

Amelioration of Hybrid Power System Using IOT

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Abstract

Today the whole world is facing one of the important crises that inadequate of natural resources like fossil fuels for energy production. In order to overcome this the use of renewable energy resources is encouraged. This paper describes about the electrical energy power generation with the interface of solar photovoltaic and wind energy. Solar Energy and wind energy are non conventional energy resources. This will provide an uninterrupted power supply without damaging the natural balance. Now a day's maintenance of power production station becomes a little difficult process. In order to overcome this drawback IoT (Internet of Things) used. IoT manages the power production data's in each PV module and wind turbines. Hence it is further used to identify the defective panels and turbines for the site management purposes.

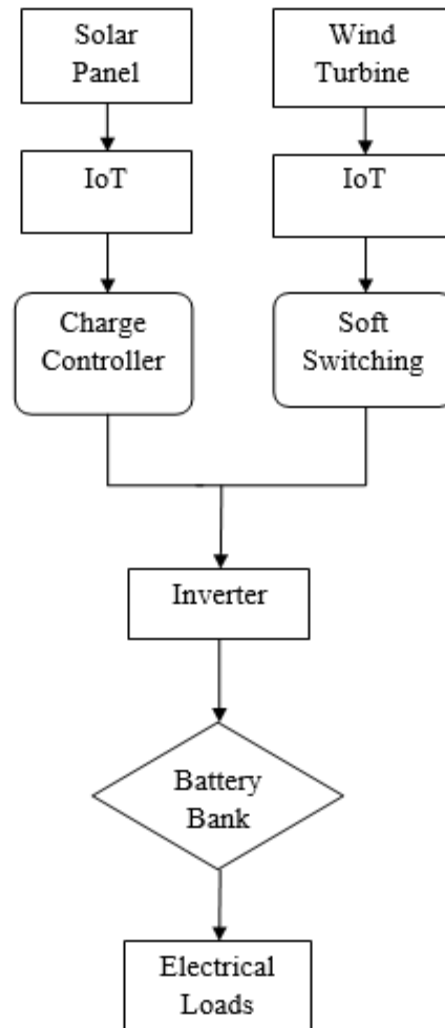
Keywords: Hybrid Power System, Photo Voltaic Cells, Maximum Power Point Tracking, DC-DC Converter, Internet of Things.

Introduction

We know that energy is one of the basic need for development. The rapid increase of population and technology increases the need of energy. The energy can be produced in different ways. But in the energy production the most considered factor is to be the energy production that doesn't harm the environment. But the fact is the usage of fossil fuels for energy production will pollute the environment [5]. The fossil fuels are been in the earth which is not sustainable. According to recent research clearly shows that the fossil fuels will last only up to the year 2050. So we are in the stage to use the sustainable energy resources like wind, solar etc. [7]. Sustainable energy resources in other term renewable energy resources electricity generation will doesn't pollute the environment and doesn't harm the living beings. But non renewable energy power generation will pollute the environment as well harm the living beings. So the future generations are motivated and encouraged to use the renewable energy resources. And now the global warming impact the climatic change.

In order the renewable energy is encouraged by the world in the climatic change submit held at Paris. Maximum of the countries accepted to increase their renewable energy electricity generating stations. Here we interface the two renewable energy resources solar energy and wind energy for power generation and some solutions for site management process. Energy which are sustainable and available by the nature itself. Example: Solar Energy, Wind Energy, Biomass etc. Energy which are not sustainable and lower in amount and vanished after few years. Example: Coal, Natural gas etc.

Flow Chart of Hybrid System



Solar Energy

It is one of the renewable energy. Solar energy can be used for generating electricity and solar cooling. For solar energy, the fig. 1 describes that[11]solar panels are used to generate the power. Solar panels convert direct sunlight into electricity. Inside the solar panels, Photovoltaic Cells are used. It is made up of silicon semiconductors, they are constructed with a positive layer and negative layer which together creates an electric field. Silicon atoms are arranged in a tightly bonded structure. Two different layers are created n-type and p-type layers.

When these layers are placed inside a solar cell, the n-type silicon disperse the electrons to fill the gaps in the p-type silicon, so the n-type silicon becomes positively charged and the p-type silicon is negatively charged creating an electric field across the cell. Because silicon is a semi-conductor that also acts like a partial insulator.

[6]Photovoltaic modules use light energy from the sun to generate electricity is known as the photovoltaic effect. This is the principle used in a solar panel. Solar cell is an important part in a solar PV system. A solar cell is made up of p-n junction that converts the light energy into electricity using photovoltaic effect. Absorption of incident photons creates electron-hole pairs in the solar cell.

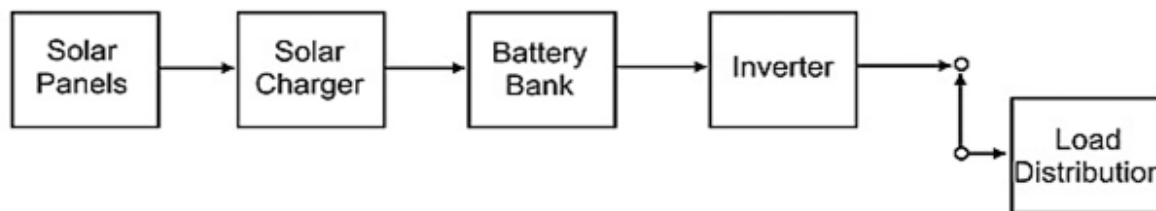


Fig. 1: Block Diagram of Solar Energy

The Direct Current which is obtained from the solar panel is given to the MPPT (Maximum Power Point Tracking) controller. MPPT algorithm extracts maximum power which includes charge controllers from the PV module under certain conditions. The maximum power which is produced in PV is called “maximum power point”. In an MPPT battery voltage and output power of PV module is compared. MPPT have the capacity to supply power to a DC load, in which battery is directly connected, MPPT algorithm is designed in way to extract more current and to charge the battery when the charge of the battery is low. MPPT is a DC-DC converter. MPPT solar charge controllers are useful for off-grid solar power system such as stand-alone solar power system, solar home system and solar water pump system etc.

Wind Energy

It is also one of the renewable energy. It is used to convert kinetic energy into electric energy by using turbine. The turbine consists of generator which converts mechanical energy into electrical energy. The Fig 2 explains that [10] Wind turbines are normally 100-200 feet or more above which are used to harness the wind and converts into energy. When the wind blows above 15km per/hr turbine blades rotates. The drive shaft is connected to a blade. The drive shaft moves along with the blades. The shaft is attached to a generator which creates magnetic flux and converts into electricity. Alternating Current is generated from wind turbines. Wind turbines does not release any harmful particles so it doesn't pollute the air in addition to that they do not require water for cooling. Wind turbines are manufactured on vertical and horizontal axis type. Wind turbine are rotated based on their axis. In Horizontal axis wind turbine at the top of a tower has the main rotor shaft and electrical generator and must to be pointed to the wind. Vertical axis wind turbine has the main rotor shaft arranged vertically. One of the main advantage is the wind turbine has been placed in desired areas [9,10].

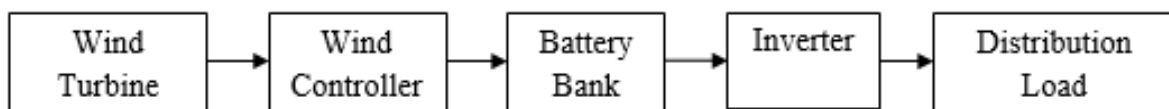


Fig. 2: Block Diagram of Wind Energy

Battery and Inverter

It is a storing device. It gives dc power to an inverter. MPPT gives a constant DC power to a battery. It is a DC-DC converter. The inverter converts Direct Current to an Alternating Current. Inverters are the brain of the system.

Solar and Wind Hybrid Power

Hybrid means combination of two or more different elements. Electricity is generated from solar, wind, biomass, tidal etc. Using hybridization, we can increase the output power and fulfill the demand of the consumer. [1,3] They are different types of hybrid power technology like solar-wind, solar-diesel, wind-hydro and wind-diesel. Above these solar-wind hybrid module is mostly used because it gives stable power supply and complement to each other. And also, eco friendly. Solar energy does not give an enough power generation during winter and rainy season so we hybridized wind energy. Sun does not produce a continuous power supply. In day solar energy produce electricity approximately 8 to 10 hrs per day. To get a continuous power supply hybridization is used.

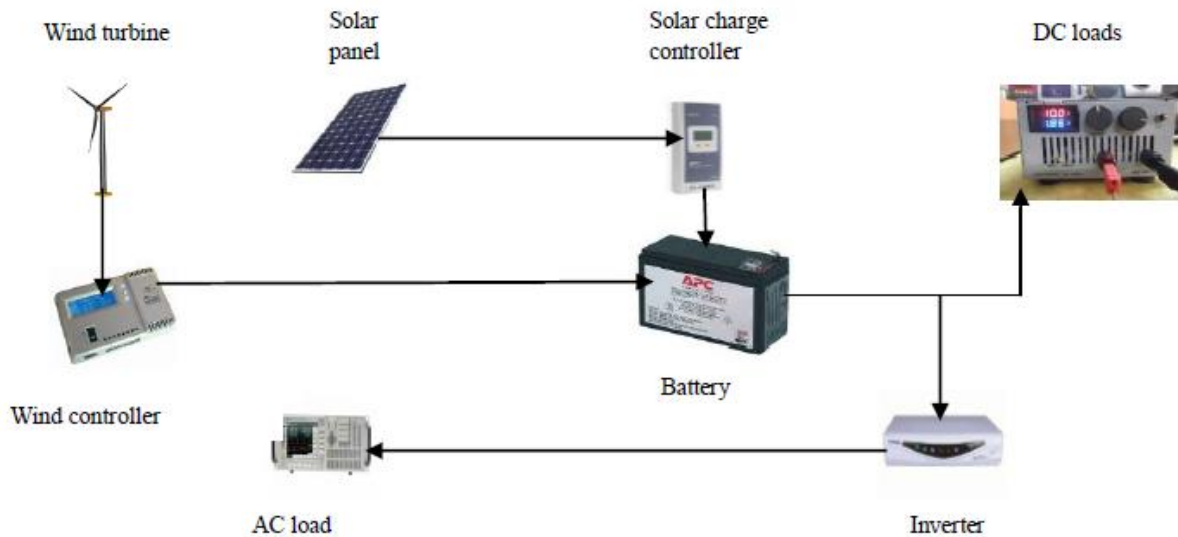


Fig. 3: Hybrid Power System

Enhancement of Hybrid Power System Using Iot

In a solar and wind energy power production there are large diverse products, standard forms. It is easy to maintain and identify the defected areas in solar PV panels and wind turbines. But in large power generation station it is difficult to identify the defective areas [4,8]. In order the IoT is interfaced with wind turbines and solar modules. From the fig 3. Explains IoT Will collect the data's of power production in each PV module and wind turbine and store it for future purposes. By checking the data's with PV module no and Wind turbine num it can be easily identified and instructed to change or repair.[2,8]IoT works either via Bluetooth or Ethernet (wire or wireless). Here we used wireless technology WI-FI to connect the IoT. IoT which stores the data in the cloud which can be accessed from anywhere by the user and can be monitored easily. It may be expanded to a technology of recognizing other smartgrid power generating facility in the future.

Results

By observing the hybrid power systems, it can be used in homes, shops, educational intuitions, banks etc. and with the help of IoT, hybrid power systems are encouraged for commercial electricity generation in worldwide.

Solar	600W	1KW	3.5KW
Wind	500W	1KW	3.5KW
Number of electricity Units produced per day (kwhr)	4	8	28

Conclusion

Combination of solar and wind power systems are highly effective in commercial sectors. It is eco friendly. By using this system in homes and commercial sectors which leads to less electricity bills and less maintenance cost.

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