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Generation of Electricity by Wind Tree

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Abstract: Power requirement of the world are ever increasing. In order to fulfill these, it is essential to discover new energy sources or rather improve the existing techniques for extracting maximum energy. The Wind Tree is a concept that uses the helical blades for generation of electric power. The helical blade is Omni – directional which means it is capable of rotating irrespective of the wind flow. The aim of the project is generating electricity by means of small wafts of air that circulate around the buildings and streets with the help of aero leaves. Multiple number of leaf shaped aero leaves can be place in the form of tree and called as wind tree. Wind Tree uses tiny blades placed in the aero leaves to generate power from wind energy. Despite of the wind being fluctuating in nature; the turbine is capable of generating electricity 24*7 as a small waft of air is sufficient to rotate this turbine.

Keywords: Eco-friendly, efficient, cheaper, wind tree

I.INTRODUCTION

Wind is considered as the fastest growing clean energy source which is readily available. The concept of wind tree is unique in itself the turbines are sculpted in the form of an artificial tree. It aims at utilizing the low winds that circulate around buildings and streets. The artificial Aeroleafs serving as microturbines spin on a vertical axis and is capable of harnessing more gentle winds. The turbine being small and light in weight are set in motion by winds as light as 4.4 miles/hr. The Betz's law calculates the maximum power that can be extracted from the wind, independent of the design of a wind turbine. According to Betz's law, no turbine can capture more than 59.3% of the kinetic energy in wind. Bets law explains that power extracted from wind energy is directly proportional to the cube of wind velocity.

OVERVIEW:

The present wind mill cannot be implemented in our natural surroundings. As it is not sensitive to all wind direction by its design it gives partial efficiency and increases cost of design, transplantation, installation and maintenance to overcome these effect and disadvantage of present wind energy system a new hybrid design of wind mill must be introduced. This research paper takes to the new era of windmill technology with its interesting applications. The main advantage of using this wind tree is that they do not need to be placed in the direction of wind due to its omni-directional characteristics. Other advantage is that it increases the surrounding beauty due to its tree look. It can be generate as well as add beauty to surrounding.

The idea of creating an electrical power generating system in the form of a tree, with its each leaf as an actual mini wind turbine. Capturing low wind speed and turbulence is at the crux of this novel approach which can deliver power and autonomy simply through a proliferation of leaves. It is the first human scale biomimetic wind turbine capable of recreating a sympathetic bond between the consumer and their means of power generation. Multiple turbines combine to capture the lowest wind and accumulate their power.

VAWT's have the main rotor shaft arranged vertically. The wind turbine does not need to be pointed directly into the wind. With a vertical axis, the generator and other components can be placed near the ground so the tower does not need to support it, also making the maintenance easier.

Betz Law:

According to Bet's law, no turbine can capture more than 16/27 (59.3%) of the kinetic energy in the wind. the factor 16/27 (0.593) is known as Betz's configuration. practical utility – scale wind turbine achieve at peak 75% to80% of the Betz limit. The Betz limit is based on an open disk actuator. If a diffuser is used to collect additional wind flow and direct it through the turbine, more energy can be extracted, but the limit still applied to the cross section of the entire structure. The power of the wind is proportional to air density, area, of the segments of wind being considered, and the natural wind speed. The relation ship between the above variables are provided in equation

$$Pw = ½ \rho Av3$$

From the studies of different IEEE papers and journals we have listed some literatures which are the backbone of our project. From the literature survey we came to know that the most fellows and trying to use traditional wind turbines like HAWT. Most of them tried to use AC generator. Also in many of the papers DC generators run by AC sources hence the

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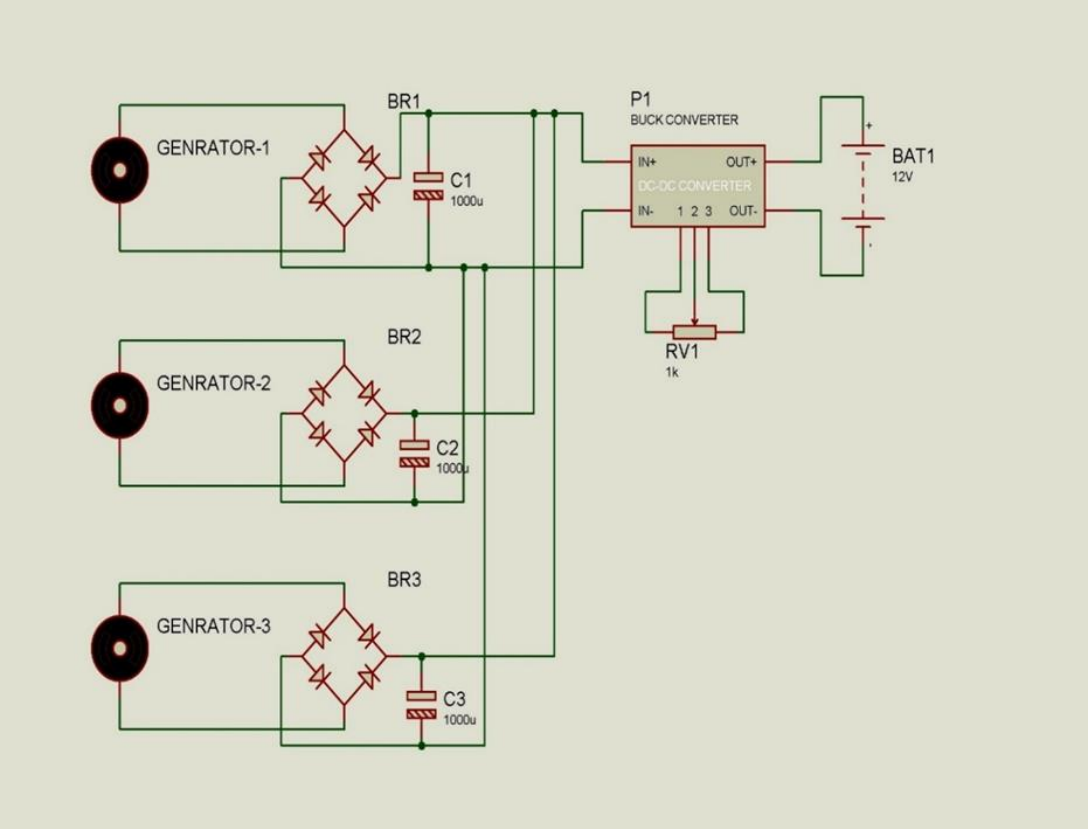
costing of the project increases as it requires inverter and rectifier circuits. As our main motto was to use AC generator as the cost of the inverter is saved. The components used along with their assembling and working is explained in chapter 3. On very next chapter we are discussing about system design and results obtained. Chapter 6 includes the conclusion and the future scope. Appendix shows the program used by the microcontroller. We have used SIEMENS NX10 software for designing a system and various views of a system where studied on it. last chapter shows the references that we have drawn. Also new wind which has introduced such a nice concept of wind tree.

II.PROPOSED WORK



This is the circuit diagram of the complete system, in which electricity is generated by wind tree. So here we are using mainly three generators as if you can see in the diagram itself (generator-1,generator-2,generator-3) the main use of these generators is to convert mechanical energy into electrical energy in other words we can say that conversion of kinetic energy into potential energy which is in the form of AC (alternating current) . The mechanical energy is generated by vertical axis wind turbine. Further these generators are connected to the bridge rectifier. Here we used bridge rectifier because the generators are generating the power in the form of ac and we required dc power so for that purpose we required rectifier to convert AC to DC. The bridge rectifier is producing pulsating DC power and for that complete filtration the capacitors is connected itself in the bridge rectifier to get the pure form of DC power. Further the bridge rectifier is connected to buck converter which mainly used of stepping down the power. If we are getting higher value of power it will step down the voltage. Similar as of stabilizer. And lastly it connected to battery which will store the power and this will used for the purpose of light up the street load and buildings, residential stadium. Or it can be used to charge electric car or vehicles. This system can light up the villages which are near the highways.

III.IMPLEMENTATION DETAILS

WIND TURBINE

Wind turbine produce electricity by utilizing the wholesome power of the wind to steer a generator. As the wind is a bare and sustainable fuel source, it mainly does not create emanation and most importantly it will not run out as it continually toping up by energy. There are two different type of wind turbine. One is horizontal axis wind turbine and second is vertical axis wind turbine. One is assemble for areas which required high speed for generating electricity, and other is assemble specifically for the area which required low wind speed mainly like places residential areas. Wind turbines consist of a set of blades attached to a rotor hub, which together form the rotor; this rotor deflects the airflow, which

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creates a force on the blades, which in turn produces a torque on the shaft such and the rotor moves around a horizontal axis, which is mainly attached to a gearbox and generator. These are inside the nacelle, which is located at the top end of the tower, along with several other electrical parts. The generator generates electricity, which is moved down from the tower and out to an available transformer, so that it can be converted from the output voltage to the some voltage for any personal use.

VERTICAL AXIS WIND TURBINE

Vertical Axis Wind Turbines are designed to be economical and practical, as well as silent and most efficient. They are great for use in residential areas. Vertical Axis Wind Turbine have the main rotor shaft arranged vertically.it does not required any yawing mechanism and that's the main advantage of this type of vertical axis wind turbine.

SAVONIUS TYPE

Savonius wind turbines is one of the type of Vertical-Axis Wind Turbine (VAWT), used for converting the force of the wind into torque on a rotating shaft. The turbine consists of a mainly three blades , usually but not always, vertically mounted on a rotating shaft or structure work, generally ground stationed.

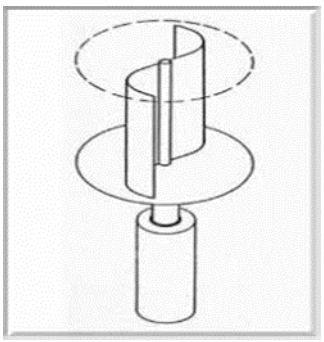

FIG. SAVONIUS TYPE WIND TURBINE

The Savonius turbine is one of the effective turbines. Aerodynamically, it is a drag-type device, consisting of two or three blades . Looking down on the rotor from above, a two-blade machine would look like an "S" shape in crosssection. Because of the spinal curvature, the blades experience less drag when moving against the wind than when moving with the wind. The differential drag causes the Savonius turbine to spin. Because they are drag-type devices, Savonius turbines extract much less of the wind's power than other similarly-sized lift-type turbines. Much of the swept area of a Savonius rotor may be near the ground, if it has a small mount without an extended post, making the overall energy extraction less effective due to the lower wind speeds found at lower heights.

Generator

The main function of the generator is to convert mechanical energy into electrical energy . The wind generator is a square torque machine and the output increases exponentially with increasing wind speed. For more of cost and simplicity, most generators use a rotating magnetic field with a stationary armature. Occasionally, a linear alternator or a rotating armature with a stationary magnetic field is used. Every generator has a certain speed at which its runs most efficiently. But since the wind is not constant , we must try to design to happy medium. As the wind speed rises , the raw power coming into the generator from the wind becomes more than the generator can effectively Use, and it gets more and more inefficient.

Bridge rectifier

A Bridge rectifier is an converting device that converts Alternating Current (AC) to Direct Current (DC) and that rectifies mains AC input to DC output. Bridge Rectifiers are extensively used in power supplies that supply necessary DC voltage for the electronic components or devices. They can be put up with four or more diodes or any other controlled solid state switches.

As the bridge rectifier gives the pulsing dc output And we required complete dc output so for that purpose there is capacitor connected which filters the pulsating dc to complete dc output.

Buck convertor

Buck converter which mainly used of stepping down the power. if we are getting higher value of power it will step down the voltage. Similar as of stabilizer. It will increase the lifespan of the battery.

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Battery

battery which will store the power, The project aims at finding a system that can charge a battery using economic and non-conventional way. Hence we have used a 12 V battery for the charging purpose as a normal lighting load can be connected to a 12 V battery . we can use a battery with higher rating as the output of the generator That can reach upto 50 V Battery bank with multiple units can be installed if the rating of the generator is increased.

CONCLUSION

In course of the project, we have come to the conclusion that is still a lot of scope of energy production with the help of wind turbines. With better design and increasing the number of turbines along with some advanced technology it is Possible to implement this project on a large scale. It would not only solve the Problem of energy crisis to a great extent but would also give a landscapic view to the city. We highly recommend these wind trees alongside the streets in order to save electricity required for the street load.

By further increasing the height and the number of turbines, it is possible to Light up an entire building with the help of these wind trees. Even though the Wind is being fluctuating in nature, it is constantly available 24*7 which make it a more reliable option than the solar panels.

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