Renewable Energy Utilization for Development of Portable Charging Station

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Abstract- **While travelling, it is common for people to drain their batteries quickly. Outside, there is no way to power a device like a phone or computer. A green energy system with a dual power generator using solar and wind energy to charge mobile phones is the answer to this predicament. To avoid theft or tampering with the charging station, this system has an anti-theft mechanism. This system is fitted with four wheels for ease of movement. It can easily be used near a bus stop, garden, historical monuments, college campus, etc. This article provides an idea of the characteristics of portable and fixed mobile charging stations powered by renewable energy sources.**
Keywords- Charging system, Environmental Sustainability, Green Energy, Energy Resources

1. INTRODUCTION

Environmental effects of energy use are constantly apparent. The world's population is expanding quickly, the global economy is flourishing, and as a result, there is an increasing demand for fuel [1]. To meet this demand, we need renewable resources. To achieve energy efficiency and environmental sustainability, we must switch to renewable energy as soon as it is humanly practicable. Sustainable development satisfies existing demands without jeopardizing the capacity of future generations to satisfy their own needs. In terms of sustainability challenges, development entails improvement in every area, including Environment, Social Equity, and the Economy. For convenient transportation and use in numerous locations, a solar-powered charging station for portable consumer electronics has been developed [2,3].

Reducing the quantity of energy necessary to offer different goods or services is crucial if we want to move toward energy sustainability [4]. It will entail changes in both the way energy is delivered and used. To improve environmental sustainability, we have suggested a design and development of a portable green power charger in this study.

Most researchers need to refocus their attention on green communication due to the growing concern over energy usage in wireless communication networks. This essential component of achieving environmental sustainability can be aided by technological advancement and innovation. These strategies were chosen as the ecologically friendly means of powering future wireless networks for a variety of strong reasons. PV chargers are complex devices, which can also be constructed entirely with reduced efficiency and performance.

Numerous elements, including the level of efficiency, depending on the layout of the PV chargers themselves as well as the function and place of mobile devices in the power chain [5]. New standards are being considered for mobile phones in the future. After standards like micro-USB and the 3.5 mm, an audio jack was launched. There are more options for the development of PV chargers as a result of the trend toward open-source platforms. But if design guidelines for PV chargers are established, user demands and expectations can be met. A high level of efficiency is required from the PV charger in addition to having photovoltaics that is the right size [6]. Thus, each element of the system structure will have a unique level of efficiency and will thus have an impact on the performance of the output.

2. PROBLEM STATEMENT

Solar power, a sustainable energy source, is utilized to generate enough energy for the battery of the portable device to solve the battery charging issue quickly and affordably. Photovoltaic (PV) solar cells are employed as an energy source as a result. The boost dc-dc converter uses the power from the PV cell to step up the input PV cell voltage to a suitable USB output voltage. Then, any type of portable device can use a USB port to recharge its battery. Although PV cell voltage can be increased to USB levels, system efficiency is still limited due to low power and voltage levels.

On the other hand, the amount of energy that may be collected from a PV cell is only sufficient for a tiny, portable solar battery charger. To provide output power for quick response, a small size li-ion battery is added to the system. Here, the energy from the PV cells powers a dc-dc boost converter with a lithium-ion battery to supply enough voltage and power to the USB port. As a result, the energy needed to recharge the portable device's battery is available.

3. DESIGN AND COMPONENTS OF PORTABLE CHARGING STATION

By connecting batteries to a wind-powered generator made of fan blades, a rotor that accelerates energy from the blades, and a motor that accepts energy from the rotor and generates DC current, we are able to charge our batteries [7]. We depend on the flow of wind when we utilize large fans to create electricity. In its most basic form, kinetic energy, often known as the energy of motion, is captured by the fans' blades from the wind's movement [8]. The shaft that is connected to the blades also rotates as they do. Rotational energy is produced as the shaft spins and is transferred to a generator. A wind turbine's generator is just a collection of magnets that rotate around a coil of wire. The wire is powered by the electrical current produced by the rotating magnets. In this case, the generator is a 12-volt gear motor. Likewise, two 3.8 watt, 8 V solar panels are utilized as the current source. The light energy is transformed into electrical energy by this solar panel. The solar module can produce about 4.9 volts at 586 mA when the amount of sunshine is at its highest [9]. The battery is charged using this current, which is fed through a 100watt DC to AC converter, or 12V to 220V. The phone is charged using this voltage.

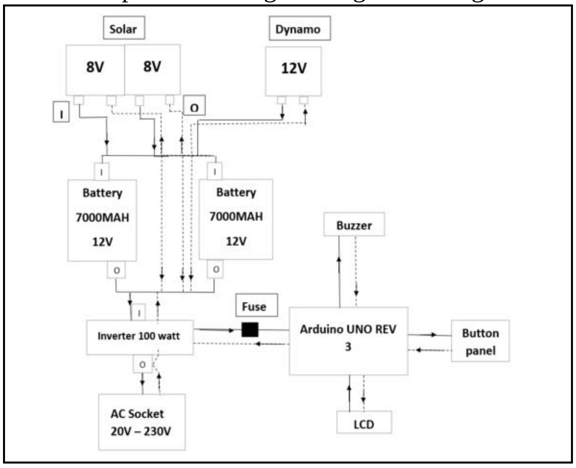


Figure 1 Circuit diagram

When the mobile charger has power, an LED illuminates, which is more than enough to run any accessory powered by the charger. It is conceivable to use an as a power source for battery recharging because the Universal Serial Bus specification calls for a 220V power supply. The mobile phone receives this. The buzzer will sound on entering the wrong pin; else when entering the right pin, Arduino will send a signal to the fuse and the charging process will start. Circuit diagram is shown in Figure 1.

4. ASSEMBLY OF PORTABLE CHARGING STATION

With the help of the photovoltaic effect, solar panels can convert sunlight into usable electricity [9]. We've demonstrated an Arduino-based Dual Axis Solar Tracker here. An Arduino board controls a solar panel that spins in response to the sun's position. Multiple microcontrollers and other controllers are integrated onto the Arduino board. The Arduino received the input command from the Integrated Development Environment platform.

A windmill is a device that converts the kinetic energy of wind into usable mechanical energy by use of sails set on a revolving shaft. Each branch circuit is protected by its own circuit breaker or fuse, which are all housed in a single enclosure known as a panel box, which is part of an electrical distribution system.

A buzzer or beeper is an audible signaling device that can be either mechanical, electromechanical, or piezoelectric (piezo for short). Buzzers and beepers are frequently used in alarm clocks, timers, train systems, and to validate user input such a mouse click or key press.

Inverters (variable frequency drive) also go by the name "alternative current drives" and "variable frequency drives" (VFDs). Transformers are electronic devices that change DC electricity into AC electricity (Alternating Current). Electric motors are ubiquitous in the tools we use for work, from handheld electronics to automobiles to office machinery [10]. Electric motors in factories are often regulated by inverters because wasteful use of power and resources can be costly [11].

Putting Together the Charging Station

Step 1: Connect the solar panels.

Use a metal frame and bolts to secure the solar panels to the roof of your structure for a semi-permanent structural mount, such as on a shed or carport. Use the appropriate brackets and screws for the sort of roof you're working with. Tents should use foldable solar panels or panels with holes that can be fastened to the top or sides. A car mounts them either permanently with a frame or temporarily using safe sticky strips.

The components are parts used for the portable charging Station as shown in Table1.

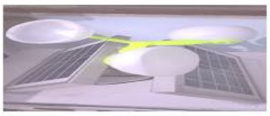
Step 2: Arrange the Batteries

The batteries need to be stored in a location that is secure, free of moisture, temperature-controlled to a moderate degree, and stable. Anywhere indoors is generally fine, but they have to be securely secured in a vehicle and most likely carried in a box that is sealed if you are going camping.

Step 3: Position the Solar Charge Controller

Because it will provide information regarding the amount of energy that is being produced, the amount of energy that is being depleted, and approximately how full collection of batteries is, keep the solar controller in a location that is both secure and simple to read. Before begin wiring, check that it can be reached easily.

Table: 1 Components used in Portable Charging Station (PCS)

SN	Main-Component	Figure	Specification
1	Arduino uno Board		Microchip ATmega328P 5 Volts 8 Analog input pins
2	Solar panel		Maximum power 40W 12 Volts
3	Wind Fan		50 Hz 2000-6000 RPM DC 0.1-6V
4	Panel Box		31.5 cm in length, 25.8 cm in width, 24.2 cm in height
5	Buzzer		Frequency range 3,300Hz Temperature ranges – 20° C to +60°C.
6	AC Inverter Circuit Board		100 W 12V to 220 V

Step 4: Integrate Everything

Wire the solar panels and controller together with the solar power lines are connected parallel based on amperage and series based on voltage requirements and then connect the batteries. A converter from the batteries to the desired power ports should be wired into the solar controller.

Figure: 2 Assembled Portable Charging Station

Charging time under zero load and full load in full sunlight are approximately 2.8 hours and 4.2 hours, respectively, while discharge time in the absence of the sunlight under full load is approximately 1.4 hours.

The objective of this study was to test whether different substrate materials affected the performance of a proposed antenna. Three different substrate materials are chosen and simulations are performed. The proposed antenna's simulated results on an FR4 substrate are compared to the results obtained using Rogger RT/duroid 5880 and Roggers RT/duroid 6010.

The proposed antenna's behaviour is compared to that of various substrate materials. The simulation results showed that the gain of the suggested antenna using the FR4 epoxy substrate gradually increases, reaching a maximum gain of 5.1 dBi at the frequency of 9.5 GHz. The proposed antenna attained a return loss of return loss (S11) of -20.27 dB at the resonant frequency of 4.46 GHz.

5. CONCLUSION

The only way out of the future energy problem is the development of renewable energy sources. For travelers and rural regions where electricity is not readily available, a portable charging station using wind and solar energy has been developed in this research. The cost of operation is quite low because this charger uses an unconventional source of energy. Energy and related services are in higher demand as a result of the need to support social and economic progress as well as to enhance welfare and health. To address the issue of sustainable energy, we have suggested designing and creating a portable green power charger that can be used to recharge many different electronic devices, including mobile phones, MP3 players, and other devices.

This charger would use green energy produced by a solar and wind energy combination to charge various electronic devices. An innovative concept for the use of renewable energy is the widespread installation of

solar canopies and the adoption of portable solar charging units. As a result, more people will be motivated to use renewable energy, reducing strain on the national grid while also helping to maintain a clean and healthy environment.
The scope for future work is improvement of charging station by accelerating the wireless charging pad's charging rates. Moreover, optimize the controller code so that the microcontroller and relay switches can interact more effectively.

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