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A Hybrid Solar Wind Power Generation System

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Abstract*: *World has shifted its outlook towards the cleaner sources of energy. Energy generation in balance with sustainable development has led to energy generation from non-conventional, renewable energy sources like solar energy, wind energy, hydel power, geothermal etc. This project is the combination of solar and wind energy. The project harness both sun's light and wind speed for the generation of power and electricity. Solar cells or PV cells are used to harness sun's energy and change it into electricity. These solar cells work on the principle of photovoltaic, conversion of sunlight into electricity. Windmills are used to harness wind energy and change it into electricity. The hybrid of both solar and wind energy increase the reliability and reduces the dependence on one single source, thus improving the output performance undisturbed by temperature, humidity, rainfall and other similar atmospheric conditions.

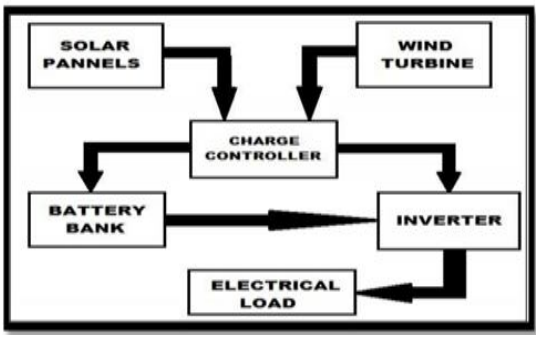
Keywords:* *Solar, Wind, Hybrid, Power, Energy

I. INTRODUCTION

The energy produced by the movement of atmospheric air is called as wind energy. Wind power has been used by humans since ancient times for sailing, rowing , grinding grains etc. This kinetic energy of the blowing air called wind could by transformed into power or electricity through wind energy systems. Electric power generation is the latest use of wind energy in the 20th century. Wind mills are the devices that rotate due to wind speed and air movement and transform wind into mechanical power through wind turbines for the generation of electricity from electric power. Coastal areas, dry areas,hills etc are developed with wind farms to harness wind energy. The energy from Sun is called the Solar energy. Solar energy is one of the most abundant forms of energy present on Earth whose efficient utilization can reduce the burden of the fossil fuels. Solar energy is pollution free thus it has no negative effect on the solar system. Photovoltaic cells or solar cells are used to convert sun's heat and light into electricity. Solar cells work on the principle of photoelectric effect. The photovoltaic cells are made of semiconductor materials like Silicion. These semiconductor materials emit electrons when hit by the solar light consisting of protons. These free electrons when captured result into electricity. Climate changes affect the working of Solar panels be it atmospheric temperature, humidity, wind speed etc. The designing aspect of solar panels thus play a great role in providing optimum output power and also provide ways to improve the factors dependent efficiency of solar panels but solar charged battery can provide power supply irrespective of weather conditions.
Both these solar and wind energy is pollution free and renewable sources of energy. Use of these types of energies reduces the dependence on fossil fuels for the generation of electricity. A considerable combination of renewable energy sources to form a hybrid power system is the basis of this project. To meet the energy demand with geographical factors of atmospheric condition, topography etc wind generators and solar charged batteries are both used together. hybrid power systems are useful in remote villages, hills, sandy regions etc due to its independent operability and reliability of the system. These systems could be used to provide electricity to homes, streets, schools, etc.

A. Block Diagram

The block diagram gives the simple layout of the hybrid power system. It has both sun driven solar panel for solar energy and wind driven wind turbine for wind energy. The batter is charged by any of the two solar or wind energy. Then there is battery bank, inverter, charge controller and this system powers the electrical load.



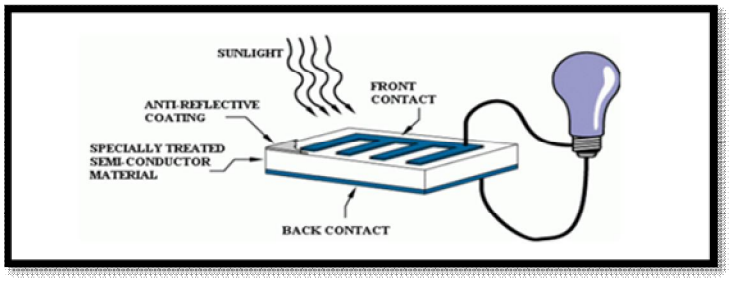
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B. System Description

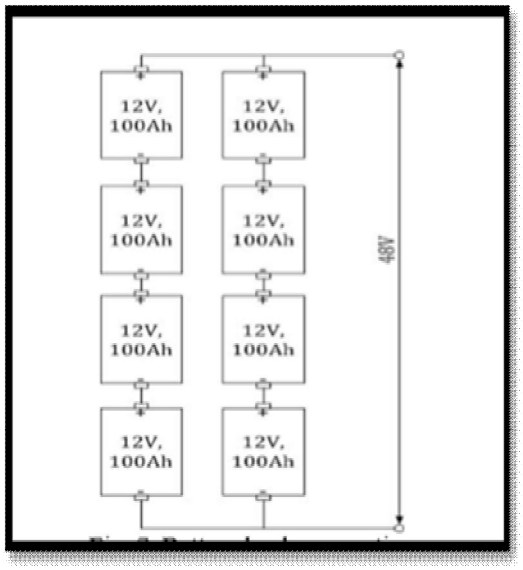
1) *Wind power system:* The high-speed flow of atmospheric air is called wind. Wind has a huge amount of energy. The conversion of wind into electrical power is done by wind generator. The wind is blown through the propeller producing torque which drives the generator producing electrical power. The velocity of wind depends upon magnitude and direction. Wind energy is a renewable energy source and prevents the burning of fossils fuels there after helping by being pollution free energy source. The wind power is dependent on the area of wind turbine and wind velocity.

2) *Solar power system:* Solar energy is one of the most abundant forms of energy present on Earth whose efficient utilization can reduce the burden of the fossil fuels. Solar energy is pollution free thus it has no negative effect on the solar system. The conversion of sun's light into electricity is called as Photovoltaics. This photovoltaic is exhibited by some materials like Silicon . these materials absorb energy from the sun , photons of light and release electrons. These electrons are then captured and tuned to give electric current. This property of absorption of light energy and release of electron is called as photoelectric effect.



A simple photovoltaic cell or a solar cell is shown in the figure above. Solar cells are built some special kind of materials called as semiconductor materials. Examples of semiconductor materials are silicon, germanium etc as per specific requirements. The solar cells have a thin semiconductor wafer which forms an electric field, with both positive and negative sides. When sun's energy hits the solar cell, free electrons are released from the atoms in the semiconductor material. The released electrons are captured with the conductors completing the circuit of positive and negative and the electrons flow as electric current , constituting the flow of electricity . This generated electricity from sun's energy can be used to power the load, or light the house appliances, water heaters etc.\

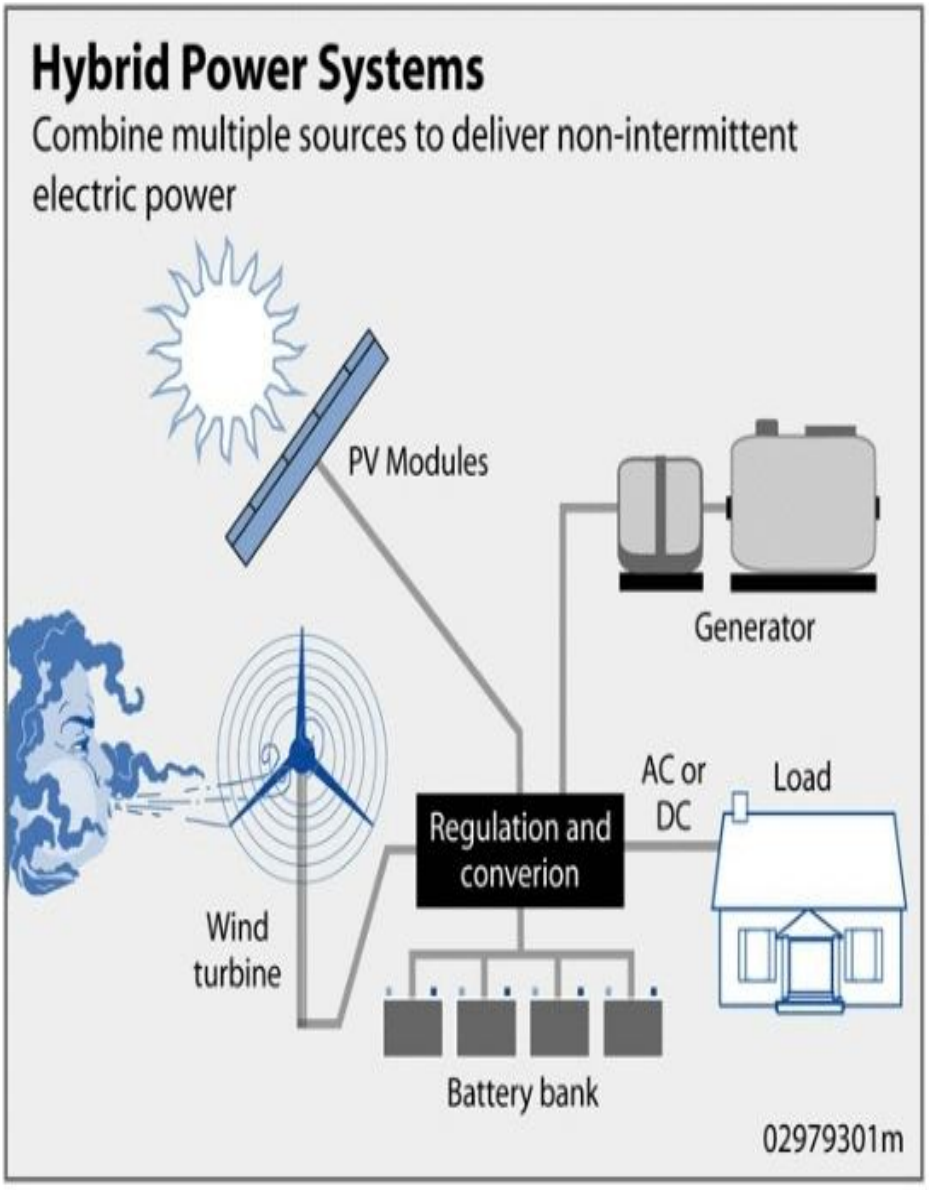
3) *Battery Bank:* A standard battery rating available confirming to the design above is 12V, 100Ah. In order to meet the voltage rating, 4 such batteries are connected in series to get the voltage rating of 48V, and two such arrangements are connected in parallel to get a total current rating of 200Ah , which is above the required design value.

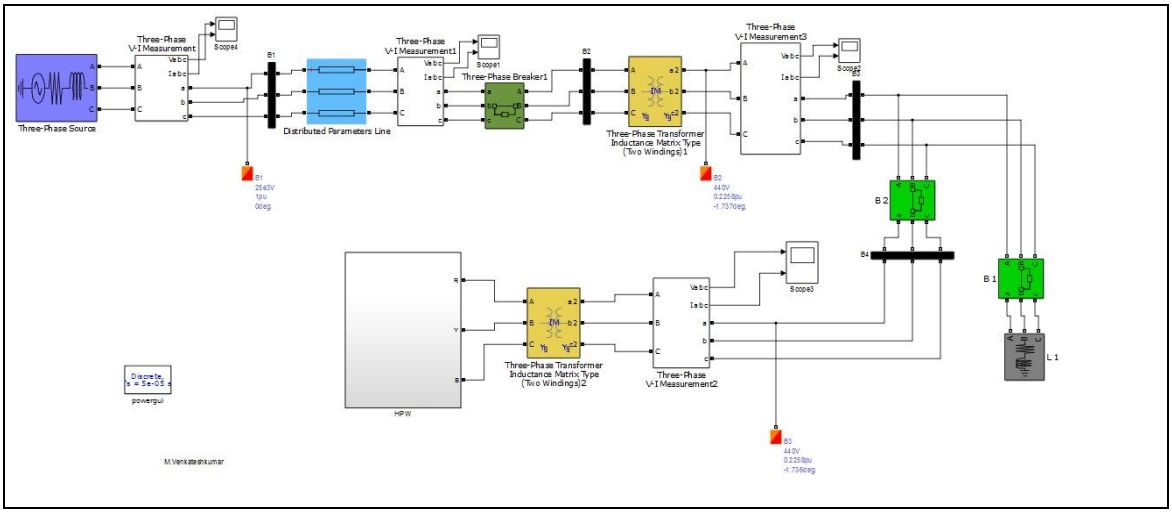


4) *Development of Hybrid power system using MATLAB: The* figure below shows the basic hardware layout of a general hyrbid power system along with the software layout of it. Matlab software is used for the analysis of this project.

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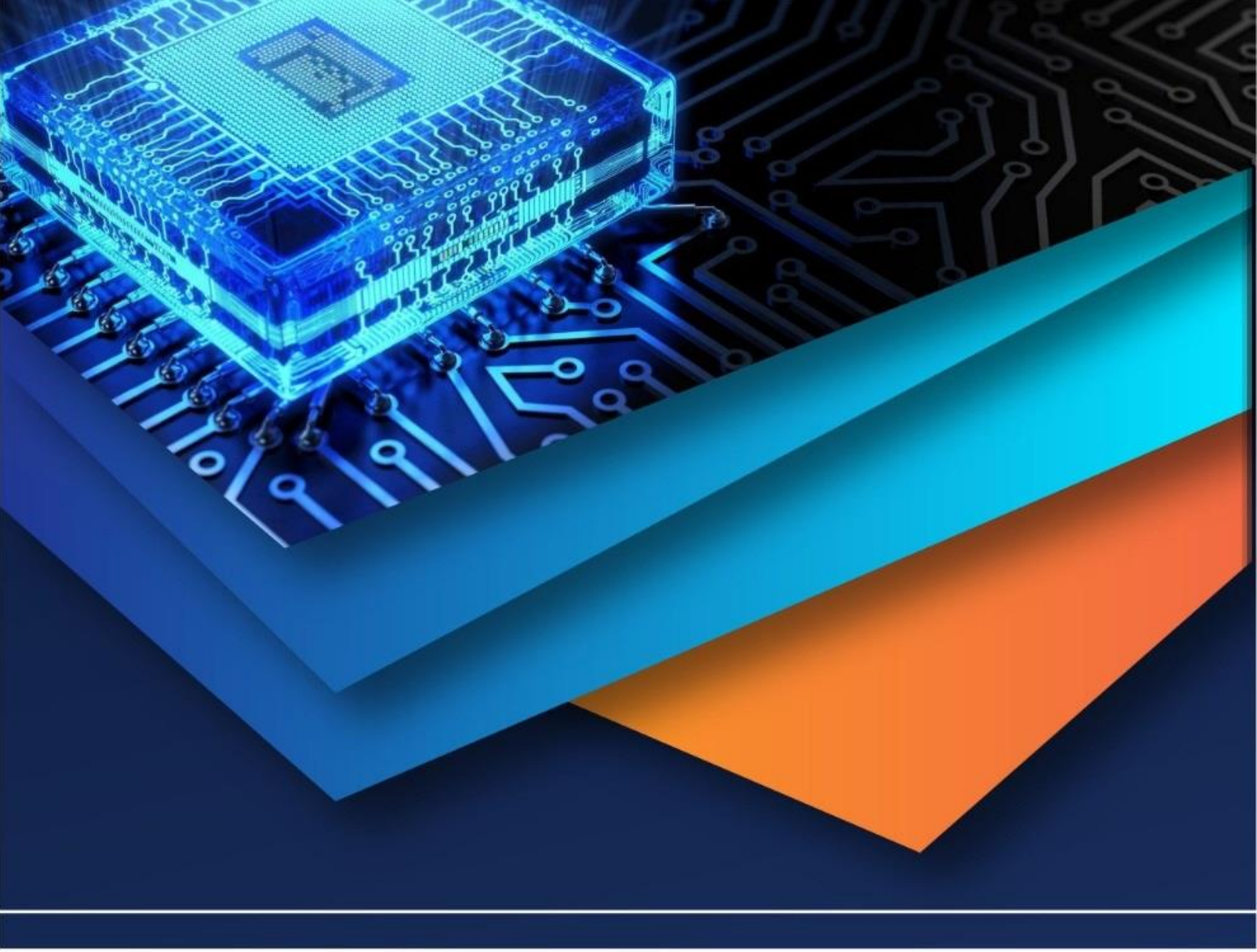
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5) *Conclusion and Future scope:* The inclusion of an additional power source (wind power) has brought down the rating of the solar panel. This has helped in the dependence of the system on a single power source and has increased the reliability. Systems of much higher capacity can be built by extending (scaling) this design. Small standalone systems like these along the coastal belt of Kerala can help in taking a considerable amount of load off the grid. This will help our state, Kerala to use the excess power for other activities. The major hurdle in implementing projects like these is to get the people understand the benefits of such projects to them, as well as the country. Since sufficient power is available from the wind, a standalone direct power inverter system which drives a load without using intermittent battery bank can also be a future work. Although such systems does exist now using solar energy, we could not find much work done using wind energy. The identification and use of other renewable sources of energy to improve the reliability and dependence on a single power source is also under consideration. The idea that has the most priority is the conversion of heat absorbed by concrete buildings (or structures) into electricity. This can in a way help to generate electricity and also reduce the burden of air conditioners as they will be running on lighter loads.

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