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Generation of Electricity by Wind Tree

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ABSTRACT: Energy from wind is the fastest growing source of electricity in the world. In this project wind energy is used to generate electricity with the help of aero leaves. Several leaf shaped aero leaves are placed in the form of tree, called Wind Tree. Wind Tree uses tiny blades housed in the aero leaves to generate power from wind energy. These wind trees are able to generate power regardless of the wind direction and with minimum wind speed of 7Kmph.In this project we have used tree shaped structure, covered with leaf shaped mini turbines called aeroleaves which are of savonius type turbine and designed to produce the power which will catch the wind from all the directions. All cables and generators are integrated into the leaves and branches. Artificial leaves operate as mini vertical turbines all around the tree. When the wind blows, the leaf turbines rotate and quietly produce the energy. This project concludes that, the power generated from wind tree is environmental friendly, mainly it generates power with least noise and it can be installed at different locations.

KEYWORDS: Aeroleaf, Vertical axis wind turbine, Savonius type

I. INTRODUCTION

Energy can neither be created nor be destroyed but it can be transformed from one form to another form. There are two types of energy sources available, which can be used to generate the electricity. They are Renewable and Non-renewable energy resources. Non-renewable energy resources are coal, nuclear, oil and natural gases which are limitedly available, and the Renewable energy resources are Sunlight, Wind, Rain, Tides, Waves and Geothermal heat and these sources are naturally replenished on a human time scale. This type of resource is much desirable to use because often a resource renews so fast that it will have regenerated by the time we used it up.

In this project we considered wind as a renewable source of energy to generate electricity. Wind energy is a source of renewable power which comes from air current flowing across the earth's surface. Wind power plants can make a significant contribution to the regional electricity supply diversification. Wind energy system transforms the kinetic energy of the wind into electrical energy that can be used for practical use. Wind electric turbines are employed to generate electricity. And there are two basic designs of wind electric turbine, Horizontal axis wind turbine and Vertical axis wind turbine. Vertical axiswind turbine can further classified into two types Darrieus type and Savonius type. Darrieus type rotor wind mill needs much less surface area. It is shaped like an egg beater and has two or three blades shaped like aero foils. Savonius turbine is S-shaped if viewed from top. This turbine turns relatively slow, but yields high torque. It is used for grinding grains and for pumping water.

Here we make use of Savonius vertical axis wind turbine and these turbines are powered by wind coming from all 360 degrees, and even some turbines are powered when the wind blows from top to bottom. Because of this versatility, vertical axis wind turbines are thought to be ideal for installations where wind conditions are not consistent, or due to public ordinances the turbine cannot be placed high enough to benefit from steady wind.

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Wind tree is designed as same as tree and it works silently. It is small in height and also the sizes of blades are small. And this wind tree consists of Aeroleaves that houses tiny blades which can generate electricity even in the slightest wind speed.

II. WIND TURBINE

Wind turbines produce electricity by using the natural power of the wind to drive a generator. The wind is a clean and sustainable fuel source, it does not create emissions and it will never run out as it is constantly replenished by energy from the sun. There are generally two different types of wind turbines. One type is built with the aim of generating electricity from wind with high speeds. On the other hand, the other type is built especially for areas with low wind speeds. Wind turbines consist of a set of blades attached to a rotor hub, which together form the rotor; this rotor deflects the airflow, which creates a force on the blades, which in turn produces a torque on the shaft such and the rotor rotates 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 either the countrywide grid or for any personal use.

The formal definition for a wind turbine is a type of device that transforms kinetic energy from the mainly from the wind into electric power.

III. VERTICAL AXIS WIND TURBINE

Vertical axis wind turbines are advocated as being capable of catching the wind from all the direction and do not need yaw mechanism rudders are downwind coming. There electrical generators can be positioned close to the ground and hence easily accessible. A disadvantage is that some designs are not self-starting.In this concept Savonius type vertical axis wind turbine is used.

IV. SAVONIUS TYPE

Savonius wind turbines are a type of vertical-axiswind turbine (VAWT), used for converting the force of the wind into torque on a rotating shaft. The turbine consists of a number of aerofoils, usually—but not always—vertically mounted on a rotating shaft or framework, either ground stationed or tethered in airborne systems.

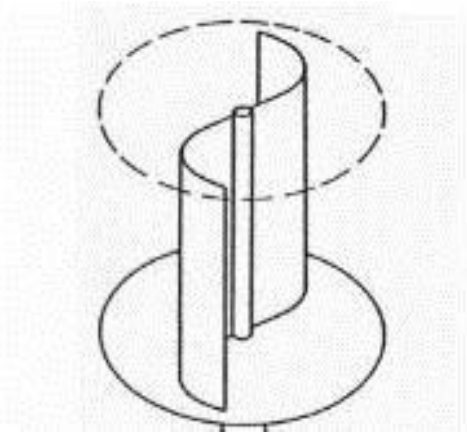

Fig.Savonius type wind turbine

The Savonius turbine is one of the simplest turbines. Aerodynamically, it is a drag-type device, consisting of two or three scoops. Looking down on the rotor from above, a two-scoop machine would look like an "S" shape in cross section. Because of the curvature, the scoops 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.

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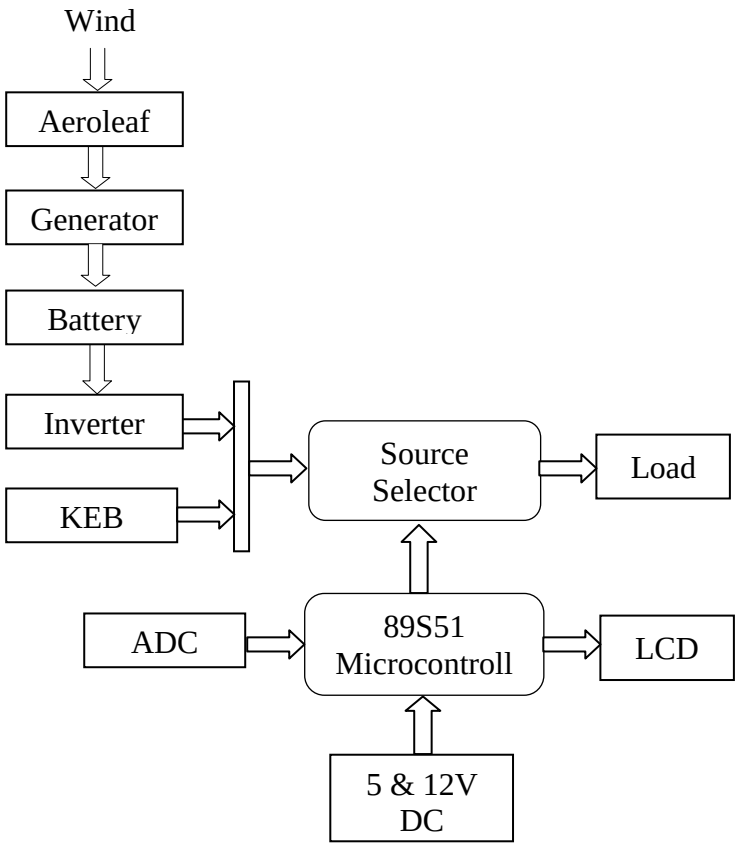
Fig.Aeroleaf(Front View) **Fig.Aeroleaf(Top View)**

V. BLOCK DIAGRAM



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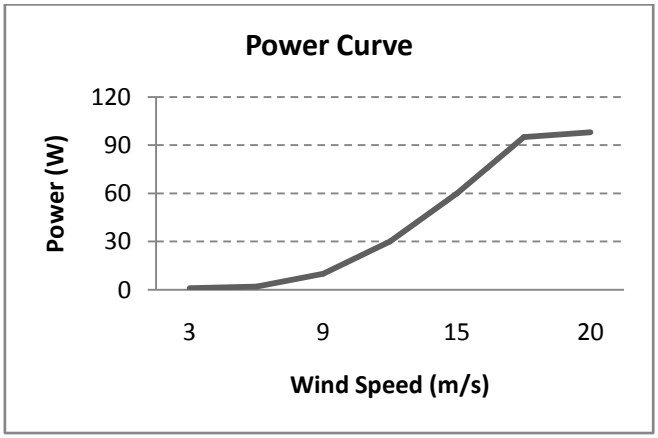
VI. WORKING

In this concept wind energy is used to generate electricity with the help of Aeroleaves. These Aeroleaves are made of fiber and molded into specified shape based on the requirement. Here we are using the generator which will be equal to the number of Aeroleaves. This model mainly works on the principle of 'Faradays law of electromagnetic induction', which states that "Whenever a conductor is placed in a varying magnetic field (Or conductor is moved in a magnetic field) an EMF gets induced in the conductor. Aeroleaves starts to rotate with minimum speed of 7Kmph flows through it, as Aeroleaves are coupled to the generator, mechanical energy gets converted into electrical energy because of the fact that the generator consists of armature (magnet) and the field coil. An EMF is induced due to the relative motion between the rotating armature and magnetic field due to field coil.

Each aeroleaves along with generators are connected in series, so the generated voltage will get added. This resulted output is given to the battery and is stored, then it is used to drive the load. Switching techniques can be done by the source selector i.e., by Microcontroller (89S51). Microcontroller is programmed in such a manner that the first preference must be given to the Tree model, while the second preference is given to the external KEB supply. Analog to Digital converter work is to measure the voltage and to convert it from Analog signal to Digital signal which results on the LCD display.

VII. POWER CURVE



The above Power Curve indicates the generation of power per aeroleaf depending on the wind velocity. If the wind speed increases the generation will also increase, basically the aeroleaf actuates with the wind speed of 7Kmph. If the wind speed becomes 12m/s then the aeroleaf produces 30Watt of energy and when the wind speed is 18m/s, each aeroleaf will generate upto 100Watt and becomes the saturation level because peak capacity of an aeroleaf is 100Watt.

VIII. ADVANTAGES

1. Gearbox is not necessary.
2. Generating 2400kwh with an Aeroleaves avoids creating the 3.2 tons of CO2 that results from producing the same amount of electricity in an oil fired power station.
3. Wind tree works silently with least noise about 5 dB and hence these can be installed everywhere.
4. As wind tree is located near to the consumer premises transmission cost will be very less.
5. With a low wind speed threshold, the low-inertia rotor system is able to able to generate production ± 300 days per year.
6. It can produce electricity irrespective of the wind direction.

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IX. DISADVANTAGES

1. Vertical axis wind turbine is not able to produce more electricity from a given amount of wind.
2. Vertical axis wind turbines are not widely used because horizontal axis wind turbine dominates the majority of the wind industry.

X. APPLICATIONS

1. Used for 15 Street lamps of 50W.
2. 1000 sq.ft low consumption office (20kwh/sq.yard)
3. Lighting for 71 exterior parking spaces.
4. Can be used for one electrical car for 10,168 miles per year.
5. Majorly used for residential purpose.
6. Used for commercial purposes like Schools, Offices, Hospitals etc.

XI. FUTURE SCOPE

Wind power is an affordable, efficient and abundant source of domestic electricity. It is pollution free and cost-competitive with energy from wind tree plants in many reasons. The paper first deals with the current scenario of the wind energy in India. Wind energy is available without any cost and it does not emit any greenhouse gases. This makes it a great source of energy production for any developing state. The field of wind energy has tremendous scope for innovation, translating to real world applications and tremendous economic opportunity. It is crucially important for India, as our economy continues to evolve. For that we will need greater resources. Clean, sustainable, renewable and equally important, domestic sources of energy are essential to fulfill the potential of India in the coming years and it is certain that wind energy will play a major part in shaping India's future. Wind power has emerged as the biggest source of renewable energy in the world.

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