

Hybrid Power Generation using Solar Energy and Wind Energy

Generation of Electrical power using solar and wind energy for mobile phone charging.

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ABSTRACT: Energy is critical to the growth of the economy of the country and also social development of the country. Indigenous energy resources is to be produced and developed to the optimum level to minimize the dependence of human beings on imported fuels. This leads to development and investments in research and investments in renewable energy resources in search of ways to meet the energy demand and to reduce the dependency on fossil fuels. Solar and wind energy are becoming popular owing to abundance, ease of harnessing and availability for electrical power generation. This paper focuses on integrated hybrid renewable energy system consisting of solar and wind energies. This system consists of grid type power generation using solar PV cells and wind turbine to generate electrical energy and supply load to the grid. In this model *atmega328* Arduino controller is programmed to run the overall grid system. We can give uninterrupted power by using hybrid energy system. The hybrid power generation here is produced for charging of the mobile phones in emergency as well as in normal conditions too. Due to use of sustainable and renewable energy resources we can generate power without damaging the environment.

KEYWORDS: Hybrid Power, Solar Energy, Wind Energy

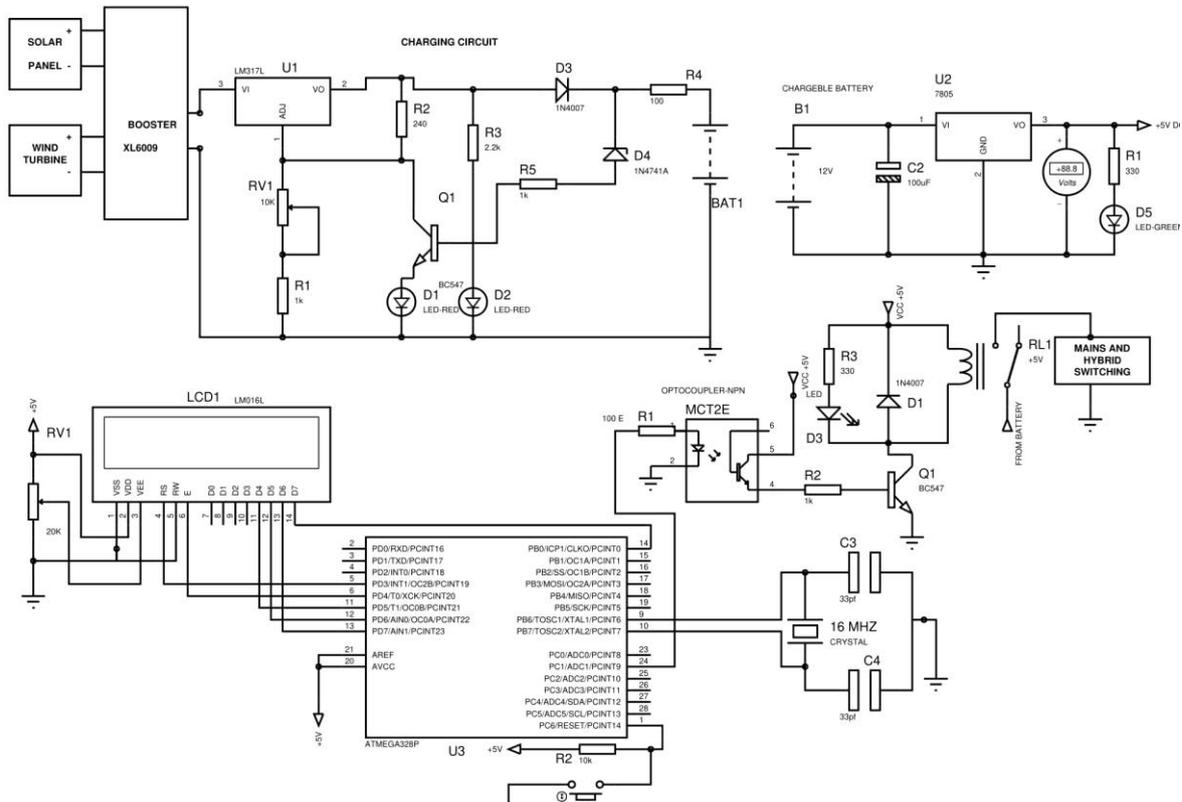
I. INTRODUCTION

Electricity is most needed for our day to day life. There are two ways of electricity generation either by conventional energy resources or by non-conventional energy resources. Electrical energy demand increases in word so to fulfill demand we have to generate electrical energy. Now a day's electrical energy is generated by the conventional energy resources like coal, diesel, and nuclear etc. The main drawback of these sources is that it produces waste like ash in coal power plant, nuclear waste in nuclear power plant and taking care of this wastage is very costly. And it also damages the nature. The nuclear waste is very harmful to human being also. The conventional energy resources are depleting day by day. Soon it will be completely vanishing from the earth so we have to find another way to generate electricity. The new source should be reliable, pollution free and economical. The non-conventional energy resources should be good alternative energy resources for the conventional energy resources. There are many non-conventional energy resources like geothermal, tidal, wind, solar etc. the tidal energy has drawbacks like it can only implemented on sea shores. While geothermal energy needs very lager step to extract heat from earth. Solar and wind are easily available in all condition. The non-conventional energy resources like solar, wind can be good alternative source. Solar energy has drawback that it could not produce electrical energy in rainy and cloudy season so we need to overcome this drawback we can use two energy resources so that anyone of source fails other source will keep generating the electricity. And in good weather condition we can use both sources combine. The system is provided with automatic switching between mains supply and generated electricity from solar and wind energy so that it can give uninterrupted power supply with the required load. The system can also be modified with third conventional power generation that is by using water turbines.

There are some basic steps which have to follow for design and planning of hybrid system-

- Evaluation of meteorological conditions.
- Analysis of Electric load demand.
- Hybrid system configuration.
- Hybrid system model development.
- Analysis using simulation and optimization.
- Operation analysis of resulting system.

II. BLOCK DIAGRAM OF THE SYSTEM



II.I:- Block diagram of the system.

In this system we have connected and used solar energy and wind energy which produces and generates electrical energy which will be used for the charging of mobile phones. The overall procedure and working of this system are as follows:

- First the produced energy from the solar energy and wind energy will be sensed by the sensor connected in series with the equipment's. The output sensed by this sensor will be displayed on the LCD display.
- After that the generated power will be boosted by the DC-DC booster which will be required for charging of the battery.
- The stored energy from the battery will be used for charging of the mobile phone.

III. HYBRID SOLAR AND WIND POWER SYSTEM.

This system is combination of wind energy and solar energy, used to generate power from each other. Hybrid system is having advantage than system those which are totally depend on single source of energy. Researchers have very tough task to maximize the total energy output from the system with lower cost & reliability. Generally, wind-solar hybrid power system consists of wind turbines, photovoltaic array, controller and storage battery. Wind turbines is used to convert wind energy into mechanical energy and then into electric energy. Whatever electric energy is generating from this system is alternate & unstable. So, some controlling units or inverters are used to make it continuous and store into battery. This energy utilizes for domestic purpose or other. Photovoltaic array having solar panels through series or parallel, converts solar energy into electrical energy. This energy is in DC form, it is stored in battery and controller supply power for AC or DC loads. This system having high daily electricity generation capacity, low fabrication cost, maintenance is low and has other advantages also.

IV. REQUIREMENTS OF SOLAR AND WIND HYBRID POWER SYSTEM.

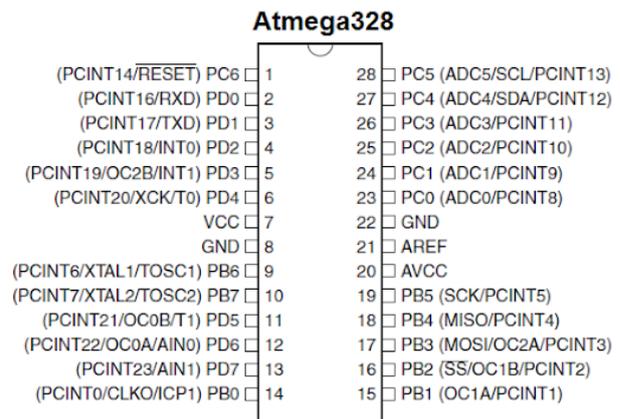
To develop this system & to investigate performance, modeling and mathematical calculations have to develop. Different models of hybrid system have covered in literature. Following are the components from review of literatures-

1. Meteorological data: - Meteorological analysis of the location has to be made for optimization process. It is important for total utilization of PV/Wind sources. Measuring solar and wind resources data is main input of the hybrid system. That all data should be measured hourly, daily and as per weather or climate change.
2. Load Demand: - It is necessary part of system to design & analyze. To find out the exact load demand it is very complicated and difficult to decide. Load variation for different seasons is not predictable, so system have to design for nearer or more than load demand to full fill requirements.

System Configuration: - By studying all data like solar radiation, wind speed and load demand proper selection of equipment's have to be made. But sizing of system will be according to the environmental conditions. Because producing power from solar-wind is depend upon the location which is to be selected.

V. MAIN COMPONENTS USED IN THE SYSTEM.

1. ATMEGA328 Controller



V.1.1:- Actual Image of the Controller

V.1.2:- Pin Diagram of the Controller

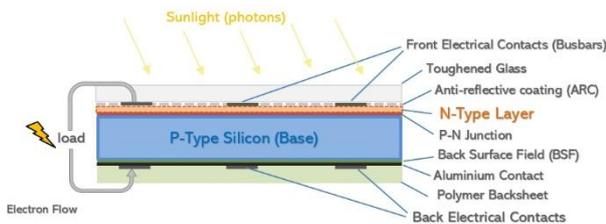
The high-performance Microchip 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.

By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.

2. SOLAR PANEL.



Solar panel is used to convert solar radiation to the electrical energy. The physical of PV cell is very similar to that of the classical diode with a PN junction formed by semiconductor material. When the junction absorbs light, the energy of absorbed photon is transferred to the electron-proton system of the material, creating charge carriers that are separated at the junction. The charge carriers in the junction region create a potential gradient, get accelerated under the electric field, and circulate as current through an external circuit. Solar array or panel is a group of a several modules electrically connected in series parallel combination to generate the required current and voltage. Solar panels are the medium to convert solar power into the electrical power.



V.2.1:- Solar Panel and its construction layout

3. WIND TURBINE.

Wind turbine converts mechanical energy into electrical energy using the alternator wind turbine. Wind turbine is that system which extracts energy from wind by rotation of the blades of the wind turbine. Basically, wind turbine has two types one is vertical and another is horizontal. As the wind speed increases power generation is also increases. The power generated from wind is not continuous its fluctuating. For obtain the non-fluctuating power we have to store in battery and then provide it to the load.



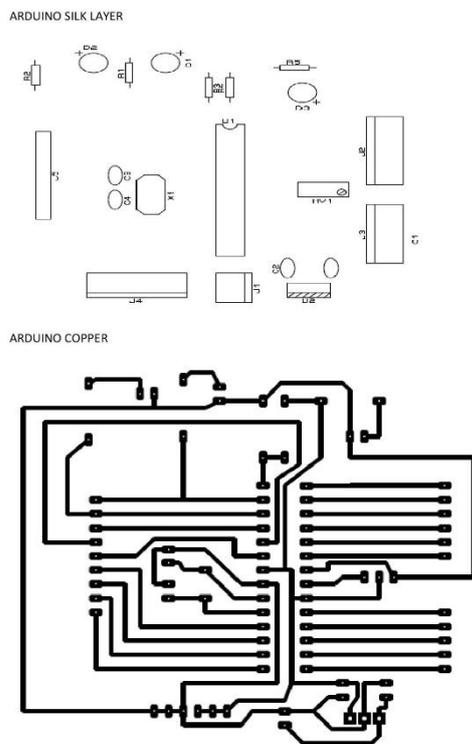
V.3.1:- Wind Turbine

VI. SOFTWARES USED IN THE SYSTEM

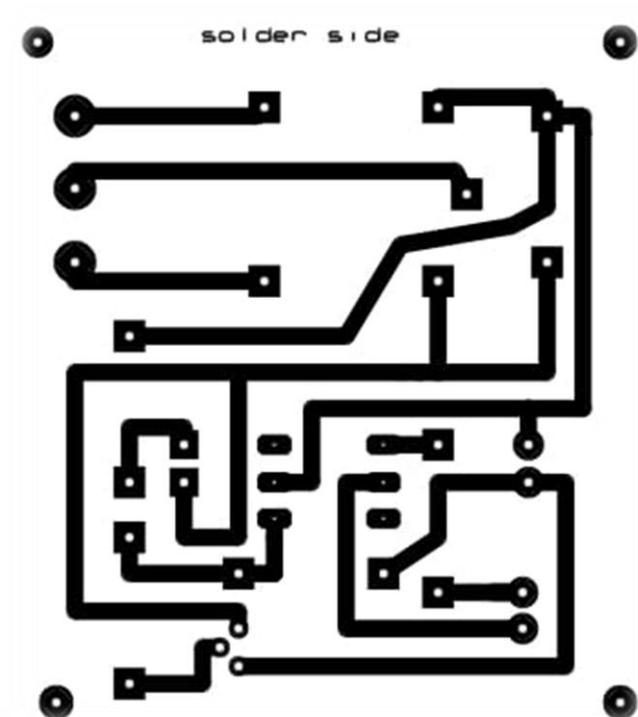
- PROTEUS 7.6

Proteus is a software package for computer-aided design, simulation and design of electronic circuits. It consists of two main parts, the ISIS, the circuit design environment that even the simulator VSM includes, and the ARES, the PCB -Designer. Developer and manufacturer of the software package is the company Lab center Electronics. The ISIS (Intelligent Switching input system) is the environment for the design and simulation of electronic circuits. The component library includes claims to more than 10,000 circuit components with 6000 prospect simulation models. Own components can be created and added to the library. ISIS includes a base-VSM engine with support for the following functionality DC/AC voltmeter & ammeter, oscilloscopes, logic analyzers, Analog signal generators, Digital Pattern Generator, Timer functions, protocol analyzers for example RS232, I2C, SPI.

- Layouts of Components produced using this software.



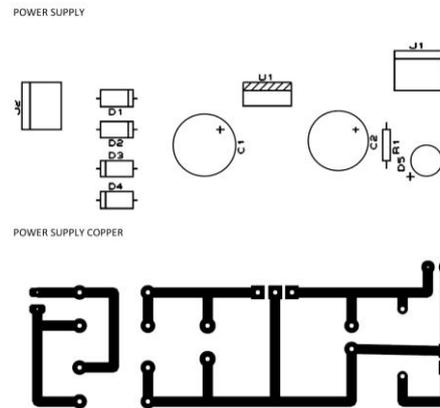
VI.1:- Design For the Arduino Circuit



VI.2:- Soldering Side of the PCB plate

VI.3:- Design of the Power supply circuit.

VI.3:- Design of the Power supply circuit.



VI.1,2,and 3:- Simulated Components and drawn the desired circuit, which is further sent for the Milling Process

VII. ADVANTAGES

1. **Continuous power supply** – The hybrid solar systems provide power continuously, without any interruption, as the batteries connected to them store the energy. So, when there is an electricity outage, the batteries work as inverter to provide you backup.
2. **Utilize the renewable sources in best way** –Because the batteries are connected to the system to store the energy, there is no waste of the excess energy generated on bright sunny days.
3. **Low maintenance cost** – The maintenance cost of the hybrid solar energy systems is low as compared to the traditional generators which use diesel as fuel.
4. **High efficiency** – The hybrid solar energy systems work more efficiently than your traditional generators.
5. **Load management** – Unlike traditional generators, which provide high power as soon as they turned on, most of hybrid solar power systems manage load accordingly.

VIII. APPLICATIONS

1. In this system the main application of this system is to provide charging output for mobile phones.
2. Nowadays mobile phones are the most important thing for human being. In countries like India and various other countries there is problem of electricity cut-off so this system will provide enough power to charge the mobile phones.
3. As the power generated is from solar energy and wind energy which is available in plenty so the total generation cost of this negligible.
4. Other various applications of this system is in road lighting, house lighting, landscape lighting, pump irrigation, industrial monitoring system and various many more applications.

5. This system is very useful at the places where the supply of electricity is difficult to reach or the places where still there is no electricity.

IX. CONCLUSION

Hybrid power generation system is good and effective solution for power generation than conventional energy resources. It has greater efficiency. It can provide to remote places where government is unable to reach. So that the power can be utilize where it generated so that it will reduce the transmission losses and cost. Cost reduction can be done by increasing the production of the equipment. People should motivate to use the non-conventional energy resources. It is highly safe for the environment as it doesn't produce any emission and harmful waste product like conventional energy resources. It is cost effective solution for generation. It only needs initial investment. It has also long-life span. Overall, its good, reliable and affordable solution for electricity generation.

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