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Research Article

MULTI WEATHER PORTABLE CHARGING SYSTEM

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ABSTRACT

Multi Weather Portable Charging System (MWPCS) is a micro controller based partially automated charging system. The hybrid system consists of various electrical and electronic components like Voltage Controller; Aurdino based micro controller and voltage controller (dc-dc) etc. The project aims to provide access to one's personal energy which suits best to climbers , hikers , travellers or to the people who like to explore forlorn areas with almost no availability of electricity , which could be used to charge low power electronic gadgets like mobile phones , LED torches etc . Once discussing future energy ideas, the power supply of remote locations and applications at minimal cost with low emission is an important issue. This paper presents modelling of a standalone hybrid energy system consisting of photo voltaic panels, water turbine and wind turbine as renewable sources of power and batteries to store the energy. Every charging method ensures eco-friendliness .

INTRODUCTION

Multi Weather Portable Charging System (MWPCS) provides all in one solution to campers, hikers etc for charging low power electronic gadgets (cell phone, LED torches etc).Which will outclass the use of power banks, since power banks once discharged require electricity for charging.The Multi Weather Portable Charging System (MWPCS) incorporates three methods (solar, wind, hydro) for charging battery embedded in it .MWPCS is a compact portable charging system which fits into the backpack.In this prototype system the energy can be generated by more than one source at a time like wind, solar, hydro. Hybrid energy generation is more important because the winds not present all time and sun radiation is only present around 8 -10 hours in a day. So far continuous power generation it is important to hybridize the solar, wind and hydro with storage battery [4][5].

To solve battery charging problem in an easy and cheap way, renewable energy source of solar power, Wind power, Hydro Power is used to provide sufficient energy for the portable device battery. For this reason photovoltaic (PV) solar cell, motors (for hydro and wind) is used as an energy source. The energy 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.

A photovoltaic module is a packaged, connected assembly constitute the photovoltaic array that generates electricity by using light energy from the Sun. The energy generated is calculated by the formula

$P = MY^2 + NY + O$

Where,

Y = solar radiation
P = power formation
And M, N, O are constants [7][8][10].

Wind power is obtained by using wind turbine. Wind turbine converts mechanical energy into electrical energy .In this process speed and direction of wind plays and important role. According to BETZ limit we can use 59% of total wind energy into electrical energy .wind power is calculated by

Where, A = Area perpendicular to the direction of flow in square meter

P = Density of air kg/cube-meter
V= wind velocity in meter/sec.

Mathematically, power within the water can be calculated as follows.

POWER (P) = FLOW RATE (Q) * HEAD(H) *GRAVITY (g) *WATER DENSITY (p) [6][9]
Where Q is in cubic meter/sec,

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H in meters
g is gravitational constant (9.81 m/s^2)
p is density of water 1000kg/m^3s

The project deals with the charging of mobile phones and other electronic gadgets with the help of charger operated with the help of natural resources of energy like solar wind and hydro. Six solar panels each of rating 80*40A having wattage of 1.66watts are employed. in the same manner, a small detachable windmill and turbines are used so charger should be made portable and operational in multi weather conditions.

Block Diagram and its Components

The components used in the prototype model are discussed below with the help of block diagram.

Table 1 Components and its specifications

S.No.	Components	Specification
1.	Microcontroller	ATMEG 328P
2.	Booster circuit	4 volts to 20 volts for charging 12 volt battery
3.	Voltage Regulators (7805)	from 12 volts to 5 volts for charging port
4.	Mono crystalline silicon panels	0.5A,3.32V
5.	li – ion batteries	4volts
6.	Permanent Magnet DC Motor	12 volts

The ATmega328 is a single-chip microcontroller created by Atmel in the megaAVR familyprovides partial automation to the proposed system. It has a modified Harvard architecture 8-bit RISC processor core. It is used to provide partial automation to MWPCS device [10][11].

The LM2731 switching regulators are current-mode boost converters operating at fixed frequencies of 1.6MHz (X option) and 600 kHz (Y option). The use of SOT-23 package, made possible by the minimal power loss of the internal 1.8-A switch, and use of small inductors and capacitors result in the highest power density of the industry. The 22-V internal switch makes these solutions perfect for boosting to voltages up to 20 V[7][12].

These parts have a logic-level shutdown pin that can reduce quiescent current and extend battery life. Protection is provided through cycle-by-cycle current limiting and thermal shutdown. Internal compensation simplifies design and reduces component count.

The voltage regulator IC 7805 is actually a member of the 78xx series of voltage regulator ICs. It is a fixed linear voltage regulator. The xx present in 78xx represents the value of the fixed output voltage that the particular IC provides. For 7805 IC, it is +5V DC regulated power supply. This regulator IC also adds a provision for a heat sink. The input voltage to this voltage regulator can be up to 35V, andthis IC can give a constant 5V for any value of input less than or greater than rated value [6].

A lithium-ion battery or Li-ion battery is a type of rechargeable battery. Lithium-ion batteries are commonly used for portable electronics and electric vehicles and are growing in popularity for military and aerospace applications. Advantages of Li-ion batteries over the conventionally used nickel cadmium battery arethat,the energy density of lithium-ion is typically twice that of the standard nickel-cadmium. Lithium-ion is a low maintenance battery, an advantage that most other chemistries cannot claim. In addition, the self discharge is less than half compared to nickel-cadmium, making lithium-ion well suited for modern fuel gauge applications. Lithium - ion cells cause little harm when disposed[14][15].

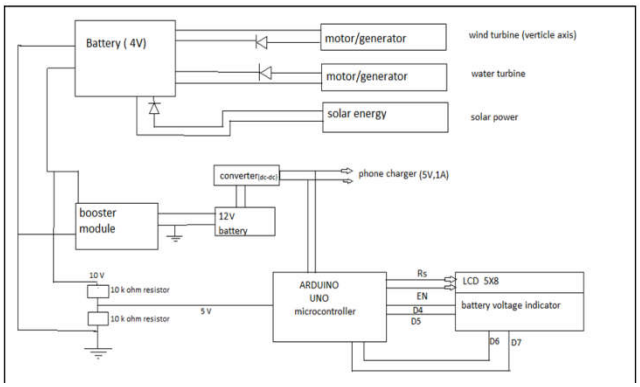

Fig 1 Block diagram representing components used in MWPC

The motors are used for generation of electricity from wind and hydro source of energy. Permanent magnet DC generator (12 volt) is used for that purpose. A DC motor whose poles are made of permanent magnets is known as permanent magnet DC (PMDC) motor. Electrical generator is a rotational machine that converts the mechanical energy produced by the rotor blades (the prime mover) into electrical energy or power. This energy conversion is based on Faraday's laws of electromagnetic induction that dynamically induces an e.m.f. (electro-motive force) into the generators coils as it rotates. There are many different configurations for an electrical generator, but one such electrical generator which we can use in a wind power system is the Permanent Magnet DC Generator or PMDC Generator.

Permanent magnet direct current (DC) machines can be used as either conventional motors or as DC wind turbine generators as constructional there is no basic difference between the two. In fact, the same PMDC machine may be driven electrically as a motor to move a mechanical load, or it may be driven mechanically as a simple generator to generate an output voltage. This then makes a turbine generator.

METHODOLOGY

Multi Weather Portable Charging System (MWPCS) employs three methods for charging 4 volt battery (li-ion).The three methods of charging employed are Solar based charging (uses solar panels),wind and hydro based charging (uses motor of 12 volts).The output from 4 volt battery is boosted up to 20 volts using booster circuit, which is fed to a 12 volt battery. This battery is used to provide supply for charging port via 7805 voltage regulator. From the booster circuit power supply is also given to microcontroller through voltage divider network as it operates on 5 volt.Depending upon the type of source available battery can be charged. Generally solar and wind are alternative to each other that is when solar is available wind may be absent and vice versa but sometimes we can use multi source at a time depending upon the availability such as combination of solar/ water , solar/wind .This increases charging efficiency of the

system and decreases the time of charging the battery.

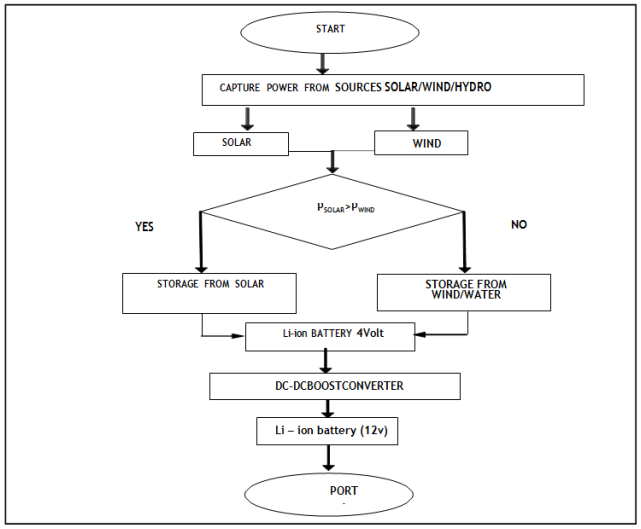

Fig 2 flow chart representing the working of MWPC

CONCLUSION AND SCOPE

The proposed system (MWPCS) involves use of green energy only, which guarantees no toxic emission to the external environment; it ensures the sustainability ofMulti Weather Portable Charging System (MWPCS). This hybrid energy system leaves us with choice of energy source (wind, solar, running water). According to the availability of energy source at particular geographic location, the system can be made to run. Hence the system can be seen as versatile and reliable. Apart from this MWPCS also provides us seasonal choice of energy sources, solar energy being more productive in summers in contrast with wind or running water energy. As mentioned earlier MWPCS employs three methods for charging via; solar, wind, and running water energy sources, and their combination increases the chances of more energy production. From the design point of view the system has the provision for improvement. Storage battery capacity can be extended up to 30 volts, which can charge other gadgets of slightly high power consumption than mobile phones and LED torches like laptops etc.

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