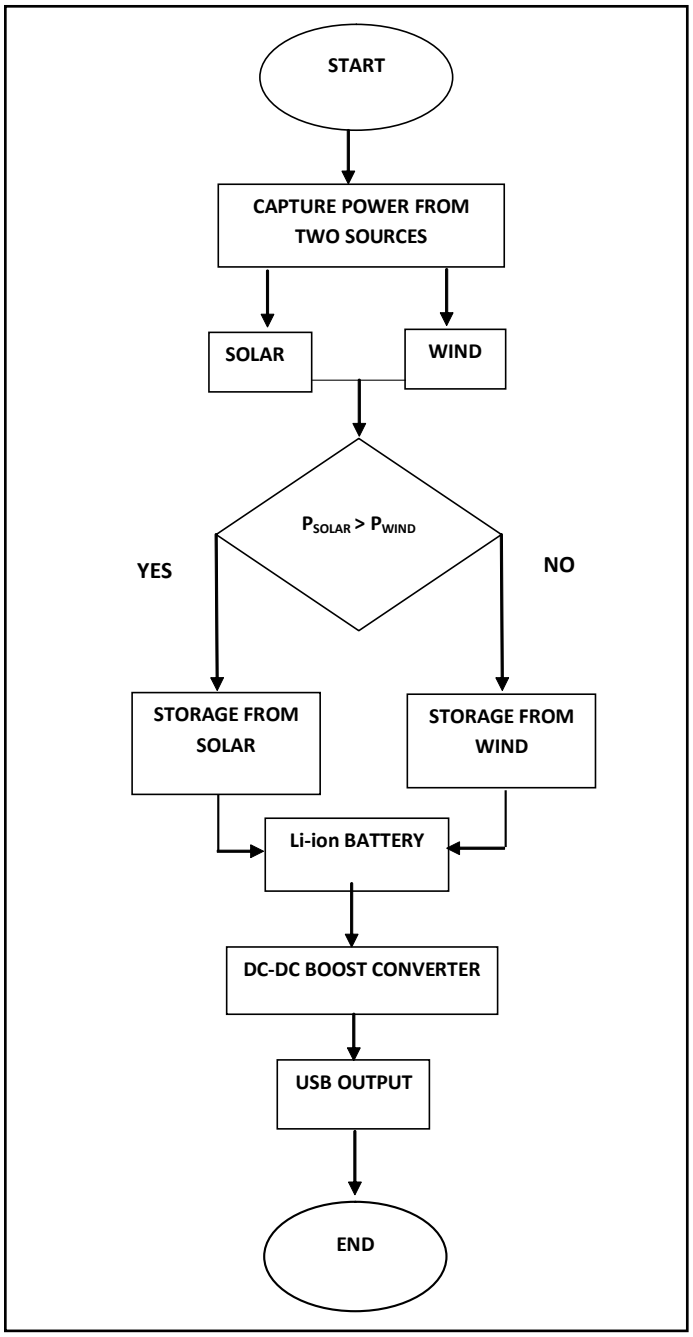

Fig. 1: Flow Chart

In order to achieve the objective that is portable green power to promote environmental sustainability, there is need to develop a handheld, universal charger/adapter device that harnesses renewable wind power / solar power and conventional wall plug power to recharge almost all your 5V digital gadgets. The concept of Capture + Store + Charge will be used to achieve the same. There are different types of energy sources, which are suitable to recharge mobile phones during a day. Out of them, solar energy is the most promising one. Cell phones and other portable electronic video and music players are irresistible devices in our lives. Bigger screens and complex processes of these devices require high power demand which can cause battery charge problem in over use. Nowadays, smart phones and other portable electronic devices are more widely adjustable to charge via USB port. While taking into account these required features, proposed design will offer necessary output to all electronic gadgets like mobile phones, Mp3 players, etc. via in built USB module.

VIII. Facilities Required

A. Hardware Requirements

1. Microcontroller PIC18f452
2. LM 741 (Op-Amp)
3. Circuit for DC-DC Boost Converter
4. Solar and Wind Module
5. USB Module
6. LCD Display
7. Li-ion Battery (2000mAh, 3.7V)

B. Software Requirements

1. MicroC PRO for PIC
2. POWERSIM (PSIM)

IX. Conclusion

Demand for energy and associated services, to meet social and economic development and improve human welfare and health, is increasing.

In this paper, we have proposed the design and development of portable green power charge to mitigate the sustainable energy challenge which can be used to charge numerous electronics gadgets like mobile phones, Mp3 players, etc. by taking green energy from the combination of solar and wind power.

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Prashant Bhardwaj has completed Masters of Technology in Embedded System from CDAC, Mohali. He has obtained his Bachelor of Technology degree in Electronics & Communication Engineering from Gautam Buddha Technical University, Lucknow in 2010. He has one year teaching experience in reputed Chandigarh University. His expertise includes electronics for medicine and biology.

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