Power Generation by Designing and Fabrication of Maglev Wind Turbine

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Abstract: *The principle point of this work is to create Maglev wind turbine and use wind vitality as essential source to produce power utilizing axil transition generator. Attractive repugnance is utilized to balance the impact of the gravitational and some other quickening. Attractive shock gives points of interest of no utilization of metal roller subsequently turbine gives all-inclusive turn. Power is created by vertical hub motion generator with utilization of lasting magnets and set of loops. Maglev wind turbines are exceptionally effective as they're prepared to use turns with starting paces as low as 1.5 meters for each second (m/s). Consequently, this innovation gives an extraordinary proficient, adaptable and rich strategy for influence age from wind with about zero contamination and efficient power vitality is conceivable utilizing this model on higher scale.*

Keywords: VAWT, Magnet, Magnetic Levitation, Wind Turbine, Energy, Wind Power

1. INTRODUCTION

A significant factor being developed of human asset is the Energy. As traditional vitality sources are depleting thoroughly, the improvement of unlimited and sustainable power source assets, similar to wind, sun powered is fundamental for human life. The breeze control been used by individual for a more prominent timeframe and the innovation connected with it is progressively altered contrasted with other non-contaminating energies. Today wind control is pulling in the advantages of intensity area and their application is going into faster improvement. The benefits for vertical-pivot wind turbine (VAWT) can be noted, for example, prerequisite of least cost, simple establishment, simple upkeep, and the ability to acknowledge wind from all headings. Contrasted and the customary flat hub wind turbine, this sort is suspended or suspended with the assistance of attractive levitation coordinating vertical on a rotor shaft. This innovation is used as a proficient substitution for metal rollers having its application on the customary breeze turbine.

This innovation is normally actualized with lasting magnets and is utilized in the middle of the turning shaft of turbine sharp edges and base of wind turbine framework. The whole rotor weight of wind turbine is adjusted by attractive orientation. The contact of the direction is wiped out and henceforth requirement for bearing grease is additionally disposed of with lessening in the upkeep cost. Further, this attractive suspension dispenses with mechanical vibration lessening commotion. As low contact diminishes beginning torque of turbine, the attractive course encourages by creating power at lower wind speed as contrasted and utilization of ordinary heading. Typical VAWT requires altogether different modifying instrument for sharp edges making its structure entangled, expensive in creation and wastage of intensity. Be that as it may, contrasting and conventional VAWT the edges of attractive VAWT are developed for programmed pitch change and consequently prerequisite of any gear is killed. The modification of sharp edge pitch is performed normally amid turn for the essential approach.

Wind is considered as another type of sun oriented vitality in light of the fact that of its start from distinction in warming of air by sun. The breezes important to utilizations of wind turbines are nearby breezes and planetary breezes. The second one is most accessible. Consequently, it establishes as significant thought in finding the destinations for legitimate working of wind turbines. The areas of these breezes are by and large along ocean shore, mountain, valleys and open fields.

2. LITERATURE REVIEW

2.1 Wind Power

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2.2 Types of Turbines

Wind Turbines are divided into two classes: horizontal axis wind turbines (HAWTs) and vertical axis wind turbines (VAWTs).

2.2.1 Horizontal Axis Wind Turbine

Horizontal axis wind turbine can be visualized as conventional box fan, a set of blades connected to a shaft that is parallel to the ground; however, function of turbine is the opposite of a box fan. It normally consists of two to three blades connected to a shaft that is connected to a generator which will produce energy from shaft work. There are two main types of HAWTs, ones that face into wind and ones that face away from wind. Turbines that face into wind require a rudder or some other type of mechanism to be able to self-orientate to face incoming wind. Those that face away from the wind do not need this rudder to self-orientate, however they suffer from a vibration due to support tower blocking part of wind flow.

2.2.2 Vertical Axis Wind Turbines

Vertical axis wind turbines operate on same principle of converting rotational movement due to wind into shaft work, which is then converted into electricity through the use of a generator. VAWTs contain a shaft that is perpendicular to ground. Unlike the HAWTs, the VAWTs can catch the wind regardless of the position that they are facing, which can lead to them being more versatile. Also, VAWTs are able to function in more irregular wind patterns than HAWTs are able to. There are two primary blade designs that are used for VAWTs that operate on different principles: the Savonius type and the Darrieus type

Fig 1. Savonius Vertical Axis Wind Turbine

Fig 2. Darrieus Vertical Axis Wind Turbine

2. PRINCIPLE & WORKING

The fundamental working standard of a breeze turbine is when air moves rapidly, as wind, the active vitality is caught by the turbine blades. The blades begin to pivot and turn a pole that leads from the center point of the rotor to a generator and produce power. The fast shaft drives the generator to deliver power. The low speed shaft of wind turbine is associated with shaft of rapid drives through apparatuses to build their rotational speed amid task. Utilizing the impacts of attractive shock, winding formed breeze turbine edges will be fitted on a bar for dependability amid turn and suspended on magnets as a substitution for metal rollers which are regularly utilized on ordinary breeze turbines. The vitality that can be extricated from the breeze is straightforwardly relative to the shape of the breeze speed. We would then be able to ascertain the power changed over from the breeze into rotational vitality in the turbine utilizing condition.

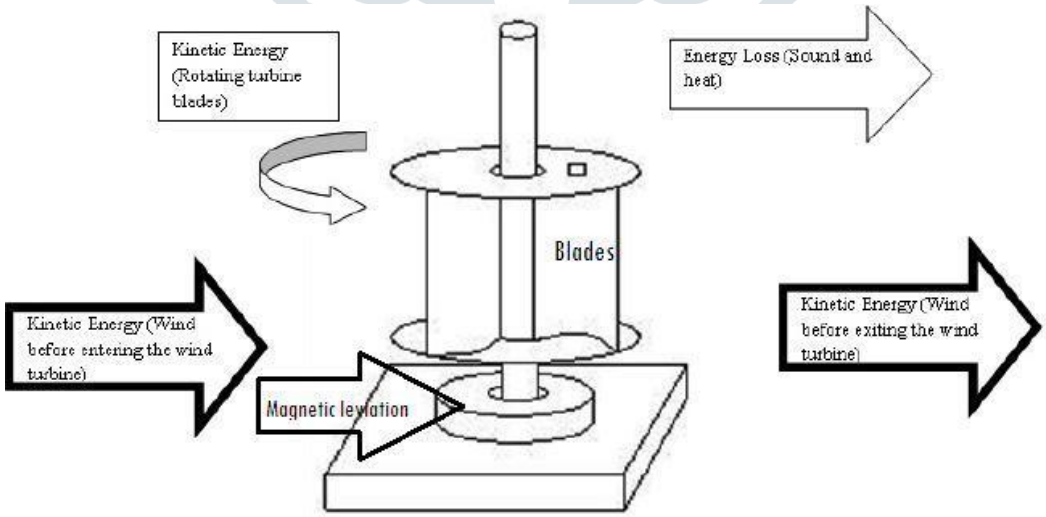

Fig 3. Working model of wind turbine

Fig. 3 gives a thought of Maglev Wind Turbine This wonder works on the shock qualities of perpetual magnets. Utilizing a couple of lasting magnets like neodymium magnets and considerable help attractive levitation can without much of a stretch be experienced. By setting these two magnets over one another with like polarities confronting one another, the attractive repugnance will be sufficiently able to avoid the two magnets as much as possible far from one another. The power made because of this shock can be

utilized for suspension purposes and is sufficiently able to adjust the heaviness of an item relying upon the edge of the magnets. Power will at that point be created with a hub motion generator, which joins the utilization of perpetual magnets and a lot of loops.

Wind control is a demonstrated and profoundly powerful approach to create power. Maglev innovation is the most effective methods for exchanging active vitality to create power. The vertical pivot wind turbine stage skims on an attractive pad with the guide of perpetual magnet suspension. This innovation dispenses with about all contact and conveys most extreme breeze vitality to the downstream direct generator.

3. OBJECTIVES

- To design a Vertical axis magnetically levitated wind turbine for low wind application.
- To study the Performance of the turbine in terms of Electric Power Generated.
- To harness wind energy in more efficient way by elimination friction.
- To fabricate the prototype.
- To obtain maximum possible output of Axial Flux Generator using bridge rectifier

4. DESIGN AND CONSTRUCTION OF PROTOTYPE

There are a few parameters engaged with the structure of an effective yet practical breeze turbine. For the most part and proficient plan of the edge is known to amplify the lift and limit the delay the blade.

4.1 Magnet Selection

The four designs in business rundown of magnets depend on development of their material every arrangement of magnet comprising with them its own attractive properties. Neodymium Iron Boron (Nd-Fe-B) is the new innovation in popularized magnets which comprise most astounding attractive properties contrasted with different magnets at room temperature.

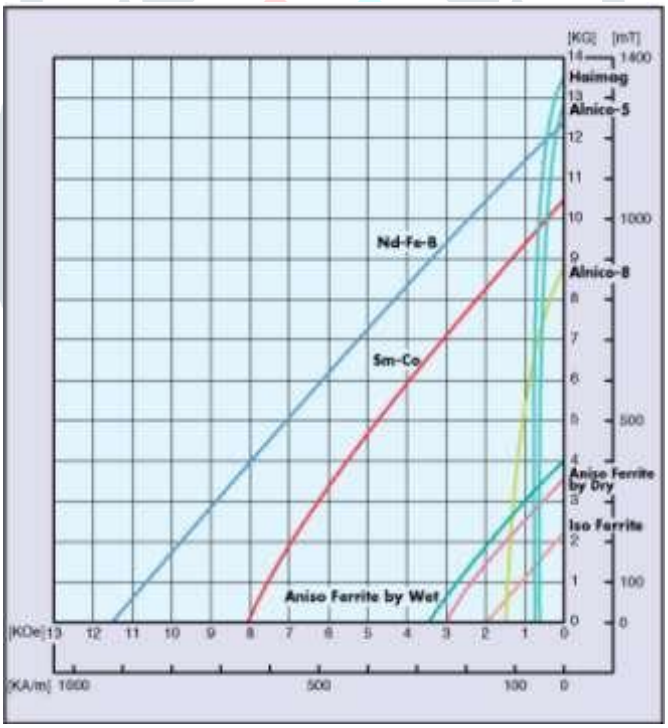

Fig 4. B-H curve of different Magnets

From Fig 4, B-H curve portrays appealing attractive normal for Nd-Fe-B offering high transition thickness with the capacity of opposing the property of demagnetization. This setup turns out to be most significant in light of levitation of substantial burden and pivot at high speeds showing a high power coordinating descending on the hub. In the event that state of magnets thought about where ring or round, they can be put on shaft with same posts confronting each other empowering repulsing power to offer help to weight of turbine which limits utilization of magnets required to satisfy the thought. The perpetual magnets chose were the N42 grade Nd-Fe-B having ring shape which comprise of nickel plating for fortifying and ensuring the magnet.

4.2 Magnet Placement

Two ring shaped neodymium (NdFeB) magnets are arranged at middle of shaft by which necessary suspension between stator and rotor is obtained. Similarly, disc magnets having parameters 10 mm in diameter and 4 mm height are placed as one North Pole and one South Pole one after the other, along the rotor circumference of 40 cm diameter. These magnets supply the useful flux which is utilized for the power generation.

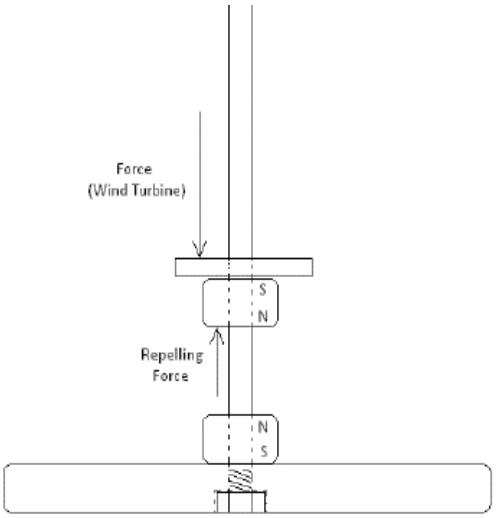

Fig 5. Magnet Placement for Levitation

Fig 6. Placement of Magnet for stator

4.3 Coil Design and Arrangement

To plan the distinct number of turns per loop is troublesome. On the off chance that the more turns are wound it increment the EMF produced from each loop yet increment the measure of each coil. For limiting the size, wire having higher measure can be utilized. On the off chance that the breadth of wire is little low measure of current streams prompting warming of wire due to the expanded opposition of wire which another troublesome errand. While planning generator for given application, reality must be realized that the issue joined with vast coil estimate is the issue field thickness.

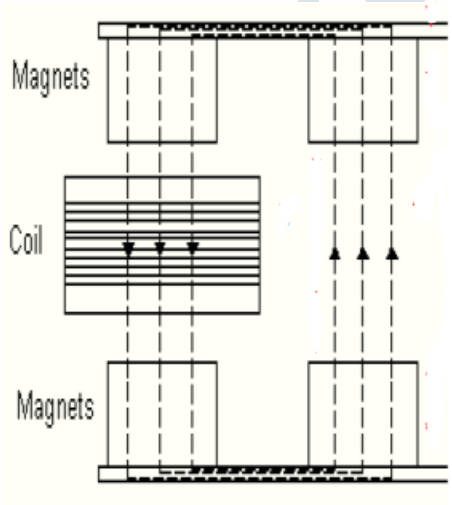

Fig 7. Coil and Magnet Placement

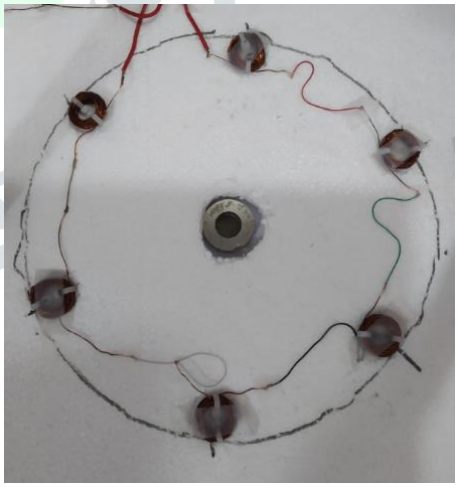

Fig 8. Coil Arrangement

The Coil position is composed on the stator periphery precisely under the circle magnets set on rotor. Each loop is kept in arrangement to get greatest yield voltage. The wire used to structure the turns of one coil is of 24 gauge having 60 turns and 6 sets of coils are organized in arrangement association in the model with an angle of 60 degrees between them. The coils are connected in series and the coil winding is done clockwise then counterclockwise for the adjacent coil.

4.4 Turbine Blades and Rotor

The choice of the quantity of blades of a breeze rotor is basic to its development just as activity. More prominent number of blades is known to make turbulence in the framework, and a lesser number wouldn't be sufficiently competent to catch the ideal measure of wind vitality. Subsequently the quantity of sharp edges ought to be dictated by both these limitations.

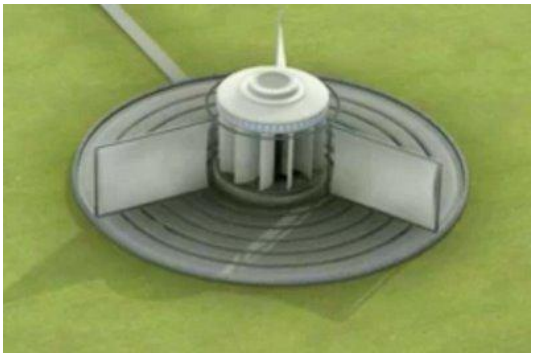

Fig 9. Turbine design for low wind speeds

Fig 10. Helical Darrieus Turbine for high wind speeds

For maximum utilization of kinetic energy of wind, the turbine blades have been structured by blending two distinctive turbines i.e. for low and high wind speeds. 4 blades are connected to the internal shaft of the rotor of length 14 inches, put at 90 degrees from one another, while for fast breezes, the design is taken from Helical Darrieus Turbine and 4 blades of length 17.5 inches are slanted at an edge of 20 degrees from the vertical. Rotor is 17 inches in height with wooden discs 12inches dia at ends and the blades are fixed. This makes the turbine suitable for low as well as high wind speeds

Fig 11. Rotor

Fig 12. Assembled Turbine Prototype

4.5 Rectifier

The output from the Axial Flux Generator is AC: to convert it into DC, a full wave bridge rectifier is used along with capacitors to smoothen the ripples and obtain constant current and voltage values.

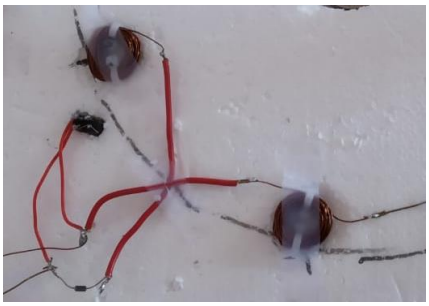

Fig 13. Rectifier Circuit

4.6 Final Prototype

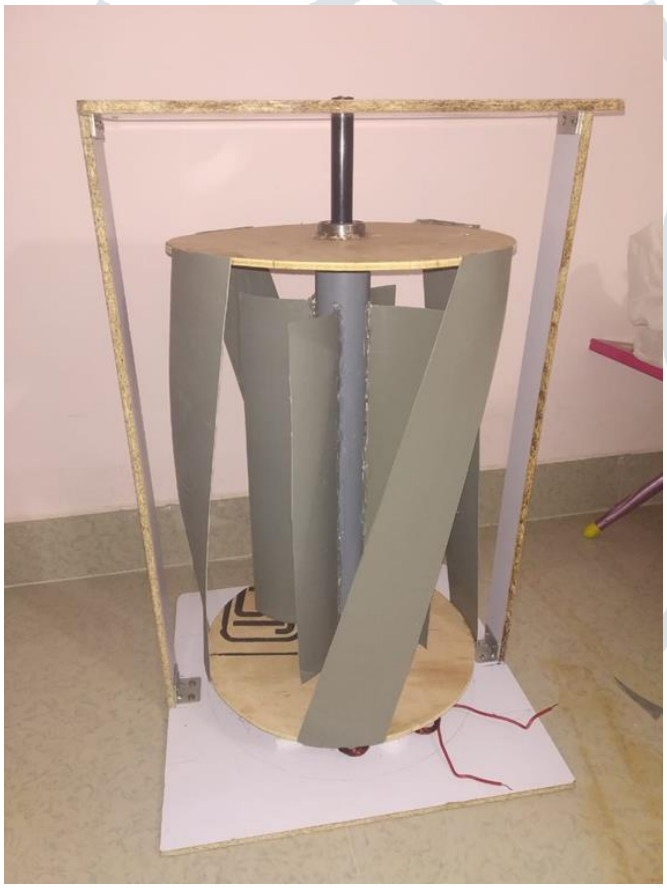

Fig.14 Final Prototype

5. RESULTS

S.No.	Wind Speed(m/s)	RPM	Voltage(Volts)	Current(amps)	Power(Watts)
1.	1	20	1.23	0.15	0.18
2.	3.7	150	1.71	0.45	0.77
3.	5.1	201	2.24	0.62	1.38
4.	6.7	282	2.35	0.98	2.30
5.	7.4	317	2.35	1.2	2.82

Table 1: Observations and Results

With the use of Magnetic levitation there is minimum to no friction which means the turbine starts with low wind velocity and the turbine takes long to come to halt which in turn increases the efficiency of the turbine. The average time taken by the turbine to come to halt after the wind blower is switched off is **1 minute and 57 seconds**. While the free rotation, the generator gives an output of **0.95 volts**.

6. CONCLUSION

The idea of vertical hub wind turbine utilizing attractive levitation effectively worked. Contrasting and conventional even wind turbines, single Maglev turbine having substantial limit gives more yield. The turbine effectiveness is improved by use of magnets turning with quick speed with immaterial contact as it offsets the weight on the pole of the turbine. This cutting edge plan of turbine gives more power yield with higher effectiveness contrasted with ordinary breeze turbine. For staying away from the vibration of the rotor, shaft was utilized. The standard windmills having set of 1000 windmills powers 5 lakhs homes while single maglev wind turbine is skilled providing capacity to 7.5 lakhs homes. The required zone for single maglev windmill is under 100 sections of land while field of 1000 windmills require in excess of 64,000 sections of land. From this perception we can say that a solitary maglev wind turbine is practical contrasted with Conventional breeze turbine.

7. FUTURE SCOPE

The vertical axis wind turbine with magnetic levitation may be mounted on residences. Here it can be erected on rooftop with very efficient and practical approach. House owner would be capable for extraction of free and clean energy with a minimized utility cost. For medium power generation this design can be used. Power generated from this turbine can be utilized in remote places where traditional method of supplying power is costlier. Power generated from turbine can be efficiently used for Street/domestic lighting and domestic appliances.

Fig.15 One equivalent MWT for 1000 Standard Windmills

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