BLADELESS WIND POWER GENERATION- AN INDEPENDENT SOURCE FOR RURAL ELECTRIFICATION

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INTRODUCTION:

Bladeless Wind Turbine uses a radically new approach to capturing wind energy. Our device captures the energy of vorticity, an aerodynamic effect that has plagued structural engineers and architects for ages (vortex shedding effect). As the wind bypasses a fixed structure, its flow changes and generates a cyclical pattern of vortices. Once these forces are strong enough, the fixed structure starts oscillating, may enter into resonance with the lateral forces of the wind, and even collapse. There is a classic academic example of the Tacoma Narrows Bridge, which collapsed three months after its inauguration because of the Vortex shedding effect as well as effects of flattering and galloping.

Instead of avoiding these aerodynamic instabilities our technology maximizes the resulting oscillation and captures that energy. Naturally, the design of such device is completely different from a traditional turbine. Instead of the usual tower, nacelle and blades, our device has a fixed mast, a power generator and a hollow, lightweight and semi-rigid fiberglass cylinder on top.

The Bladeless Turbine harness vorticity, the spinning motion of air or other fluids. When wind passes one of the cylindrical turbines, it shears off the downwind side of the cylinder in a spinning whirlpool or vortex. That vortex then exerts force on the cylinder, causing it to vibrate. The kinetic energy of the oscillating cylinder is converted to electricity through a linear generator similar to those used to harness wave energy.
This puts the technology at the very low range of capital intensity for such projects, it also makes it highly competitive not only against generations of alternative or renewable energy, but even compared to conventional technologies.

OBJECTIVE:

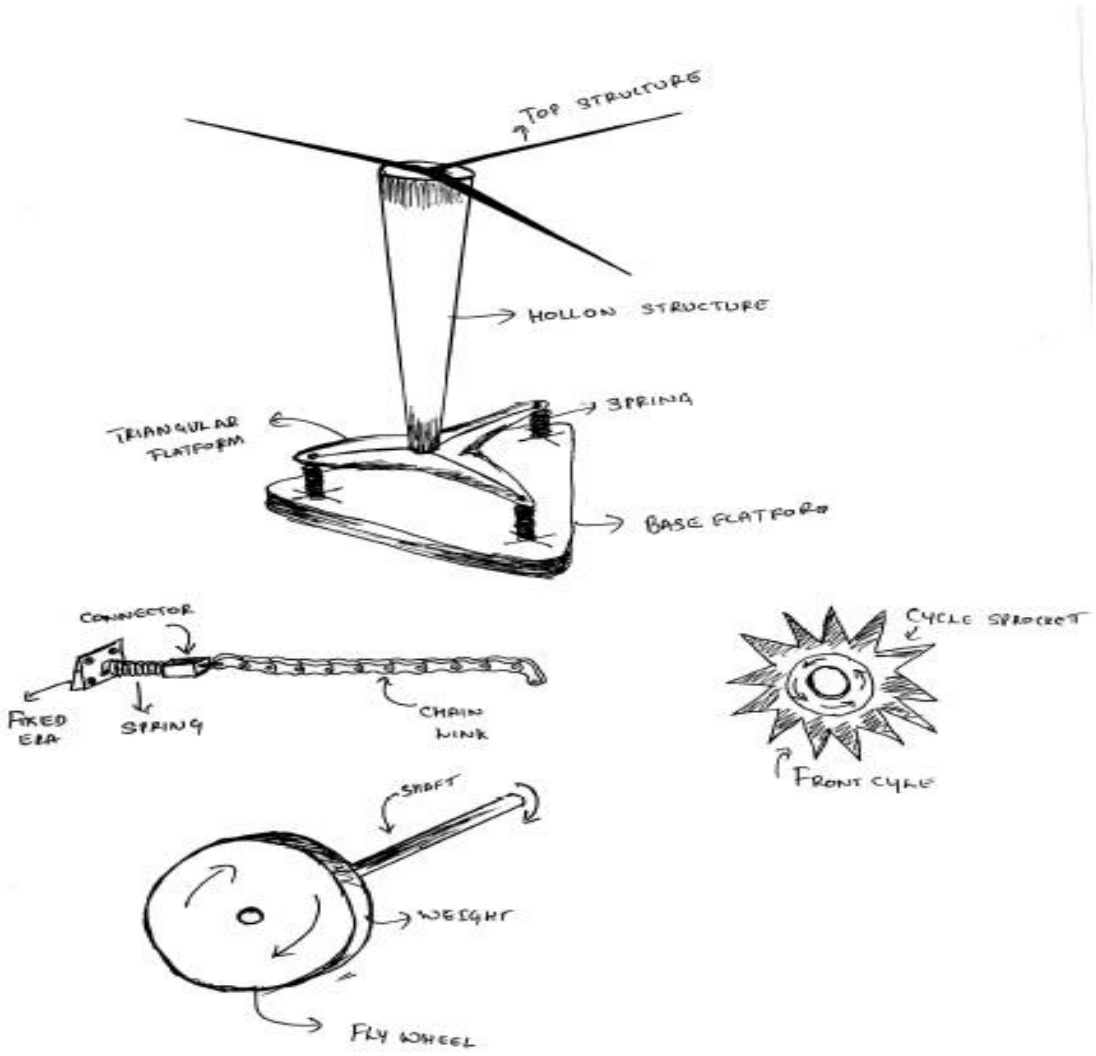
The main objectives of this project is as follows,

1. To increase the efficiency of wind power generation.
2. To produce clean energy to meet the increasing demands.
3. To make the wind energy economical and efficient.
4. Rural electrification.

5. To reduce pollution and global warming.
6. Development of the project so that it can be used on domestic purposes.
7. To reduce the manufacturing cost of the turbine.
8. It aims to be a ‘Greener’ Wind alternative leaving less carbon footprint on the environment.

METHODOLOGY:

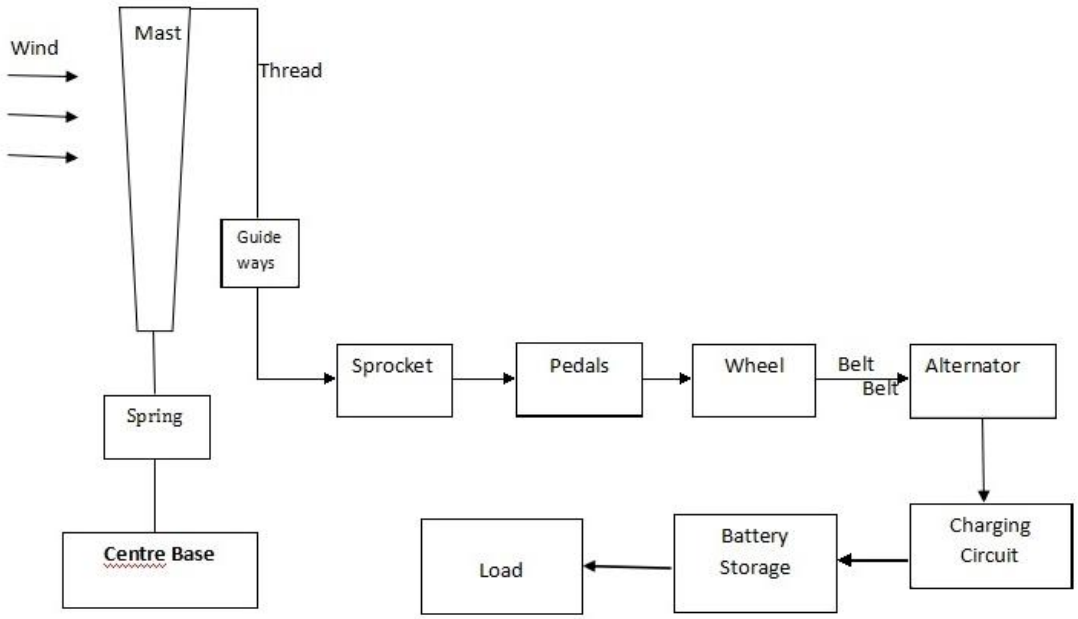
The main principle behind this project is the conversion of linear oscillation of mast to rotational motion. As the mast is subjected to wind energy, it tends to oscillate due to the vortices formed around the structure of the mast, which can be converted to rotational force to generate electricity. In the bladeless wind system configuration, the mast is fixed with respect to the ground and the rib structure at the top of the mast comprising of thread arrangement is used for pulling the threads attached to it. Energy is obtained by continuously oscillation of the mast. The mast utilizes wind power to pull the threads along with the chain attached to the sprockets which drive the shaft which intern rotates the alternator to generate power.



During the oscillation of the mast, the mast tries to oscillate in any direction depending on the wind direction. The rib structure at the top of the mast is attached with six threads to absorb the energy from the wind. Each set of the thread arrangement of the rib structure corresponds to one sprocket on the shaft which is driven by the chain which is pulled by the thread. Hence three sprockets are available in the shaft out of which one of the sprockets always is always in motion during the oscillation of the mast.

The arrangement of the threads on the mast is such that the power is generated on all direction of oscillation of the mast. Each of the threads is joined with the chain which drives the sprocket attached to the shaft to generate the maximum amount of power. The thread joined with the chain is fixed with a spring mechanism, during the oscillation of the mast one of the six threads is pulled which make the chain to drive the sprocket on the shaft. After the maximum oscillation on one side is reached, the mast returns to its initial position and then continues the oscillation on the other side where in the other arrangement of the threads and sprocket drives the shaft hence providing the continues movement of the shaft. Such operation has been developed and tested through numerical simulations, considering a quite accurate model, which takes into account the aerodynamic characteristics of the mast and the strength of the threads, and employing self-tuning magnetic coupling system to maximize the

net generated energy. So that it can operate in a wider range of wind speeds and also withstand the high wind velocities. This system allows maximizing the oscillation amplitudes when wind intensifies.



When the wind strikes the mast, it starts to oscillate due to the vortices formed around the structure and suspension spring placed at the bottom of the mast. The energy absorbed by the spring during the oscillation of the mast contributes to the increase in the amplitude of the oscillations. The rib structure with the six thread arrangement at the top of the mast is attached to the bottom chain drives through the guide ways which helps the mast to oscillate in any direction of the wind.

During the back and forth oscillation of the mast, one of the six threads is pulled from the rib structure of the mast depending upon the direction of the wind. The thread being pulled due to the oscillation of the mast is connected to chain which drive the sprocket on the shaft. Each set of the thread arrangement of the rib structure corresponds to one sprocket on the shaft which is driven by the chain which is pulled by the thread. Hence t three sprockets are available in the shaft out of which one of the sprockets always is always in motion during the oscillation of the mast.

The thread mechanism is provided with guide ways and pulleys for maximum transfer of the pulling force from the oscillation to the sprockets of the shaft. It also helps to increase the tensile strength of the threads which is necessary to increase the conversion efficiency to the maximum extent. The shaft driven by the sprockets arrangement rotates only in clockwise direction and restricts the rotation of the shaft in the opposite direction which otherwise may cause the threads to be pulled which may disrupt the oscillation of the mast and bring it to a halt. This shaft is welded with two bicycle pedal at the end spaced 180 degrees apart and the flywheel is provided with four counter weights 90 degrees apart, the arrangement of the pedal and the counterweight helps to increase the rotation of the flywheel. As the power is generated in the half cycle of the oscillation of the mast the shaft is subjected to a jerk motion rather than a smooth motion. Such arrangement of pedal and the counterweight helps in the smooth rotation of the flywheel trying to achieve perpetual motion.

The power wheel is connected to the alternator via belt drive which increases the rotation of the alternator with a ratio of 1:10 when the shaft is in the motion. The belt drive eliminates the gear system thereby reducing the maintenance. The maximum oscillation on one side is reached with the thread pulled to maximum extent, at which the maximum energy is absorbed from the wind. After which the mast returns to initial position and continues the oscillation at other end where in the other arrangement of the threads and sprocket drives the shaft hence providing the continues movement of the shaft. Since the power output of the alternator is AC. It is rectified using a rectifier circuit, filtered and regulated using a regulating circuit to 12V. The output DC Voltage obtained via the dual output of the regulation circuit charges the battery.

RESULT:

The project was tested using a mast of height 7.5 Ft. at Merry hill, Mangaluru which is an elevated area. The winds are more or less turbulent depending upon the direction of the wind. If the wind comes from the south turbulence will be more to the hitting the mast. If the wind is coming from east or west, the flow will be laminar, since the land is open in these directions. The wind speed was approximately 10m/s, the following results are obtained. Maximum power output of 200W at high wind speeds and a minimum of 100W at nominal wind speeds. The conversion efficiency from the linear oscillation of mast to the rotation of the flywheel is maximised by

1. By tightening the thread.
2. By aligning the mast in the direction of the wind.

The frequency of oscillation of mast is 1 cycle per second. For each cycle of oscillation of mast voltage is between 50V-60V. The revolution of flywheel at 50 RPM gives 1500RPM at the rotation of the generator. The energy is stored in the battery via the rectifier and measurement circuit.

CONCLUTION:

Tapping the wind for renewable energy using new approaches is gaining momentum in the recent years. The purpose of this paper is to provide some fundamental results on the bladeless wind system and serve as stepping stones for the future development of bladeless wind power generating system. The forces that are beneficial or useful to generate power in bladeless are different from those in conventional horizontal axial wind turbines. Our device captures the energy of vorticity, an aerodynamic effect that has plagued structural engineers and architects for ages (vortex shedding effect). As the wind bypasses a fixed structure, its flow changes and generates a cyclical pattern of vortices.

As the wind energy is powerful and consistent, the usage of conventional wind turbine for utilizing the wind energy in lesser area and cost is not possible. Hence bladeless wind energy helps us to achieve these criteria. This project has three main advantages

1. Utilizing less area
2. Generation of high power

3. Economical

In summary, the generation of electricity is made possible by the small structure of bladeless turbine. High efficient power is generated. This project will satisfy the need of continuous generation of electricity. The overall project uses less space area hence highly economical for the rural electrification of India.

FUTUREWORK:

Tapping newer ways of wind turbine for renewable energy is gaining momentum in the recent years. The purpose of this project is to provide some fundamental results on the analysis of bladeless wind turbine structure and serve as stepping stones for the future development of bladeless wind generating system. The output can be increased by the following techniques,

1. The output of this project can be improved by increasing the height of the mast.
2. By using lighter material for the construction of the mast (fibreglass or carbon fibre) the weight of the mast can be reduced to increase the oscillation. This project can be connected with a feedback control system with magnets in order tune the mast to the natural frequency.
3. The threads can be increased with cable wires in order to withstand the wind forces.
4. The base can be made simple and compact by installing a compact pulley mechanism.
5. By installing efficient generators, output can be increased.
6. By installing efficient transmission system, the output can be improved.
7. The efficiency of the transmission system via the thread mechanism can be improve d by using threads with higher tensile strength
8. A control mechanism can be implemented at the base for the protection of the mast from turbulent wind.