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A Non Conventional Energy Based Mobile Charger towards Green Computing

[1]Kaushik Kumar, [2]Shrabanti Saha, [3]Aniket Kumar and [4]Sudipta Sahana*
[1]*Department of Computer Science and Engineering, JIS College of Engineering, kalyani, Nadia, W.B. India.*
[2]*Department of Computer Science and Engineering, JIS College of Engineering, kalyani, Nadia, W.B. India.*
[3]*Department of Computer Science and Engineering, JIS College of Engineering, kalyani, Nadia, W.B. India.*
[4]*Assistant Professor, Department of Computer Science and Engineering, JIS College of Engineering Kalyani, Nadia, W.B. India. * Corresponding Author*

Abstract: *Conventional energy are tapped and used abundantly at present. Keeping in observance a way of precaution is taken to upturn the use of non-conventional energy. Decreasing the use of conventional energy, a two way (or twin) hybrid mobile charger is taken in consideration for implementing both solar energy and wind energy, as the renewable sources of energy. The proposed innovative two way hybrid mobile charger can be used both all through day time and night time, while travelling by possessing the device near the vehicle window panel or motorcycle handle. Energy harvesting is explored, with a device relying on the solar panel energy observation and turbine on formation of electrical energy from solar and wind energy owing to the availability of wind and solar energy. Wind energy and solar energy is considered as the main source for the generation of energy along with AC charger input option within it. The energy generation from the use of non- conventional source of energy in the charger and AC input option will definitely bring a prodigious walkover. The novelty of the product lies in its innovation, effortless simplicity and indisputable intention, accentuating the underlying societal impact and leads towards green computing.*

Keywords: *Wind energy, Solar energy, Rechargeable battery, Energy harvesting, Green computing.*

I. Introduction

In recent days, digital devices smart phones, laptop etc. has become an omnipresent personal electronic device in people's daily lives. Users are always alert for cell phones that have an advanced technology. Especially when we are talking about "Digitalization of a country", which indirectly means the smart devices. In order to run the smart digital devices we need to charge the digital devices to remain disrupted with our ongoing task in it.However, the difficulty to charge the phone battery which commonly due to a power supply problem has not yet been resolved satisfactorily. Despite the advanced technology of mobile phone, the battery still cannot meet the increasing power demand due to the rapidly increasing functionalities of the mobile phone. In the proposed work an attempt has been made to develop a model by which wind energy and solar energy can be used to charge mobiles while we are travelling especially by train or by any other vehicle. During travelling, charging of mobile phone is a big problem as power supply source is not generally accessible. Traveling Chargers for Mobile Phones, iPods and MP3 players are available but they are expensive and need separate models for charging at home and in the car. So, in this paper a mobile charger using wind and solar energy is proposed. In the proposed work, wind energy is used to get 6 Volt with the help of generator and solar energy is used to generate 6Volt with the help of solar panel. The proposed charger will solve the problem of mobile charging during traveling, power cut and non-availability of power at remote areas. It can be easily installed in the window. As the train starts moving the wind enters the compartment and hence the fan rotates which is positioned at the window panel. The wind turbine generator produces enough energy to charge a mobile along with the solar panel. This minimizes the dependency on other source of power and makes travel pleasurable and hassle free. A simple and portable device which can be carried anywhere and can be used anywhere. It consists of minimum number of parts making it cheaper.

A clutching clamp can be provided at the bottom of the device to eases fixing the device within few minutes at required place like windows panel, motorcycle handle and etc. It would not require any special skill to install and use. Additional features provided like the solar panel at the roof top, AC input charging system and a rechargeable battery inside the device with emergency light makes it more users friendly. The solar panel and AC input source provides an alternate source of power when we are not travelling or when the wind is not sufficient to run the generator. When both wind energy and solar energy is present and we are not charging our mobiles this energy can be comfortably saved in the rechargeable battery and during the absence of both like nights are when it's raining or when the atmosphere is such that we cannot open the windows this provides an alternate means to charge our mobiles.

II. Related Work

In this section, we discuss acknowledged and published works in the annals of Conventional Mobile charger. As proposed we have basically two ways of using natural resources - first the wind energy and second the solar energy. Previously an attempt has been made by Shafiur Rahman et. al. in their paper work "Development of wind powered mobile charger" to develop a small compact and easy to carry mobile charger which utilizes wind energy to charge mobile phones with ease during travelling. It minimizes the dependability on conventional chargers. It utilizes a fan connected to a DC generator, a bridge rectifier which minimizes fluctuations. It works effectively between vehicle/wind speed of 40kmph and 80kmph. It can be easily installed in the window of the car/bus/train etc. and mobile phone can be charged directly [1].

Saikumar.P et. al. in their paper come with a solution of maintaining sustainability of energy stored in the phone battery exploration has been carried out with mobile phone by "Wind Driven Mobile Battery Charger". This concept utilizes wind generated electrical Energy to charge the mobile phones battery. The model consists of four main components that are propeller, generator, chip integrated on PCB, and mobile set suitable charging pin [2].

Pawan Vijay et. al. proposed a mobile charger using wind and solar energy. In their work, wind energy is used to get 6V with the help of generator and solar energy is used to 8 V with the help of solar panel. The proposed charger will solve the problem of mobile charging during traveling, power cut and non-availability of power in remote areas [3].

Kharudin Ali et. al. presented the design and implementation of a portable battery charger by using multi direction wind turbine. Methods/Statistical Analysis**:** A prototype of battery charger is developed for application with mobile phones as an example to address the design considerations, plus demonstrates the performance of the charger adapted to a practical application system. This mobile charger is better than normal mobile charging as it uses wind power as a renewable energy source [4].

N Raghu Ram Reddy et. al. proposed a novel type of mechanical and electrical mobile charger has been designed. A new type of mobile charger has been designed to charge the mobile phone while traveling from one place to another place. It is a combination of 3 mobile chargers which works using wind power, human power and electrical power. Any one of these power sources can be used to charge the mobile phone based on the need. This kind of mobile charger is similar to normal chargers but it can be used to charge while travelling using wind turbines and can be used for instant charging using Geared DC Generator. This mobile charger is better as it uses renewable energy source such as wind power and human power [5].

III. Proposed Work

Here in this model we have used a very simple and pre-accomplished technology in a new way to full fill the need of the modern public after analyzing their daily requirements. Here we are using the term hybrid to represent our model,as because it it the combination of three modules namely the wind ,solar and electric power. It was needed to do hybridization :- a) For increasing output, b) For providing uninterrupted power suply(day & night), c) To be designed for both off-grid and on-grid.

1. Wind Turbine Generator: Here the front-facing wind turbine is working on a very simple principle. The wind energy will turns all the blades around a rotor which spins a generator to generate electricity which will be stored in the rechargeable battery via charger circuit.
2. Solar Panel: Here the solar panel we used will absorb the sunlight and generate the electricity which will be also stored in the rechargeable battery via charger circuit.
3. AC input: Here an option is provided for charging the rechargeable battery directly with electric power in case needed for emergency when none of the solar and wind power is available, and the battery is fully drained out. The AC power is converted in DC suitable for charging the specified battery.
4. Hybrid Two input energy charge controller circuit :- The Hybrid Circuit can be divided into two parts; i.e. two half that is Left & right, left side will be responsible for accepting and regulating the wind energy source while the right side processes the solar electricity for charging the single common battery. Although the two stages look similar, the modes of regulation are different.

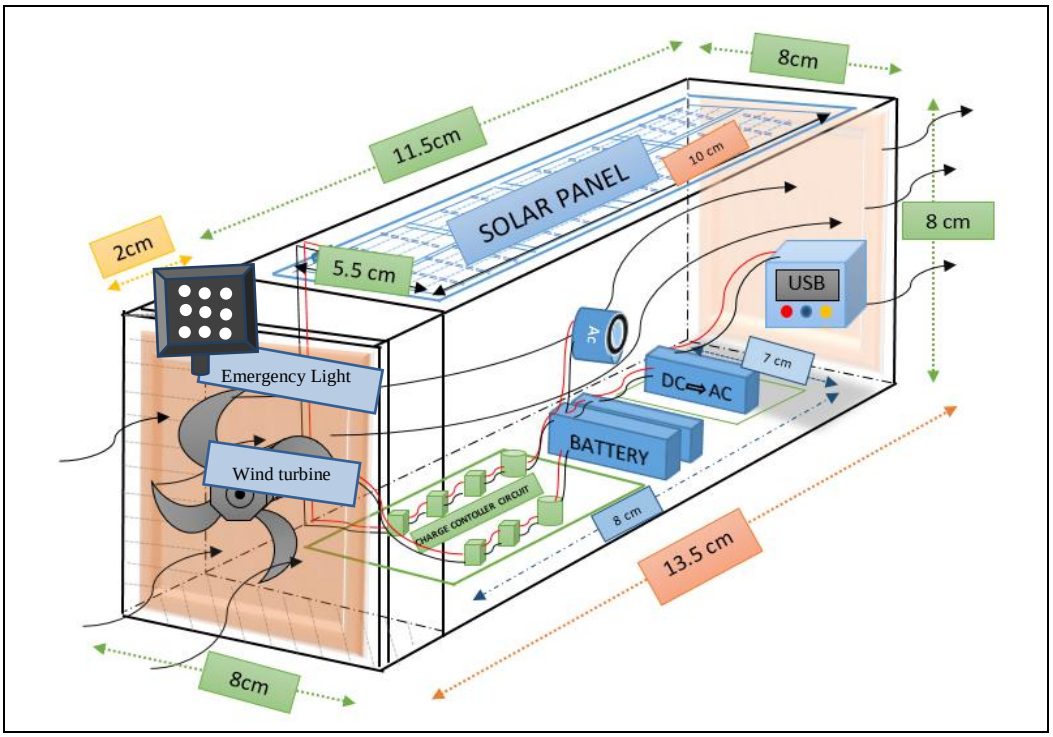


Figure 1: - Sketch showing the conceptual idea behind prototype model

I) The wind energy controller circuit regulates the wind energy by shunting or shorting the excess energy,
II) The solar energy processor stage does the same by cutting of the excess energy instead of shunting.
The above explained two modes are very crucial for both the resources since this will safeguard all the internal working devices from over current, and keep the device working in a controlled manner.

5 Regulator & USB power supply module: The function of this regulator module will be to convert the stored power (which is in DC form) to mobile chargeable form (i.e. DC power) [3.3 or 5 volt].The function of the output jack will be to deliver the power to the target device.

6 Emergency Light: Here in this device an emergency light is provided for use with an ON/OFF switch.

7 LED Indicators: The functions of the different colored LED's will be to indicate the working of the internal devices: I) Working of Wind turbine motor → Red LED, ii) Working of Solar power generator → Green LED, iii) Functioning of Battery charge indicator → Blue LED.

IV. Working Principle

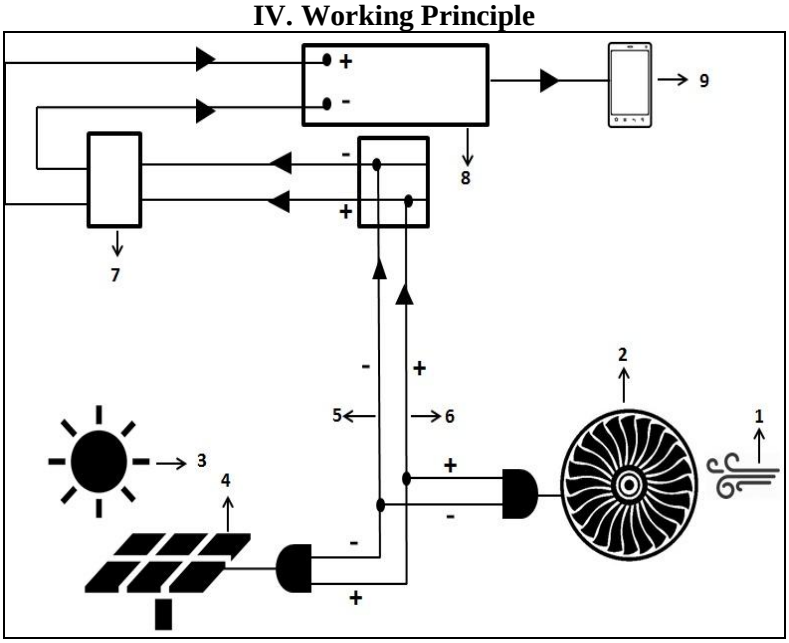


Figure 2: Network line arrangement of non-conventional energy generated unit.

1: Wind Energy. **2:** Turbine to capture wind energy. **3:** Solar Energy. **4:** Solar Cell to absorb photon. **5:** Energy source negative terminal. **6:** Energy source positive terminal. **7:** Battery charger processing circuit. **8:** Rechargeable Battery. **9:** Mobile.

Explanation:

The above figure represents the prime connections and the circuitry of the total arrangement. All the connections are made in series. Energy source positive and negative terminal from the solar cells and turbine motor is connected in series connections. All the energy source positive terminals as well as the negative terminals are put together in series and leads to the battery charger processing circuit. The charging circuit is placed inside the connector. The rectifier inside the battery charger processing circuit helps in changing the alternating current to direct current which leads to direct charging of battery. A switch is there to on off the charger and USB port connects with the mobile to provide charging facility.

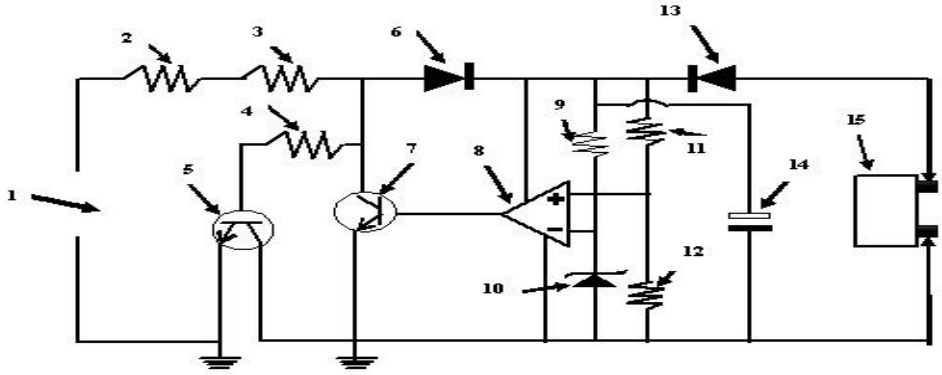


Figure 3: Battery charger processing circuit through solar energy.

1: Input Solar Energy **2:** Resistor **3:** Resistor **4:** Resistor **5:** Transistor **6:** Schottky Diode **7:** Transistor .**8:** Op-Amp. **9:** Resistor **10:** Zener Diode. **11:** Resistor 5. **12:** Resistor 6. **13:** Rectifier Diode. **14:** Capacitor. **15:** Rechargeable Battery.

Explanation:

The above figure represents the battery charger processing circuit through solar energy. The solar energy processor stage does the same by cutting of the excess energy instead of shunting. The right side op-amp stage processes the solar electricity for charging the single common battery in the middle. Therefore when the solar energy is applied to the left circuit, the opamp tracks the voltage and as soon as it tries to exceed the set threshold voltage, pin#6 of the IC goes high which in turn switches ON the transistor T1.

T1 instantly short circuits the excess energy restricting the voltage to the battery at the desired safe limit. This process goes on continuously ensuring the required voltage regulation across the battery terminals. The introduction of T2 makes sure that whenever the solar energy is higher that the set threshold, T2 keeps cutting it OFF, thereby regulating the supply the battery at the specified rate, which safeguards the battery as well as the panel from unusual inefficient situations. R4 used on both sides can be replaced with pre-set for facilitating easy setting up of the threshold battery charging level.

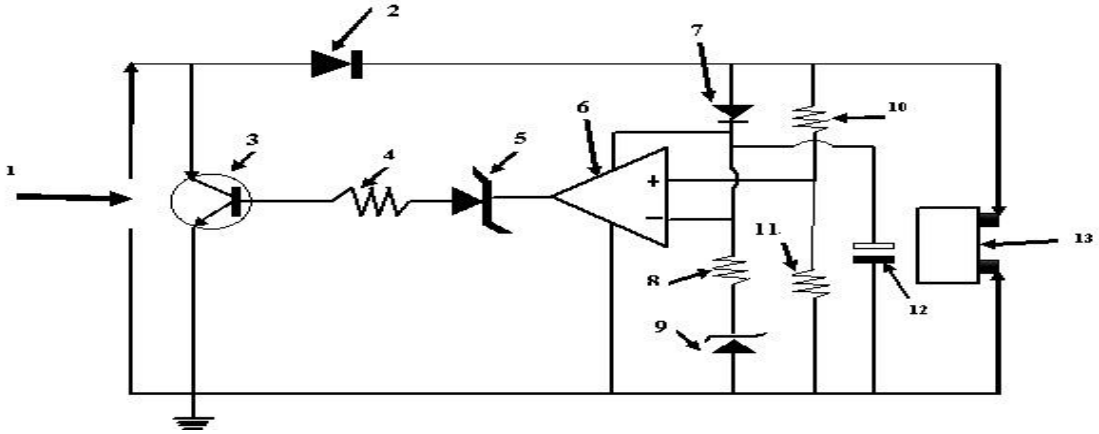


Figure 4: Battery charger processing circuit through solar energy.

1: Input Wind Energy. **2:** Schottky Diode 1. **3:** Transistor. **4:** Resistor 1. **5:** Zener Diode 1. **6:** Op-Amp. **7:** Rectifier Diode 2. **8:** Resistor 2. **9:** Zener Diode 2.**10:** Resistor 3. **11:** Resistor 4. **12:** Capacitor. **13:** Rechargeable Battery.

Explanation:

The above figure represents the battery charger processing circuit through wind energy. The wind energy controller circuit regulates the wind energy by shunting or shorting the excess energy to ground. The opamp are configured as comparators where the pin#3(non-inverting input) is used as the sensing input and pin#2(inverting input) as the reference input.

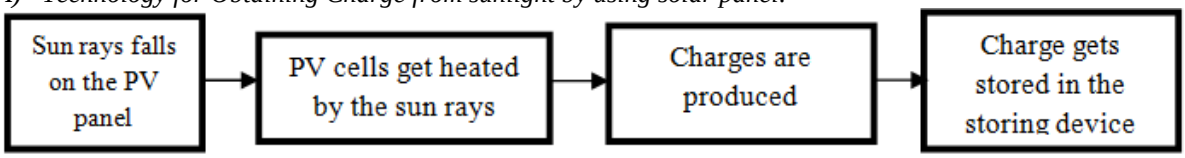
The resistors R3/R4 are selected such that at the required battery charging voltage, pin#3 just becomes higher than pin#2 reference level.

Therefore when the wind energy is applied to the left circuit, the opamp tracks the voltage and as soon as it tries to exceed the set threshold voltage, pin#6 of the IC goes high which in turn switches ON the transistor T1.

T1 instantly short circuits the excess energy restricting the voltage to the battery at the desired safe limit. This process goes on continuously ensuring the required voltage regulation across the battery terminals.

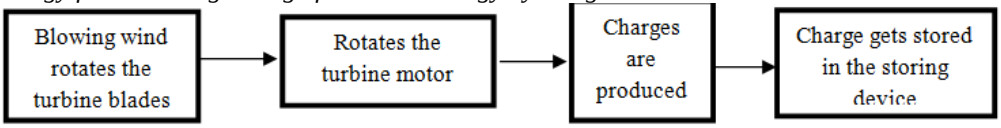
Flowchart for the technology behind:

A) Technology for Obtaining Charge from sunlight by using solar panel:



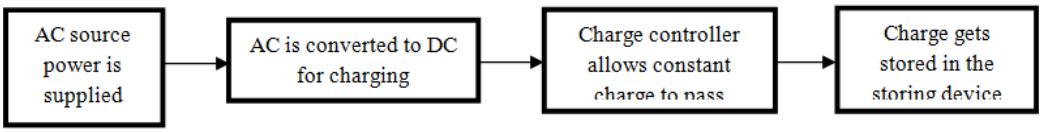
The Solar Panels are placed on the top facing of the prototype model which absorbs sun rays, on absorption of sunrays the PV (Photovoltaic cells) present inside the panel get heated which produce some charge .This charge generated from the heating of the PV cells is passed through the a charge controller circuit which allows the suitable amount of charge to pass on to the rechargeable battery by cutting or restricting the excess amount of energy.

B) Technology for Obtaining Charge from wind energy by using wind turbine



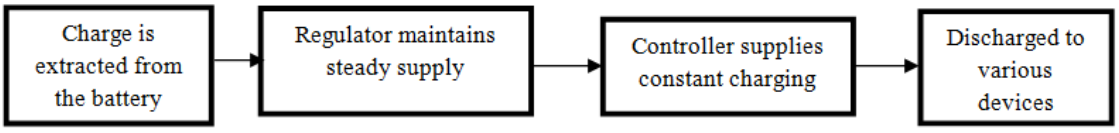
The wind turbine motor is fitted rotating aerodynamic blades which moves depending on the pressure of the wind energy. When a sufficient amount of wind is available enough for rotating the blades indirectly the wind turbine motor, wind motor start rotating and by some mechanical means charges are produced thereby. As wind pressure is not always steady in general alternating which requires excess energy to be shunted or shorted ,so that the coil inside is safeguarded from over current thereby keeping the speed of the alternators at a controlled rate.

C) Technology for Obtaining Charge from AC source



The rechargeable battery is charged from an AC source by using a convertor and charge controller before letting the charge to pass on to the battery.AC power source is applied and the current is passed to the convertor which coverts it into a suitable form for charging the battery and the charge controller is used such that to maintain the constant supply to charge the rechargeable battery.

D) Technology for Obtaining Charge from the storing device



To charge external devices a power supply USB module is used with a regular with two different range, to be chosen as per requirements. The battery is discharged by using a regulator for maintain constant discharging from the battery and a charge controller which supplies constant charge to pass for charging the external device.

Calculation of charging time via USB Module:

Normal capacity of the mobile phone battery = 4000 mAh (say)
Normal output of the charger = 1000mA
Therefore, the time taken for charging
T=4000/1000 →T= 4.0 hours
Assuming an efficiency of 80%, then the time taken for charging a completely drained mobile phone battery,
T =4000x0.8/1000 → T= 3.2 hours

Validation of the Prototype Model

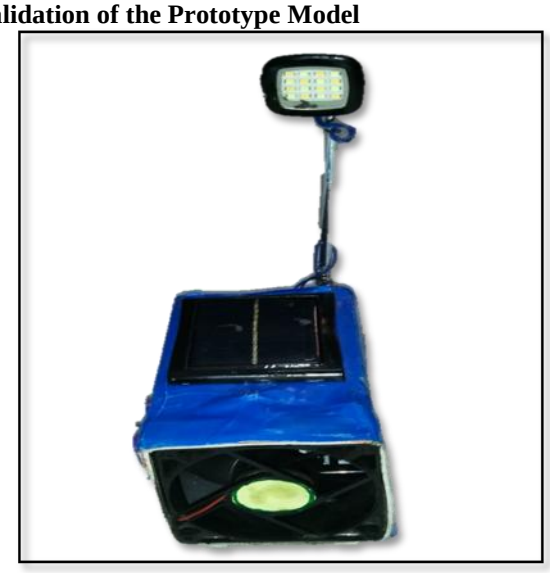


Fig. 5: Device Front Face with Top View

Fig. 6: Back view of the Device

Fig. 7: L.H.S view of the device

Fig.8: R.H.S view of the device

Fig. 9: Device Front View

Fig. 10: Device Top View

V. Result Analysis

The testing of the prototype model is carried out module wise practically in real world by different user. At first the wind turbine module is tested under a wind/vehicle speed between 0 km/hr and 80 km/hr, which output can be used to charge a cell phone directly or a rechargeable battery. It is found that the fan starts running at a speed of 10 km/hr with a minimum output of 0.5 volts, as the speed of vehicle is increased the output voltage of the wind turbine is also increased in parallel. At a speed of 40kmph and starts generating enough power (i.e. 3.7voltsat 300mA) required for directly charging a mobile phone. The charger works effectively even at 80kmph as the maximum output of generator is 5.3 volts. The voltage developed at different speeds is as listed in the table as shown below.

Table: - Output voltage of wind Turbine at different speeds

Sl. No.	Speed of Vehicle/Wind (in km/hr)	Output Voltage
1	0	0
2	10	0.8
3	20	1.6
4	30	2.4
5	40	3.0
6	50	3.8
7	70	4.6
8	80	5.3

Secondly, the solar panel can be effectively used to either charge the cellphone directly or charge the rechargeable battery. It produces an output of 5.4 volts and300mA of current at maximum sun light.
During the absence of wind energy and sun light (during night times or when it is raining etc.) the rechargeable battery provides an effective means of charging.

VI. Conclusion

In this paper we have proposed a hybrid method of charging mobile batteries of different mobile manufacturer using wind, solar and electrical power has been designed for travelers, peoples in rural and remote areas where the current supply is not available all the time. The result shows that the system is very useful and appropriate to be applied on vehicles, especially motorcycles, trains without any external electrical energy sources. Therefore, the natural energy can be utilized effectively in a whole day. This mobile charger is also portable, cost-effective and energy efficient.

This paper is very useful and needed in today's life because now days the necessity of communication is very important which comes from the digital devices. This mobile charger is very useful especially when we are going for long travel. Future work focuses on decreasing the size of Modules used inside in parallel to increase the efficiency of wind turbines and solar panel. This mobile charger is better than normal mobile charger because it has multi features. In the future work, based on this exploration, suitable modifications charging of laptop and other high power digital gadgets will be accomplished.

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