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Implementation of automated wind power generation system on Indian highway

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ABSTRACT

Wind energy has been the subject of research in the field of power generation. As the population increases and energy demand increases, renewable energy sources such as wind can be used to generate electricity with proper technology. To make the traditional method more efficient, i.e. Horizontal wind turbine axis, experimental research has shown that for low wind conditions vertical axis wind turbine can be used. The omnidirectional vertical axis wind turbine uses less space and higher power output. Since the rollers used in earlier models lead to a high loss of friction, we make use of magnetic levitation. We propose this design model with two steps, each with three blades in each stage. The blades are savonius type blades. Power generation is done using a pulley and belt system with the help of a DC motor.

Keywords*— Wind energy, Wind turbine, Vertical axis wind turbine, Savonius blade.*

1. INTRODUCTION

Wind power is the fastest growing clean energy source in the world. This is mainly due to the rise in fossil fuel prices and government incentives. In the coming years, the use of wind energy is expected to grow dramatically. Fluctuation in the energy source is a major problem with this clean technology. Due to the fast-moving vehicles, there is an almost constant source of wind power on the highways. Wind power is one of the unconventional forms of energy and is widely available. Using a vertical axis wind turbine, electricity can be generated. Windmills with a vertical axis, like the Savonius (built in 1930), use drag instead of the lift. Drag is like a brick wall, resistance to the wind. The blades on vertical axis windmills are designed to resist the wind and are driven by the wind as a result. Vertical and horizontal axis windmills are used in many ways. Some are hydraulic pump, engine, air pump, oil pump. Churning, friction creation, heat director, electric generator, Freon pump and a centrifugal pump can also be used.

In recent years, the increasing demand for energy has seen an increase in the development of alternative sources of energy. It is an excellent alternative to conventional energy sources that wind is one of the most abundant and easily available sources. So we use a vertical wind turbine. Its smaller size compared to other types allows easier installation, requires less space and reduces noise, all of which are comfortable in urban environments. The simple design makes it cheaper. Compact shape allows the system to be moved to rural areas for off-grid or power outages.

The windmill has been improved a lot over the years. To control speed in strong winds, windmills were equipped with air breaks. Some vertical axis were even equipped with hinged blades to prevent high wind speed stress. Some windmills, such as the cyclo-turbine, have a vane that senses the direction of the wind and causes the rotor to rotate into the wind. Wind turbine generators have been equipped with control gearboxes (shaft speeds. For many decades, however, Europeans have experimented with curved blades on vertical wind turbines. Wind turbines have also been equipped with generators that convert shaft power into electricity.

Many of the windmills ' sails have also been replaced by airfoils like propellers. Some windmills can also stop in the wind for wind speed control. But above all these improvements, when the fantail was invented, the most important improvement to the windmill was made in 1745. The fantail rotates the sails into the wind automatically. Most wind turbines generate electricity at 11 m / s and shut down at speeds close to 32 m / s. The swept area is another variable of the efficiency of the windmill. The swept area of a wind wheel in the form of a disk is calculated as: The area is equal to the pi times diameter divided by four (pi is equal to 3.14).

Scientists estimate that 10% of the world's electricity will come from windmills by the 21st century.

Wind power equipment is used to generate electricity and wind turbines. The shaft and rotational axis orientation determine the wind turbine classification. A turbine with a shaft mounted parallel to the ground is known as a wind turbine with a horizontal axis (HAWT). A wind turbine with a vertical axis (VAWT) has a normal shaft.

Both configurations have immediately distinctive rotor designs, each with its own favourable characteristics. Vertical axis wind turbines (VAWT) can be divided into two main groups: those using aerodynamic drag to extract wind power and those using lift power. The VAWTs have the advantages of being able to accept the wind from any direction. This simplifies their design and eliminates the problem imposed on a conventional machine's rotor by gyroscopic forces as the turbine tracks the wind. The vertical rotation axis also allows the generator and drive train to be mounted on the ground level. The disadvantage of this type of rotor is that it is very difficult to control the output of the rotor blades by pitching them, they are not self-starting and have a low tip-speed ratio.

2. PROPOSED WORK

2.1 Savonius blade wind turbine

Savonius blades have a diameter of 20 to 30 inches. The Savonius scoops have to be set up. The cylinders are cut in half and the center line is offset. In this way, air entering the coop by half is recycled to the scoop on the opposite side. The second pair of scoops can also be stacked on top of the first pair and placed at 90 degrees in order to prevent the turbine from stalling in a certain position. This greatly increases the Savonius components ' efficiency. The fluid flow through our designed Savonius rotor was model able using Solid Works.

The importance of 1 radius offsetting the hemispheres has been demonstrated once again. It bounces off the wall and escape through the outlet as the fluid flow through the inlet. After the prototype was built, this fluid analysis was completed confirming the theory.

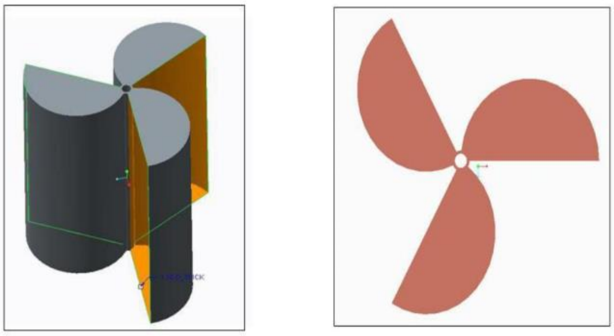

Fig. 1: Savonius blade wind turbine

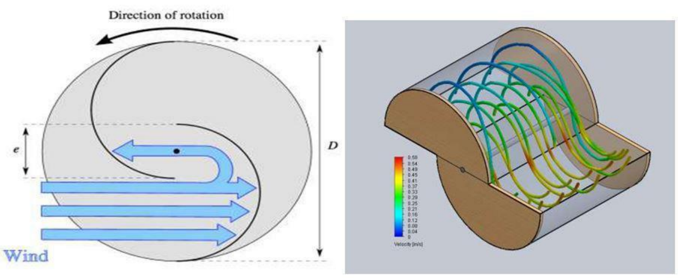

Fig. 2: Wind rotation in savonius blade

2.2 Gear mechanism

Most turbines have gear boxes to "step up" the turbine's angular speed. This is particularly important in the design of the highway wind turbine, as it is positioned with slower moving wind at lower elevations. We will use a simple gear train consisting of two gears to amplify the number of rotations. Initially, we wanted to produce the maximum gear ratio with a set of gears, but it would run the risk of interference.

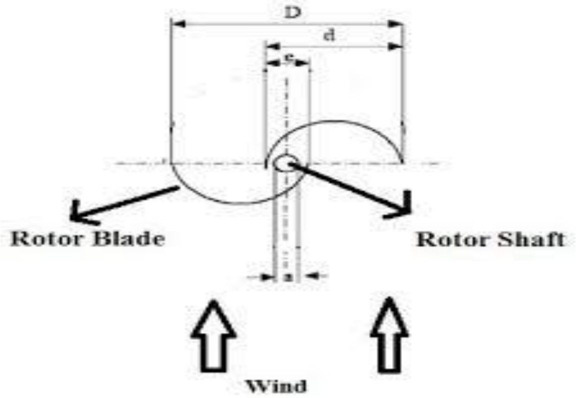

Fig. 3: Gear mechanism of savonius blade

2.3 DC Generator

The most important components that can be used in place of DC generators are permanent Magnet DC motors. The electricity generated by the magnet's spiral movement within the component is the magnetic field. The main reason is that it is cheaper than electric generators and contains many components that we use in our daily lives. A motor is a device that converts electricity into mechanical energy when electrified through its outputs, but permanent Magnet DC motors can also have adverse effects. The magnetic field created by the magnets flows through a coil.

We used the Johnson metal gearbox motor to generate electricit y with 500 RPM side shaft.

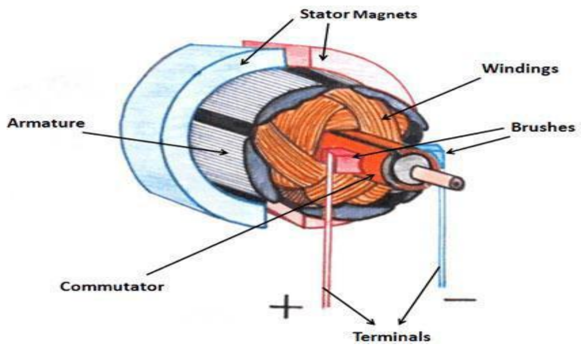

Fig. 4: DC generator

2.4 Energy storage

An automotive battery is a rechargeable battery supplying this h ybrid system with electrical energy. Its main objective is to prov ide energy. Once the wind turbine is running, the battery supplie s the power for the LED light.

Fig. 5: Energy storage

2.6 LED lights

An LED or light-emitting diode is a semiconductor-based light source-materials that are neither pure conductors nor isolators but have an electrical conductivity somewhere in between.

Electrons recombine with holes in the semiconductor when a voltage passes through the LED, emitting lights in the process.

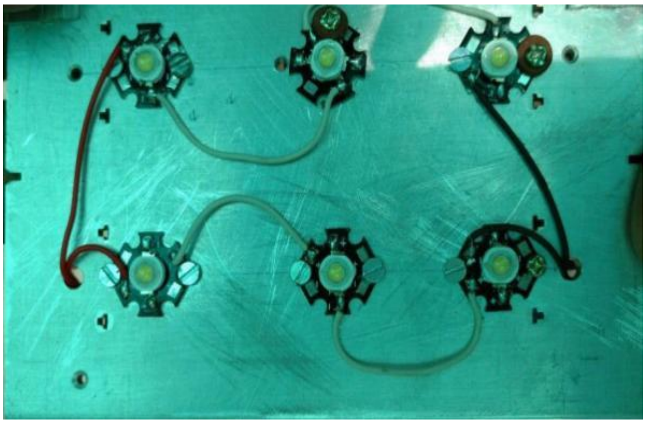

Fig. 5: LED lights

3. BLOCK DIAGRAM

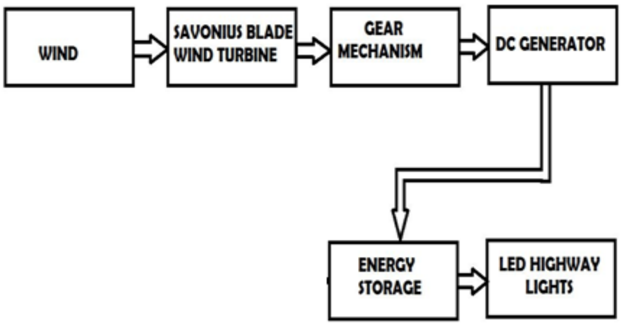

Fig. 6: Block diagram

4. IMPLEMENTATION

The proposed system will be basically a VAWT system which converts mechanical energy into electrical energy. The various important steps in working are as follows:

4.1 Side selection considerations

The available power in the wind draft increases rapidly with the speed so wind energy conversion machines should be preferably located in areas where the wind is strong and persistent.

4.2 High annual average wind speed

The critical parameter is the wind draft velocity. The power in the Pw wind draft through a given X-section area for a uniform wind velocity is Pw3= KV (K is constant), watt It is evident that small increases in V significantly affect the power in the wind due to the cubic dependency on the wind draft velocity.

4.3 Availability of wind $V_{(t)}$ curve

This important curve determines the maximum energy in the wind draft and is, therefore the primary control factor in predicting the electric o/p and therefore the revenue return of the machines.

4.4 Wind structures at the proposed site

The wind is turbulent especially near the ground, and it rapidly changes indirection and speed. This departure from the homogenous flow is referred to collectively as "The wind structure"

4.5 The altitude of the proposed site

If the air density and therefore the power in the wind draft affec ts and therefore the useful electrical power outpour.At higher al titudes, winds tend to have higher speeds.

4.6 Local ecology

If the surface is bare rock, lower hub heights can result in lower structural costs if there are trees or grass or venation. It all tend s to destructure the wind.

5. FUTURE SCOPE

India is a land of unlimited potential, but it is not effectively used. Wind energy is a great source of energy to meet and develop India's energy needs. India's future and development depend on many factors: One of them depends on its energy requirements. India will be free from its dependence on other countries for the generation of nuclear energy. Although the plans of the government now look ambitious, they certainly aim to rely on themselves. They focus primarily on the wind (generation and distribution) of all major renewable sources. However, the implementation of this technology has certain limitations that must be taken into account.

India is a country with unlimited potential, but it is not used effectively. Wind energy is a great source of energy for India's energy needs and for their development. The future and development of India depend on many factors: One depends on its energy needs. India will be free to rely on other countries for nuclear power generation. While the government's plans now look ambitious, they certainly aim to rely on themselves. They focus primarily on all major renewable sources of wind (generation and distribution). However, there are certain limitations to be taken into account in the implementation of this technology. In India, the metro network can be a great source of wind power generation, as lighter equipment than conventional wind turbines will be needed to harness the wind generated by metro trains. Metro rails are already running in some cities and government plans to run them in several other cities. Therefore, lighter wind turbines can be installed at metro stations so that wind energy can be generated without much extra investment.

India's is currently heading towards an increasing graph with a slower slope than before.

If it wants to achieve its objectives in the energy sector, it will n eed to keep the slope of this growth rate steeper

6. ACKNOWLEDGEMENT

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